

COLOR AND CHILDREN

MITSCHKE

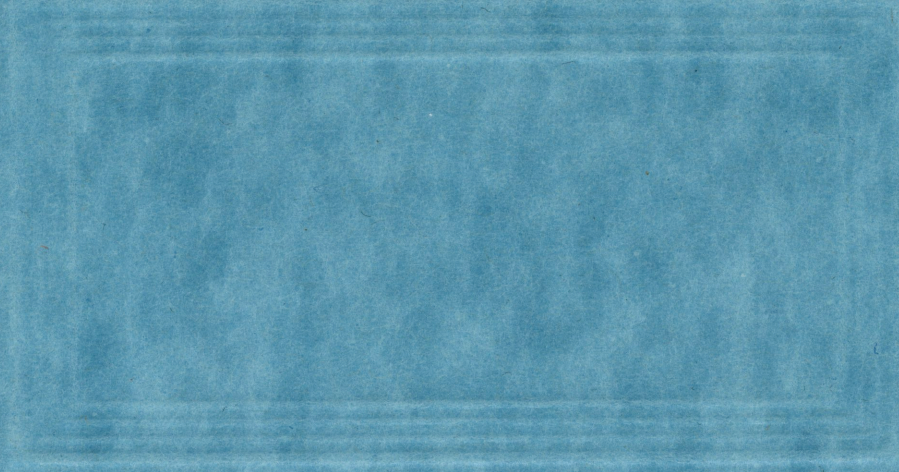
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Thomas N. Mitschke

May 25, 1959

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COLOR AND CHILDREN

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Thomas N. Mitschke

PREFACE

As part of his senior thesis, the author, a student of architecture, has recently had the pleasure of designing a toy shop for children; pleasure because the designs of the shop and its accouterment grew almost effortlessly upon the drafting board.

However, the forms, arrived at so painlessly and delineated (successfully it is hoped) in the blacks and grays of charcoal, if brought into actual existence would change character completely were not correct colors chosen to give life and depth to them.

Certainly the colors chosen should appeal to children, but which colors are they? Bright ones assuredly, but exclusively? Need the shop be garish? Or might bright colors be accents against a muted backdrop? Must some colors be avoided?

To answer these and similar questions, and as a continuation and completion of his thesis, the author turned to the study of color and its relationship to children.

That the right choice of color is more than a mere decorative matter quickly became evident. The importance of correct colors is pointed out by Louis Cheskin, Director of the Color Research Institute of America, when he says:

Color is an optical and psychological factor everywhere. Colors affect our emotions at work and at play. Some colors create a pleasant mood. Others produce discord and irritability. Emotional stability and efficiency depend to a great extent on environment, of which color is a most important element.¹

¹Louis Cheskin, How to Color-Tune Your Home (New York: The MacMillan Co., 1954), p. 141

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INTRODUCTION

Every animal with the sense of sight, insofar as it uses sight to distinguish objects, distinguishes those objects through color.¹

For:

Properly speaking, form cannot be perceived except as color, because color is simply the reaction of the form of an object to the rays of light by means of which we perceive it.²

So the human animal has known color for some time since, if we ignore the philosopher's question whether or not color can exist without eyes to see, man antedates color by eons.

In our discussion of color and children, therefore, let us overlook the children for a time and, giving deference to age, begin our study with the nature of color. We shall have not only logical sequence on our side but propriety as well.

¹The case of the bat's "Sonar" and the snake's heat cells, by which sound waves and infra-red rays respectively are used to sense the presence of objects in no way invalidates the statement nor does the fact that a cat's eyes, lacking color cones, see only achromatic colors (shades of gray).

²Herbert Read, "The Definition of Art", A Modern Book of Esthetics, ed. Melvin Rader, (New York: Henry Holt & Co., 1952), pp. 30-31.

CHAPTER I

THE NATURE OF COLOR

The housewife who sends her husband to town to purchase paint for her kitchen and cautions him that it be "green, a real green, but not too green, and certainly not that awful green" is not alone in her ambiguity. For man, in spite of his long and intimate association with it, and in spite of his present-day scientific and mental prowess, is still confused about color.

Color means one thing to the physicist, another to the artist, a third to the physiologist, and quite a fourth to the psychologist. Within and between these separate fields it is not always possible to find areas where authorities agree. A fifth man, the colorist, the metaphysician of the color world, attempts to synthesize all fields of color into a workable whole. That he doesn't always succeed is understandable. That he succeeds so well is laudatory.

The study of color and its use and effect, especially in the field of psychology, is of recent beginnings. As in all new sciences, the problem of semantics often magnifies slight differences of opinion into major disagreements. These disagreements can be confusing to the layman, but we need not be overly concerned since the primary object of our study is to obtain a working knowledge of the use of colors with children and not to settle scientific disputes. Let the authorities contend with linguistic problems.

Our study will begin with a survey of the physical, chemical, physiological and psychological aspects of color. Volumes have been written on each subject and our survey will necessarily be brief. Still some survey, however slight, must be made if our study is to have any validity at all. The contending factions within each field will be glossed over if mentioned at all and the reader is cautioned that apparent contradictions between the various fields is not necessarily real.

The Physical Aspects of Color

The absorption or the reflection of light constitutes the physical aspects of color. To the physicist color is light. That light itself is little understood and may travel in waves or in packets of energy called photons or a combination of both is not germane to the study of color.

That color contains light is evidenced in the rainbow when light is actually broken into its various component colors by the prismatic action of mist. This breakup of light was first duplicated in the laboratory in 1666 when Sir Issac Newton, by refracting a ray of sunlight through a prism, obtained all the colors of the rainbow in their proper order. The same experiment has been conducted countless times in school laboratories ever since.

As broken up by a prism, sunlight displays the visible spectrum of violet, indigo, blue, green, yellow, orange and red. From this one might presume that the primary colors are seven in number and so once they were considered. Since Newton's time, however, physicists have discovered that all colors, including white, can be duplicated in light by the three primaries, red, green, and blue-violet.

According to the physicist, color is produced by the reflection of certain light rays from an object to the eye. Thus redness is produced in a red object by the reflection of red rays and the absorption of all other visible rays. Colors besides the primaries are produced by the absorption of certain wave lengths of colors and the reflection of others.

To show that understanding of color is never static even within a single field, the Newtonian theory of color, which has held sway for centuries, has recently been challenged by Edwin H. Land, the developer of the Polaroid camera. During a physics colloquium at Columbia University Mr. Land presented a demonstration, the description of which is quoted as follows:

Land took two black-and-white slides of the same scene which differed only in that one had been photographed with a red filter and the other a green one. In effect, these filters separated the long wave-length end of the color spectrum from the short. Then, with a projector with two lenses, Land sent red light through the red-filtered slide--and white through the other. When the images were brought together, the result was not pink, as one might have expected, but a full color picture. Continuing, Land showed that not only would red and white lights produce full color, but so would two yellow or red ones of almost the same hue--or many other pairs as well--if the same slides were used.

These experiments are only the simplest of the ones which Land introduced to indicate that the eye does not see, as classic Newtonian theory and all current textbooks hold, by responding to the wave lengths of specific colors. All it needs is two "channels" of information about a scene. Then the eye-brain system puts together the picture we "see".¹

Whether or not Newton's theory will have to be superseded in no way destroys the beneficial uses of color, based on his theory, that physicists have found. The use of color in a physical sense "is almost a matter of engineering; for color rightly employed can insulate against

¹"Color the Brain Sees", Newsweek, May 18, 1959, p. 65.

heat, minimize the evaporation of liquids, preserve foods and substances which may be destroyed by light."¹

The Chemical Aspects of Color

Chemistry's concern with color lies in the development of pigments and dyes to produce long-lasting, brilliant colors of a specified hue.

The chemical primaries coincide with the artist's primaries, that is; red, yellow and blue. From these three colors all other chromatic colors can be produced with a degree of success depending on the skill of the artist and the color purity of the pigment.

Color chemistry is not an exact science today; it was far less an exact science in ages past. Much of the romance of color is directly connected with the success or failure of chemistry to produce certain colors. For example, the royalty of purple stems from the fact that in ancient times the hue was so difficult to produce that it was reserved for royalty and commoners were forbidden to wear it, often under pain of death. Our own color chemistry research and a not so minor part of the industry received its impetus from the fact that certain dyestuffs, formerly imported from Germany, could not be obtained during World War I.

Our interest in the chemical aspects of color, for the purpose of the present study, is slight.

The Physiological Aspects of Color

Colors as light waves reflecting off an object or as pigments residing in or on an object are impersonal. Colors as they effect the eye, sway the mind, or influence the emotion, however, are very personal indeed. For this reason the physiological and psychological aspects of color are the most important fields we will survey.

¹Faber Birren, Functional Color, (New York: The Crimson Press, 1937), p. 12.

To the layman the two fields often seem to overlap and the distinction between what constitutes a physiological and what a psychological reaction is difficult to see.

The primary colors are the same in both cases; red, blue, green and yellow. The reason for the choice of primaries, however, differs.

The physiological primaries are based on the phenomenon of the after-image. "When the eye sees an area of red, there is a strong reaction to green, its opposite."¹ Or in other words, when one looks at a red surface for a minute or so, then glances at a white surface, the color green will be seen. "The after-image of red is green; the after-image of blue is yellow--and vice versa."²

That the colors mentioned are primary is further proven by "the way in which color blindness manifests itself, either in relation to red and green or to blue and yellow."³ Because of this "Physiologists . . . conclude that red and green are perceived through one set of receptors in the eye and blue and yellow through another set."⁴

In addition to the after-image, other physiological effects of color are evident:

Colors in strong contrast will appear surrounded on their edges with a "fringe". This is due to aberration, to an overlap of stimuli on the retina and to an inability to focus all rays of light at one and the same time. The eye is nearsighted for blue rays and farsighted for red rays. Red and blue, when juxtaposed, show a brilliant fringe. At the same time, red and all warm colors will tend to advance, while blue and all cold colors will tend to retire.⁵

¹Ibid., p. 29.

²Cheskin, op. cit., p. 134.

³Ibid., pp. 133-34.

⁴Ibid.

⁵Birren, op.cit., p. 29.

More will be said about the physiological effects of color below.

The Psychological Aspects of Color

To the psychologist, concerned with the eye, only those colors are primary which produce a unique sensation.

The eye responds to four [such] color sensations and to white and black. The colors involved are red, yellow, green, and blue. . . . Each [primary] color has a precise identity and looks unlike the others . . . all other colors resemble the primaries. Orange and violet look like red, but red does not look like orange and violet.¹

All colors, including the primaries, are further "divided into two general psychological classifications--stimulants and sedatives."² These divisions also are known as the warm and cool colors, and coincide with the physiologically advancing and receding colors.

The warm and stimulating colors are yellow, yellow-green, orange-red, red, brown, beige, buff and all other colors that are predominantly³ yellow or red in hue.

The cool and sedative colors are blue-green, green-blue, blue, violet, magenta red and all other colors that are predominantly³ blue in hue.⁴

The division of colors into psychologically warm or cool colors seems to be universally accepted. What constitutes a warm or cool color, however, in the case of one author at least, is disputed.

We have seen above that warm colors are the reds and yellows; cool colors the blues. And again, "colors are advancing or receding, warm or cool, according to the amount of blue or red they contain."⁵

¹Ibid., p. 105.

²Cheskin, op. cit., p. 19.

³(Italics mine)

⁴Ibid., p. 20.

⁵Sterling B. McDonald, How to Use Color, (Chicago: The American Colortype Co., 1940), p. 76.

One colorist, Paul Hartley, holds that all colors have "a definite yellow or 'warm' cast; or . . . [a] blue or 'cool' [cast] Of the three primary colors, red¹ does not seem to have any appreciable effect upon color temperature"² And further, that:

The so-called warm end of the spectrum (yellow, orange, and red) can have a bluish cast,¹ . . . and thus belong in the cool tribe of colors. . . . The greens, the blues, and the purples . . . can have a yellow cast,¹ and to this extent belong across the line in the warm tribe.²

However, Mr. Hartley goes on to add, "by using the brighter and more sparkling colors in either tribe--the yellows, reds, and oranges--you can create the illusion of warmth and brightness."⁴ So the apparent contradiction does not exist at all and the blue or yellow "tribes" become really a question of harmony and not warmth.

Much more will be said of the psychological uses and effects of the warm and cool colors later in this paper.

¹(Italics mine)

²Paul Hartley, How to Beautify Your Home with Color, (New York: McGraw-Hill Book Co., Inc., 1952), pp. 6-7.

³Ibid., p. 8.

⁴Ibid.

CHAPTER II

THE OSTWALD COLOR CONE

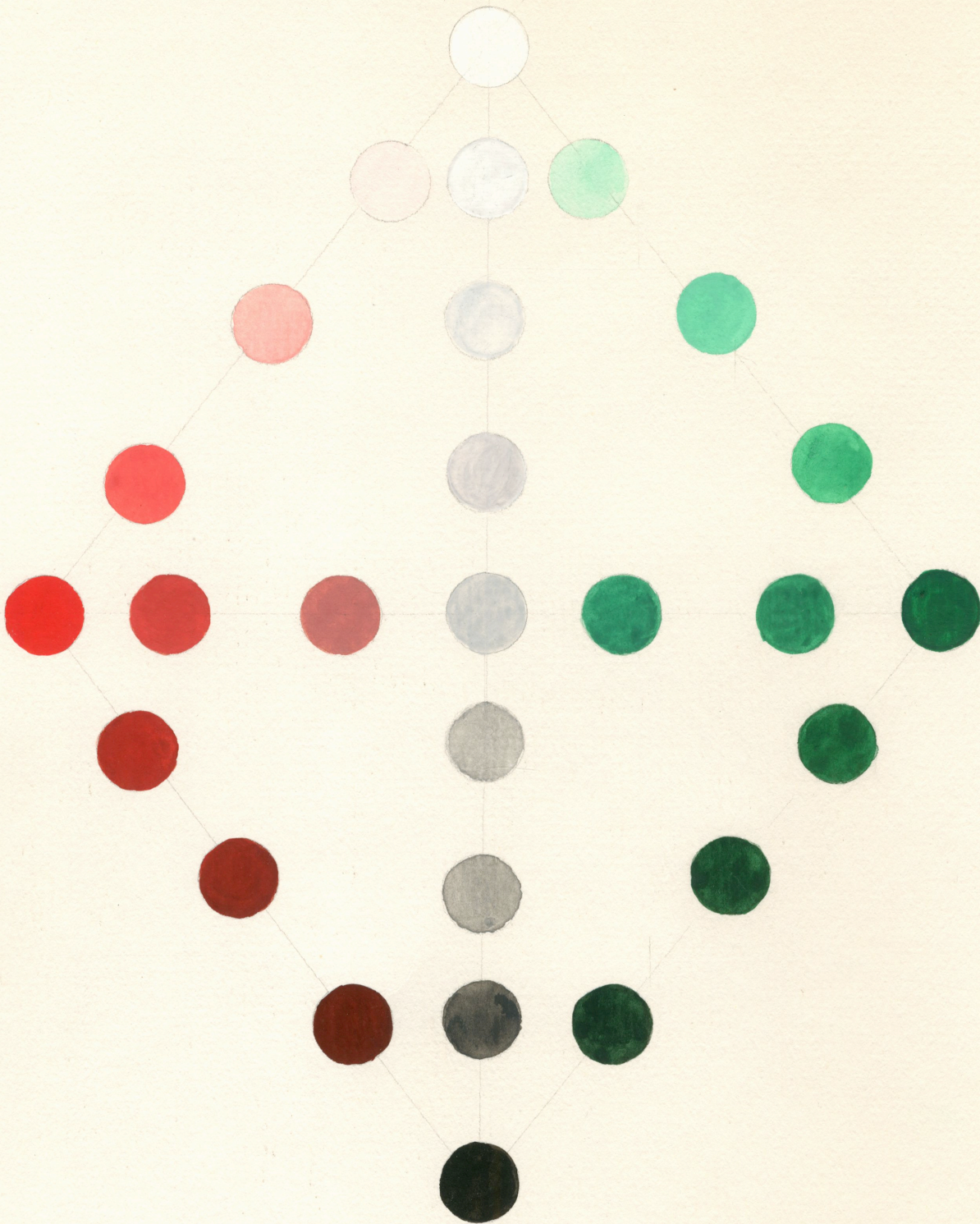
Many color systems and charts have been devised to provide some means of classifying colors according to hue, tone, shade, etc.

An examination of more than one system would be of academic interest only. Each system has its proponents and detractors but for our purpose any will work. The author has chosen the Ostwald color cone because it seems at once the clearest exposition and the easiest to use.

The system consists of two cones placed base to base, extending through the core, from apex to apex, the achromatic colors (black, shades of gray, white) rise from black to white. The hues or pure colors (primaries, secondaries, tertiaries) ring the equator or base of the cones. Shades lie on the surface of the lower cone; tints on the surface of the upper cone. The tones lie below the surface of the cone and extend to the core.

The cone is so arranged that complementary colors (e.g., red and green) lie 180° from one another around the cone.

Illustrations on the following pages will help the reader visualize the Ostwald color system.



THE OSTWALD COLOR CONE

On the facing page is a diagram of the Ostwald color cone cut on a vertical plane through the center illustrating the red-green complementaries. One should notice the gray tones rising vertically through the center and the pure hues at the right and left extremities. Notice, too, that the colors become lighter as they rise toward white and darker as they approach black. The voids between the colors should, of course, be filled with shades, tones and tints of infinite variety.

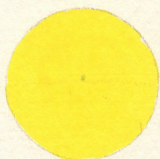
A more complete explanation of the use of the color cone occurs later in the chapter

These diagrams exist only for purposes of illustration. The hues shown may not coincide with the true primaries, and the tints, tones and shades may not be accurately located in distance relationship to the pure colors.

yellow-orange



yellow



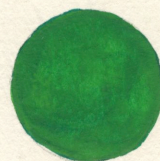
yellow-green



orange



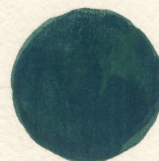
green



red-orange



blue-green



middle gray



red



blue



red-violet



blue-violet



violet



To the right is an illustration of the Ostwald color cone cut horizontally through the double base. Twelve colors plus gray are shown. For clarity, the tones, which would occupy the interior, are omitted. The nomenclature used corresponds with that of color chemistry.

Some of the difficulties that beset the color world are made obvious by an examination of the diagram.

The chemical primaries are red, blue, and yellow. These three colors are located 120° from one another with three intervening colors between each. Three "violets" separate red and blue, three "greens" separate blue and yellow, and three "oranges" separate yellow and red. A line connecting each primary to the center would form an inverted "Y".

The physiological and psychological primaries are red, yellow, green and blue. Red and green diametrically oppose one another as do yellow and blue. These and all other colors so opposed form complementary pairs. The primaries are 90° apart and a line drawn from each to the center would form a cross. But, notice that if a cross with horizontal and vertical arms were drawn on the diagram, three of the colors joined would not coincide with the primaries indicated. The error lies not with the chart but with the nomenclature. Physiology's "red" is chemistry's red-orange, physiology's "green" is chemistry's blue-green, and physiology's "blue" (often called blue-violet) is chemistry's violet.

Physics' primaries are also present on the chart. Colored light cannot, of course, be duplicated in pigment; but its equivalent hue in pigment can be indicated. The physical primaries are red, green, and blue. Again three colors and 120° separate the hues. Here new problems in nomenclature develop. Physics' "red" is chemistry's orange and physics' blue (also called blue-violet) is chemistry's violet. A line drawn to the center from these primaries would form a "Y".

In the case of the physical and chemical colors, those hues lying between and separating the primaries are called secondaries. They are formed from the combination of the two primaries they separate. Tertiary colors (not shown) are formed by combining a secondary composed of two primaries with the third primary, or by combining two secondaries.

To return to our illustration, if we were to eliminate gray and green from the color wheel, a straight line drawn through the center and extending from the space between red and red-violet to the space between yellow-green and blue-green, would separate the warm and cool colors. All hues, tones, tints and shades lying above and to the left of the line are classified warm. Those lying below and to the right of the line are cool.

We have eliminated gray from classification because it has a negative quality, is achromatic, and is neither warm nor cool. Green, on the other hand, is positive but somewhat neutral. It can be warm or cool depending on its setting. In most cases it is neutral and is a good color to use when no specific effect is desired.

"Warm" colors derive their classification from their psychological effect. Actually, since light is energy and energy is heat, a white wall, being more reflective than a wall of any other color would transmit more measurable B.T.U.'s to the room. The physical temperature of a room or its occupants notwithstanding, a person "feels" cold in a white room and warm in a red room.

"Cool" colors are so classified for the same psychological reason.

We have said previously that warm colors are advancing, cool colors receding; this is not precisely correct. The line used to divide the warm and the cool gives a rough division of the advancing and receding colors, however, both yellow and violet would have to be eliminated. These colors, according to Faber Birren and others, are visually stable

in regard to eye focus, and hence neither advance nor recede. Both colors should be ideal backgrounds against which to view objects. Yellow, being so visually stimulating, however, is too distracting as a background. Violet is visually correct but in some cases may present a psychological conflict.

The color world being what it is, not all authorities would agree with the above division of advancing and receding colors. Sterling MacDonald¹ considers yellow as the most advancing color and violet as the most receding. His classification is based on the lightness or value of the colors so that hues become more advancing as they progress around the color wheel in either direction from purple to yellow. He bases his theory on the fact that when a color wheel is carried into a dark room yellow and the colors nearest yellow on either side, are the last to lose their identity. By his reasoning white should be the most advancing "color" of all yet it is well known that white has just the opposite effect and can be used advantageously to enlarge a small room. The author is inclined to hold to his original classification.

We have classified color as primary, secondary, tertiary, warm, cool, advancing and receding. One other classification must be investigated.

Color may be complementary or analogous. Complementary colors, we have seen, oppose one another on the color wheel. Each pair of complements, with their tints, tones and shades, comprise a color family.

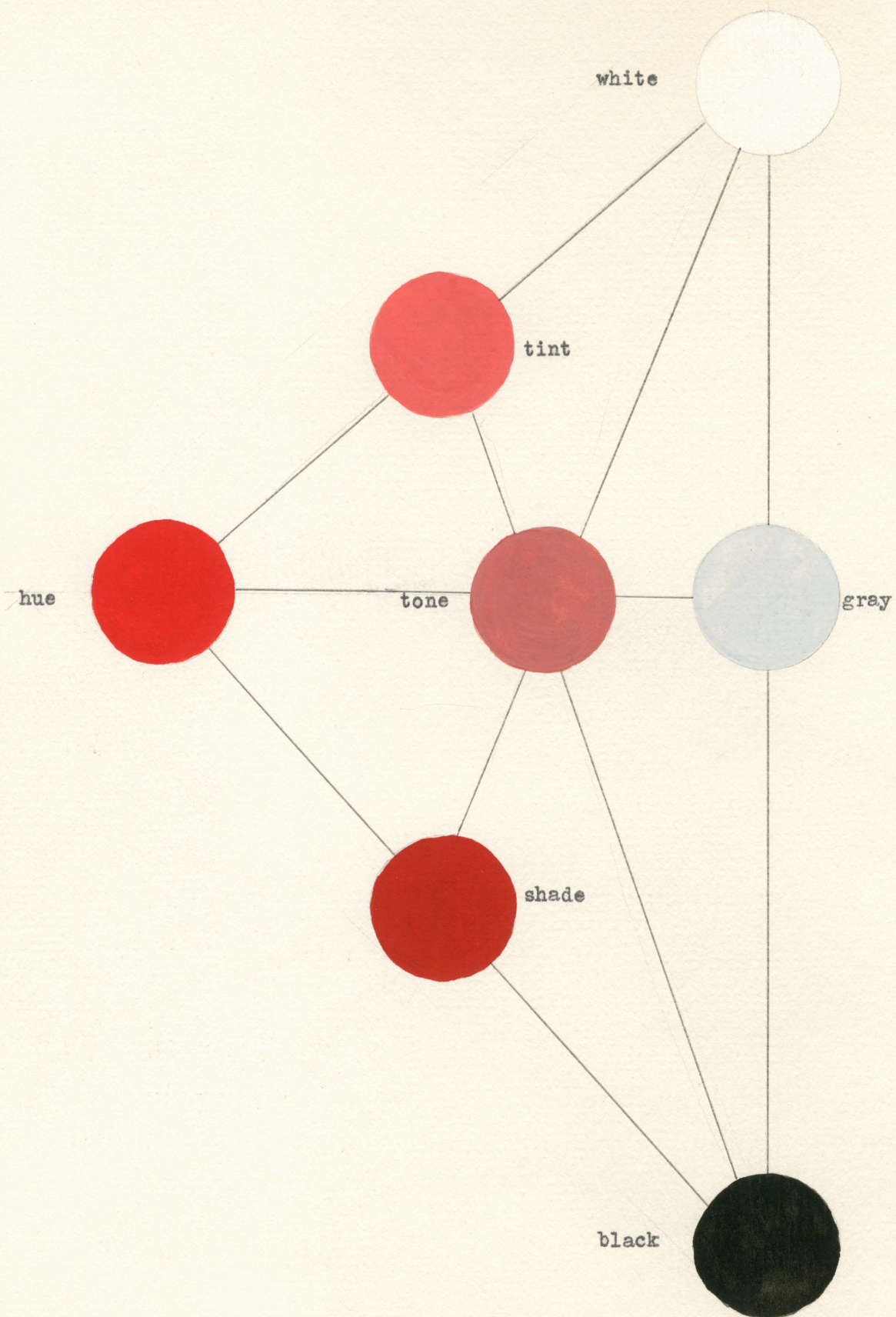
Unlike complementary colors, analogous colors lie in close proximity to one another and share one primary in common. For example, orange which is composed of red and yellow is analogous with yellow-green, yellow, red, and red-violet. On occasion, this definition seems somewhat broad.

¹op. cit., pp.5-6.

Analogous colors supposedly resemble one another; but it is difficult to see the resemblance between red-orange and yellow-green, both of which contain yellow.

Cheskin¹ holds those colors analogous which lie in the same quarter of the color wheel, (on our color wheel every three colors are analogous). Cheskin's definition would seem to be too narrow. Red-orange, orange, and yellow-orange are analogous and comprise a quarter of the color circle, yet red, which lies out of the quarter-circle, certainly resembles the other three colors and must be analogous.

¹op. cit., p. 146.



An incomplete representation of the Ostwald color system for red is shown opposite. The explanatory matter presented below is based on information contained in Faber Birren's book, Functional Color.¹

The color system shown is similar to the "cone" on page 10 with the exception that only the red half is considered and fewer values are used.

The gray scale lies on the line between black and white. The gray shown is "middle gray". All grays lying above "middle gray" grow progressively lighter as they approach black.

Color tints consist of pure color plus white. Tints lie on the line between hue and white and their position in the line is determined by the ratio of white to hue in their make-up.

Shades consist of pure color plus black. Shades lie on the line between hue and black and their position in the line is determined by the ratio of hue to black in their make-up.

Tones consist of pure color plus black plus white, (i.e., hue plus gray). Tones occupy the entire interior of the triangle and their exact position is determined by the relative amounts of hue, black and white in their make-up.

All colors that lie on a straight line with one another harmonize well. Thus black, tone, and the related tint harmonize as do white, tone, and the related shade as well as hue, tone and the related gray. Other harmonious arrangements are hue, tint, and white; white, gray, and black; black, shade, and hue. Successful triad harmony may be secured with hue, white, and black. A more subtle, esthetic arrangement would be shade, tint, and gray.

¹Birren, op. cit., pp. 80-85.

Greatest contrast within the triangle is obtained with color and white, color and black, color and gray, black and tint, white and shade. Tints and shades also contrast since one consists of color plus white, the other of color plus black.

[In general] The warm hues . . . make the best shades and also seem to harmonize perfectly with black. . . . [The cool colors] seem only dirtier when black is added to them. The cool hues generally make the best tints and also seem to harmonize beautifully with white. White added to violet, blue and green will make very appealing tints, while red, orange, and yellow will tend to suffer.¹

As stated previously, the Ostwald color system has its oponents as well as proponents. Sterling MacDonald, for example, contends that a tone consists, not of hue plus gray, but of hue plus its complementary.²

David Wight Prall has criticised the cone because:

The scheme fails to represent accurately some of the relative distances as measured in terms of felt degrees of similarity and contrast. Full saturated yellow is not for our vision so far from white as any of the other full hues; . . . Moreover, it is obvious that any line through the cone at any angle will give a set of variations along a dimension that constitutes a series just as clearly as the sets of variation along the traditionally selected three lines.⁴

With these admitted deficiencies, the cone seems adequate for a layman's use and has a quality of clarity that enhances its value.

¹ Ibid.

² Sterling MacDonald, op. cit., p. 4.

³ David Wight Prall, "Sensuous Elements and Esthetic Orders", A Modern Book of Esthetics, ed. Melvin Rader, (New York: Henry Holt and Co., 1952), p. 251.

CHAPTER III

COLOR PERCEPTION IN CHILDREN

Now that we have investigated the world of color and are sufficiently familiar with the nomenclature of that world so that words like warm, cool, tone, and receding, etc., will not confuse us, we are ready to pass on to a study of children and their relationship with color.

A child, before he is able to prefer one color over another, before he is able to be affected by color, must be able to see color. But when he is born he is, so to speak, incomplete. His extremities, of course, are present; but his nervous system is barely in working order. He cannot control the voluntary muscles of his body, he cannot focus his eyes, and he cannot see color.

Just when the ability to perceive color develops in the child is not known. Certainly no set age can be determined because each child develops at his own personal rate after birth, but some average age should not be too difficult to find. However, "many studies have been conducted upon the development of color vision, but the results are at considerable variance with each other because of the differences in the techniques used."¹ "The age of color vision has been set anywhere from the fourth month to the third year."²

¹Frieda K. Merry & Ralph V. Merry, The First Two Decades of Life, (New York: Harpers & Brothers, 1950), p. 554.

²Ibid., citing R. Staples, "Color Vision and Color Preferences in Infancy and Childhood", (Summary of Investigation from 1890 to 1931), Psychological Bulletin, XXVIII, (1931), pp. 297-308.

A short description of some tests and the results of other tests will be given below. For clarity the ages of the children tested will be separated into two groups; children two years old and under; children two years old and over.

The Child to Two

M. W. Shinn reports several observations and some experimental work on her niece's ability to discriminate color from birth to three years of age. When her niece was six months old Miss Shinn used red, yellow, blue, violet, orange, pink, and green ribbon and allowed the child to make a choice among them. Blue and violet were noticed seldom. Green was noticed least. When she changed the degree of illumination by placing blue, violet, and green in a strong light and yellow, orange, red, and pink in a weak one the child appeared to prefer the former. Her results indicate that brightness in color determine their choice. In conclusion she states that from the fourth week until the end of the first year her niece discriminated in terms of light in color. Light is probably used to mean brightness.¹

Results of a test conducted by Miss R. Staples as reported in 1931:

In a . . . carefully conducted experiment on 262 children under two years of age [Miss Staples] tried to discover differences in their responses to red, yellow, green, blue, and gray of equal brightness and checked these results with 50 preschool children, 100 [grade school children] . . . and 100 adults.

Infants responded at birth to the brightness, and not to the color, of colored or uncolored light, but at three months they prefer colors to gray. Color preferences were quite marked between 6 and 15 months, . . .²

Results of another experiment by Miss Staples are discussed by Dr. Arlitt:

Miss Staples states that infants 3 months of age may perceive color to a certain degree. By the fifteenth month children see

¹Ada Hart Arlitt, Psychology of Infancy and Early Childhood, (New York: McGraw-Hill Book Co., 1946), p. 281, citing M. W. Shinn, "Notes on the Development of a Child", (Berkely University Press, 1907), II, pp. 148-172.

²Merry and Merry, loc. cit., citing R. Staples, "Color Vision and . . . "

saturated red, green, yellow, and blue. Staples results . . . are somewhat open to question, inasmuch as there is no indication whatever that these infants were not reacting in terms of brightness rather than color.¹

The divergence of opinion between experimentors is already shown in the above tests. We shall go on now to experiments with older children.

The Child Two and Over

Dr. Arlitt writes of still other tests on older children. The results of some of these tests, but not a description of the tests themselves, will be given below.

Bird T. Baldwin and Lorle Stecher² indicated that at three years old the child's color discrimination was "far from perfect".

W. M. Cook³ found color naming inaccurate to five years of age and matching, except for red, inaccurate in younger children.

E. M. Luken⁴ tested children in the following age groups: two years to two years six months; two years and six months to three years; three years to three years six months; and three years six months to four years. The test consisted of matching a color held in the experimenter's hand from a table laid with colored cloths of similar and different hues.

¹Arlitt, op. cit., p. 283, citing R. Staples, "The Responses of Infants to Color", Journal of Experimental Psychology, XIV, (1932), pp. 119-141.

²Ibid., p. 282, citing B. T. Baldwin & L. Stecher, Psychology of the Preschool Child, (New York: D. Appleton-Century Co., 1924), pp. 123-130.

³Ibid., p. 282, citing W. M. Cook, "Ability of Children in Color Discrimination", Child Development, II, (1931), pp. 303-320.

⁴Ibid., p. 282, citing E. M. Luken, Color Discrimination in Young Children, (University of Cincinnati, 1933).

The inability of two year olds to match colors correctly was quickly discovered. The increase in color discrimination from two to four was also evident. Even at four the children were not completely accurate in yellow and green and were less than 75% accurate in red and blue. The poor showing in the case of blue and red was attributed to the fact that brown was often confused with blue and that pink was not recognized as a tint of red.

From these and other experimental results Dr. Arlitt has concluded, "There is no doubt that the average child two years of age and younger does not perceive differences in color. . . . and that even at three years of age a child's color preferences are not strong."¹

From another field of study, Victor Lowenfeld,² Professor of Art Education, Pennsylvania State University, states that, "one of the first stages of color perception is merely to distinguish between colors. This usually occurs during the stage of 'Naming of Scribbling'",³ which, according to Professor Lowenfeld, falls between the ages of $3\frac{1}{2}$ and 4.

Author's Conclusion

The results of the above tests are compiled as follows:

Shinn: No color discrimination below one year.

Staples: Color preference, and hence discrimination, marked between 6 months and 15 months.

Staples: Color perception to a certain degree at 3 months.

¹Ibid., p. 285.

²The author sincerely recommends that parents of young children read Victor Lowenfeld's book, Your Child and His Art, (New York: The MacMillan Co., 1954), which explains how the growth of creativity in a child may easily be stunted by incorrect art teaching methods and coloring books.

³V. Lowenfeld, Creative and Mental Growth, (New York: The MacMillan Co., 1957), p. 102.

Baldwin and Stecher: Color perception far from perfect at 3 years.

Cook: Color naming inaccurate at 5--color matching inaccurate at younger ages.

Luken: Inability to match colors at two. Color matching 18% incorrect at four.

Lowenfeld: Color discrimination at $3\frac{1}{2}$ to 4.

Considering the gulf existing between the conclusions of the several experts noted, it would be presumptuous indeed for the author to attempt to set an age for color perception. He is safe, however, in stating that the approximate average age between the highs and lows recorded would probably land somewhere around the age of $2\frac{1}{2}$ years. The inexactitude on the author's part in arriving at even an average age stems from his inability to determine exactly what age is meant by "younger than five".

Parents, incidentally, may increase their child's awareness of color, and thus his perception of it, by adding the color to the name of any object mentioned during baby's play, (e.g., the red ball, the blue top).¹

¹The author is indebted to Mr. Verne Dusenberry, Associate Professor of English, Montana State College, for this little training aid.

CHAPTER IV

COLOR PREFERENCE IN CHILDREN

Authorities on children's preferences in color are in much more general agreement than they were on children's perception of color. This statement is made with the reservation, of course, that the authorities be in agreement that the child is old enough to perceive color. It follows, naturally, that one who believes a child cannot see color until two will scoff at another who states that a child has preferences at one.

As in the last chapter, the author thinks it best to quote authorities for the most part rather than give a mere summary of test results. He will make no judgement here as to whether or not the ages mentioned are too young for color vision.

For purposes of comparison Faber Birren's list of adult color preferences is given, without endorsement, below:

Men prefer, in order: Blue, red, violet, green, orange, yellow.

Women prefer, in order: Red, blue, violet, green, orange, yellow.

We shall begin this examination of color preferences with a continuation of Miss Staples' findings as reviewed by Frieda and Ralph Merry:

Color preferences were quite marked between six and 15 months, with the following order: red, yellow, blue, green. The colors, which are most liked by babies are least liked by adults. At 19 months blue is the best liked color and yellow is the least liked. Yellow is also preferred least by preschool children, grade school children, and adults. Preschool children preferred red, green, and blue; school children blue, red, and green; men like blue and women green. Red is the best liked until school age, when it is replaced by blue. Girls show slightly more mature color preferences than do boys.¹

¹Merry & Merry, loc. cit., citing R. Staples, "color Vision and . . . "

Miss Staples' findings that blue is favored at 19 months, loses favor during preschool years, and regains favor during the school years, is pointed out without comments as is her statement that women prefer green, which is in contradiction to Birren's list.

Cheskin states:

Children from the age of one to six are very much intrigued with pure colors. Normally, they like red best and blue least; yellow, though it has greater visibility than red, fails to stimulate them. . . . They are not attracted by delicate tints or deep shades. Baby pink may thrill mama, but it leaves baby unimpressed. A very strong red, on the other hand, may annoy the cultivated sensibilities of the modern mother, yet provide a distinct thrill for the two-or-three-year-old.¹

And again:

. . . Color-preference tests conducted with children demonstrated that combinations of yellow and violet-blue and yellow-green and violet are not the choice of most boys and girls. Nor did infants take to objects of these colors.

.
For infants and children of all ages, . . . violet-blue and yellow are sterile. When the [violet-] blues and yellows won preference, there was usually some question about the child's emotional normality.²

Or yet again:

Normally, if you try giving a baby two identical toys--one red, the other blue--almost always the child will choose the red or stimulating one.³

Ann Van Nice Gale,⁴ from experiments among several hundred school children in the third to eighth grades, found the pure colors, in order of preference, to be orange, red-violet, blue, blue-green, violet, yellow.

¹Cheskin, op. cit., p. 21.

²Ibid., p. 72.

³Ibid., p. 22.

⁴Faber Birren, op. cit., p. 74, citing Ann Van Nice Gale, Children's Preferences in Color, Color Combinations, and Color Arrangements, (Chicago: University of Chicago Press, 1933).

She also found that children seemed to prefer the warm colors to the cool colors and analogous color arrangement to the monochromatic. Two-color combinations, in order of preference, are red-violet and yellow, yellow and blue, blue and green.

A re-examination of the above preference ratings shows that while the first choice of Miss Staples' subjects alternated between red to blue for the first six or seven years of life, Cheskin's subjects preferred red throughout roughly the same period.

Ann Van Nice's listing of orange as the preferred color to school children is very much akin to Cheskin's red. Indeed, considering the vagaries of color chemistry, her orange may be as red, if not more so, than Cheskins. (It would be well to point out at this time that the red of the spectrum is quite close to the orange of pigment. Of such is the nature--and confusion--of color).

Whether or not Ann Van Nice's orange is close to the hue of Cheskin's red, it is, at least, composed partly of red, and, like red, is a warm color. Miss Staples' blue is directly opposed to the other first choices. While red is a warm color, and orange warmer yet, blue is the coldest of colors. Psychologists are quite in agreement (as will be seen) that children, unless they are abnormally introverted, prefer warm colors. This plus the fact it is generally assumed that children love red above all colors, leads the author to suspect Miss Staples' research methods.

How then shall we order the child's real preference in color? If we compromise and call the first color red-orange--and allow yellow and the violets to contend for last place--considering the child's love for both warm and bright colors we should come up with somewhat the following order.

On the color circle (page 12) start with red-orange, move through red, then orange, skip across the yellows and choose green, then blue, blue-green, then skip back to yellow-orange, back across to yellow-green, then finally to yellow and the violets.

Yellow, as we have seen in David Wight Prall's criticism of the color cone, is close to white in "hue". Violet (or purple if you will) approaches black in darkness. Children abhor black and white because neither is positive, ergo, both violet and yellow have low preference rating. Unlike violet, blue, though dark, is bright enough to have a definite "coloriness". Hence the comparative high regard for blue.

Let us repeat our color preference rating in a more easily seen form.

Children love, in order of preference:

<u>Hues</u>	<u>Psychological Primaries</u>
red-orange	red
red	green
orange	blue
green	yellow
blue	
blue-green	
yellow-orange	
yellow-green	
yellow	
violet	

Until the age of seven, a child's drawings and paintings reflect his preference in colors. Color is used for the sheer joy of it and there is no realistic relationship between the color used and the object drawn. Thus a representation of a man may be painted green or red or any other color that appeals to the child at the time.

Though they may more properly be inserted here, other indications of children's color preferences will be given, for exposition purposes, in the following chapters.

CHAPTER V

THE EFFECTS AND USES OF COLOR

We have already mentioned some of the physiological and psychological aspects of color. Let us now explore these aspects in relation to their effect on the individual so that we might determine what use, if any, can be made of them.

Except in certain cases of color preference and color-value preference, a child's reaction to color parallels that of the adult. Therefore, while much of what follows is based on experiments with adults, the information gleaned is applicable to children.

When apropos, certain experiments and case histories will be inserted to illustrate a point.

"The warm colors, yellow, orange, and red, are positive and aggressive, restless, or stimulating, as compared to the cool violets, blues, and greens, which are negative, aloof, and retiring, tranquil, or serene."¹

Cheskin reports several experiments which have been carried out to determine precisely what the psychological and physiological effects, if any, of warm and cool colors are.

Four small rooms were color-treated; one entirely in red, the second in green, the third in blue and the fourth in yellow. In each room, walls and all furnishings--desks, chairs, typewriters--were the same respective color throughout.

¹Maintland Graves, The Art of Color and Design, (New York: McGraw-Hill Book Co., 1941), p. 256.

The brilliant red color caused persons staying in the room to experience an increase in the blood pressure and pulse. It was not possible for them to work in it or even to remain in it for any length of time. Normal activity was out of the question because of the overstimulation caused by the vibrant red. . . .

The blue room produced . . . [an opposite effect] to that of the red room. Blood pressure and pulse declined. The occupants became sluggish and their rates of activity dropped below customary levels.

The brilliant yellow room caused no change in blood pressure, but many activities were impossible because of extreme eyestrain.

The green-room experiment indicated that if any of the four hues can be called a "normal" color it is green. . . . The occupants . . . however complained of monotony and asked for a varied color scheme.¹

A further proof that definite physiological and psychological effects might be induced by color was given by Cheskin in reporting that test subjects enjoying a dinner were made to lose their appetites or actually grow ill when colored lights were played on the food.²

The above experiments plus what we have already seen of warm and cool colors should enable us to make the following statements about certain colors:

All red hues are stimulating to some degree. The warmer the red, (the more yellow it contains) the more aggressive and advancing it is.

Orange . . . has such warmth and vibrancy that . . . many people quickly tire of it because of its overstimulating effect.

Yellow produces the sensation of sunlight and warmth. The psychological reaction to yellow is not as positive as it is to the red or blue.

Green . . . produces the most comfortable reactions. Blue-greens are cool and yellow-greens are warm, but even a cool green is not really a cold color.

Blue, though the coldest of colors, . . . enjoys wide popularity. It is generally found that this color is a psychological sedative for

¹Cheskin, op. cit., p. 10.

²Ibid., pp. 11-12.

people who are inclined to be easily overstimulated. It can be depressing for the morose type of individual, and persons inclined to melancholy should avoid an overabundance of it.¹

The psychological effect of various colors often serves to qualify an individual's preference in color. Thus while it is almost universally accepted that children of all ages prefer red as a favorite color, " . . . it has been observed that children who are emotionally unstable or given to morbidity choose blue or black as their favorite color. Children who are starved for sunshine prefer yellow, and those in slum areas where shrubbery is rare are attracted by green."²

These qualifying factors aside, and except when they are chosen for a particular effect, all colors chosen for an environment should, in general, suit the personality of the occupants. Warm colors, being aggressive and stimulating, are proper to the extrovert; cool colors, being retiring and sedative, are proper to the introvert. Green, a color somewhat balanced between warm and cool, is proper to the "balanced" personality.

Having such emotional harmony in mind, it would seem poor advice to suggest to an excitable person that the home atmosphere ought to be cool in quality so that it will calm her nerves. Exactly the opposite takes place. Having no release, natural tensions may be bottled up, and the warm personality in a cool home may suddenly burst, or rush out of the house to a more compatible and stimulating place.

With children, for example, virtually all of whom are extroverts, bright [and warm] colors have a pacific effect. Why not? If they are bubbling over inside and if what they see outside also bubbles, they are emotionally convinced that all's well with the world and therefore with themselves. If you want to see them boil over, just expose them to the august, still pressures of monotony.³

¹Ibid., p. 19.

²Ibid., p. 22.

³Faber Birren, "What Color Suits you Best?", House and Garden, CVIII, (Sept., 1955), pp. 78-87.

Bright splashes of color in an otherwise dull room would hardly be sufficient as a source of stimulation for children, though many people apparently are under that impression. The following excerpt is from a magazine article entitled, "Children Love Color".¹ The article was of the type we might refer to as, "A weekend with the Jones'es". It had little to do with either color or children and it did not pretend to advise parents. We are inserting it here to point out the errors found in print and to caution the reader not to follow color suggestions willy-nilly without first checking those suggestions against known scientific facts.

The article begins:

"I like blue, I like green, I like red . . ." This was the sing-song answer little Joyce . . . gave her mother, Bettie, when asked what color she wanted in her new room. Joyce, like most children her age, prefers good, strong, primary colors. Bettie, like the good mother she is, believes in consulting her children and taking their wishes into account.

The walls of Joyce's bedroom, [which also served as a playroom for the other children] and woodwork [were] painted white, the furniture sprayed in the primary colors.

We hope the white playroom was not copied by many families. The color was certainly not correct according to Cheskin who reports on a case somewhat similar in which an acquaintance "invested a lot of money in fixing up a playroom in the basement" only to have the children ignore it in favor of the neighbor's less well equipped playroom.

Mr. Cheskin continues:

My host's play space was orderly. It was whitewashed with the idea of giving the room "a clean look". It had the clean look of a nineteenth-century hospital room or a temporary emergency station.

¹J. Hulburd, "Children Love Color", Better Farming, CXXV, (March, 1955), pp. 106-107.

The white walls were bleak and uninspiring. He had not realized that white has no appeal to children. . . . White is unstimulating, it reflects nearly all of the light. The glare is an irritant and discourages play.

.....

But the neighbor's walls were burnt orange (a tone of red-orange), and the center of the ceiling was painted a clear green-blue which gave the impression that it was much higher than it really was. A three foot border of ceiling at the walls was painted white with indirect light fixtures distributed every six feet. The reflected light circled the room around the green-blue ceiling center.

The colors and lighting were dramatic and stimulating. The reflected light did not strike directly at the eyes as it would have done from a white wall, and the colors were "play colors".

The orange-red tone of the walls was rich and vibrant, and the light green-blue ceiling cool and soothing. Both colors produced an effect of the out-doors. The color scheme was optically and psychologically balanced. The lighting was easy on the eyes. The surroundings were inviting and inspired activity.

The children enjoyed spending their time in this color-tuned playroom. Adults felt comfortable in it.

My host's lack of awareness of the importance of color and his ignorance about its optical and psychological characteristics were responsible for his children's discontent.¹

One must not assume from the above that all children's rooms should be red-orange, or red, or the like. Each child's personality, and the uses for which the rooms exist, must be taken into account. We have already seen that some disturbed children have definite preferences in color. Other disturbed children may have definite color aversions. In the former case it is not always best to follow the child's wishes; certainly a child starved for greenery might be given a green room, but a melancholy child should not be given a blue room even though he may prefer that color. In the latter case, that of a child with an aversion for a certain color, it is most often wise to follow the child's lead.

¹ Cheskin, op. cit., pp. 76-77.

A traumatic experience may give an impressionable child a life-time abhorrence for a certain color. One case on record¹ is that of a child who was severely punished by a teacher when he had failed to complete a color painting of a Halloween pumpkin. The experience so disturbed the child that he became hysterical whenever he had occasion to use or be in close proximity to the color orange. Obviously a red, orange, or even a yellow room would be a poor choice for this child.

The author wishes to add, parenthetically, that parents should be aware of the danger of using fear in place of discipline to obtain obedience. One unwise mother pointed out a policeman to her young son and threatened that if the child were bad the policeman would take him away and lock him up. The child was naturally frightened but what impressed him was not the policeman but the blue of the uniform. From that time forward, the child's father could in no way approach the child if he were wearing a blue suit.²

The uses to which a room is put have much bearing on the correct color choice. A room, or a corner, used by young students for study should not be overstimulating. An overstimulated child (or adult) cannot study because stimulation requires physical action whereas study is a sedentary occupation. In almost all cases the reds and oranges would be poor choices for the study while the more sedative greens and blues would be ideal.

The physiological construction of the eye, too, dictates that certain colors and values be avoided. Yellow is too "eye filling" for a study; white does not differ sufficiently from the printed page or a sheet of paper to provide relaxation for the eye. Both yellow and white reflect too much light and eye-straining glare.

¹Ibid., pp. 14-16.

²Ibid., p. 18.

The colors selected for the study should be dark enough in value to provide a relaxing contrast between the value of the study material and the wall, however they should not be so dark as to provide extreme contrast.

Two physiological facts enter the picture to make extreme contrast detrimental. First is the phenomenon of "field view", by which the iris of the eye is adjusted somewhat to the major light value of the surrounding area, e.g., if a person reads under a direct light source in an otherwise dark room, the iris of the eye will enlarge to compensate for the dark surroundings thus allowing more light to enter the eye than is necessary for reading, with a consequent strain on the eye.

The second physiological fact is that the iris, while adjusting to the "field view" is not really adjusted to the dark surroundings or to the lighted page and when the eye glances from one to the other it has to make extreme adjustments which, if repeated often enough and long enough, are injurious.

A middle value then, of a cool or neutral color, is suggested for the study; and for the same physiological reason as given above, the entire room, including the walls, should be under equal illumination.

CHAPTER VI

SUMMARY

What follows below constitutes much of a review of previous matter. By repeating it here in a more concise form we should hope to make it of greater value to the reader. Also some new matter will be presented that could not have been inserted earlier.

Our summary will consist of some general rules for the decoration of children's rooms.

The Nursery

In general, an infant much under a year does not react to color itself but rather to the value of color. Thus, while mother may like baby blue and pink these tints fail to interest baby. As a child's color perception develops more sedate color will interest him, but as an infant he likes primary colors such as vibrant red and brilliant blue. One cannot paint the walls of the nursery to satisfy the child because the colors would disturb the adult, but one may provide color interest for the child in the form of "toys in red and in as many other bright colors as you can get."¹

Another visual stimulant in the nursery is wallpaper with designs of animals in bright colors.

Such wallpapers should be hung as murals, and they should be changed every six months in order to enrich the child's knowledge of the animal world. . . . The mural should be no wider than one width of wallpaper because too many elaborate designs and acrobatic figures are often overstimulating to children.²

¹Ibid., p. 70

²Ibid., p. 108.

The Playroom

As the child grows older his color perception improves. He then comes under the psychological and physiological influences of color. A child's playroom, therefore, should be color-tuned to suit the extroverted personality he is. Reds and greens do very well in the playroom. Orange-red and blue-green as complementaries are suitable for several years; from infancy through the lower grades at least. Blue-green is not a warm color, but it is not really cool either and can be used effectively on the wall of a child's room allowing the child's furniture, painted red, to provide the stimulating atmosphere. Otherwise, warm colors of the red-orange groups should be used on the walls.

The Study

As the child reaches school age his room may have to be changed if it is predominantly warm in hue. Warm, bright colors should not be used to any great extent in an area used for study. The best conditions for study are provided by a quiet, restful atmosphere. Such an atmosphere is induced by the cooler colors. Blue, blue-green, and green are ideal colors for the study area. Green is probably the best color since it is neither too cold nor too warm.

In the study hues are used "to increase legibility, to decrease eyestrain, . . . [and] to cooperate with illumination. . . ."¹ The hue chosen, therefore, should be neither too light nor too dark. If it is too light, in addition to producing glare, it will fail to provide a resting change for the eyes. If it is too dark the contrast between the study matter and the wall will be too great, resulting in eyestrain.

Where children are concerned, white and yellow in any large areas are to be avoided. In the nursery they are difficult to perceive; in the playroom they are unstimulating; in the study they are factors in eyestrain.

¹Birren, op. cit., p. 12.

CHAPTER VII

CONCLUSION

What conclusions can be drawn from our study of color and the child?

Perhaps the most important lesson we should have learned is that colors are personal; they effect our emotions, our physical well being, our mental balance. Therefore, color choice, even in the adult world, should not be a matter of mere fashions but should be dictated by the individual personality. How much more important correct color choice becomes when applied to the child. The adult, after all, exists now as a definite mental, emotional and physical entity. The child, on the other hand, is developing and is susceptible to change. What marvelous chances we have to help guide the development of that personality, for personality is the sum total of man's reaction to the influences of the environment under which he grows. By providing a happy environment for our children we lay the foundations for a happy adulthood.

If you value your children's happiness, if you want your children to grow up emotionally stable and in good health, you will not minimize the importance of having the right surroundings for your children when they are at play. By right surroundings, I mean particularly a room in which the colors and lighting are planned so that the place is easy on the eyes, inviting, conducive to healthful activity and contribute to emotional stability.¹

¹Cheskin, op. cit., p. 78.

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