KODACHROME
AND KODACOLOR
FROM ALL ANGLES

CHIEF BIG SNAKE

Of all the colorful subjects that intrigue Kodachrome photographers, no subject arouses more enthusiasm than does a First American, when he can be caught in full regalia. The author is no exception, and many contacts have resulted in some of the finest friendships I have ever enjoyed.

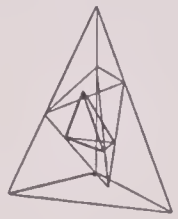
Seldom can one find such a happy combination of forceful character and splendor of color as this seventy-five year old Chief presents. Three-quarter's of a century of vivid experiences and vigorous living have etched character into this old Chief's face, his figure and his bearing —as staunch as the pyramidal composition that gives strength to this figure study.

The range of tone values, from the delicate fluffiness of the feathers to the somber, light absorbent black velvet tunic, is a little more than Kodachrome can record with fidelity, due to its limited latitude. But since the extremes of light and dark are both simple masses, some loss of detail is less objectionable than might otherwise be true with a subject of a different character. The nicely rendered detail in other areas compensates for the slight loss at the extreme ends of the scale. The exposure for this shot was based on a meter reading on the flesh, which in this case was fortunately about half-way between readings on the extremes of light and dark.

DATA: Exposed on 4x5 cut film Kodachrome; Camera, Speed Graphic; Lens, 10 inch Goerz Dagor. The reproduction is four color process, letterpress; plates made from a Wash-Off Relief Color Print made from the Kodachrome.

KODACHROME AND KODACOLOR

FROM ALL ANGLES



FRED BOND

ALL ILLUSTRATIONS BY THE AUTHOR

except where otherwise designated

CAMERA CRAFT PUBLISHING COMPANY
SAN FRANCISCO

Second Edition

CAMERA CRAFT PUBLISHING COMPANY

San Francisco

First Edition, April, 1942

Second Printing February, 1943

Printed in the United States of America
by the MERCURY PRESS, San Francisco

FOREWORD

SELDOM has such a varied, yet related, experience served as a background for any book on photography as that which the author has drawn upon in producing this volume on Kodachrome and Kodacolor photography. Literally, the result of thirty years' intimate association in and with the fine and graphic arts are written into these pages. Conclusions at which the author has arrived are tempered and influenced by a composite experience that includes schooling in the fine arts, years spent in the art and photographic phase of advertising and graphic arts production, and continuous work in Kodachrome since the introduction of this medium more than five years ago.

It will be clear as you read these pages that the author is no "snapshot" photographer. Since cut film, professional Kodachrome came on the market he has made thousands of exposures under almost every conceivable condition, and every shot was made with due regard for the exactitude the medium demands if the full scope of its capacity for faithfully recording the beauty of this colorful world was to be even moderately realized.

The new medium of Kodachrome, and the still newer one of Kodacolor, are both simple and yet complex. Our understanding and appreciation of the possibilities in color photography are only just beginning to develop. There are many things we do not know, there are others that are in the process of becoming conclusive, and yet others that are already established as axiomatic.

The author assumes no authoritative pose beyond that of his own intensive study and extensive experience. Rather, he prefers to align himself with all those eager color enthusiasts who work with Kodachrome with an open mind, an appetite for proof, and in an adventurous spirit that accepts the challenge of the yet unknown possibilities in the fascinating field of color photography.

This book can and will be a constant source of both inspiration and fact to all who give it study. It is the first complete and comprehensive work on the subject of Kodachrome and those fundamentals of color that have such an important bearing upon satisfactory results.

Whether you are a beginner or an advanced, proficient worker in color photography, this book will not only help you achieve better results more easily, but it will add a wealth of enjoyment through helping you develop a finer appreciation for color, all color, in your everyday associations with the world in which you work and play.

THE PUBLISHER.

ACKNOWLEDGEMENTS

The author wishes to express grateful appreciation for much helpful information and cooperation from many individuals and organizations, in the production of this work. Special acknowledgment is hereby given the following:

GENERAL ELECTRIC COMPANY
THOS. S. CURTIS LABORATORIES
WESTON ELECTRICAL INSTRUMENT COMPANY
EASTMAN KODAK COMPANY
HARRISON & HARRISON
THE MUNSELL COLOR COMPANY
MCKNIGHT LABORATORIES
WABASH PHOTOLAMP CORPORATION

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(All black and white photographic reproductions shown in these pages, except those that are diagramatic or that illustrate eqnipment or devices, are from negatives made direct from the original Kodachrome transparencies.)

BLACK AND WHITE ILLUSTRATIONS—Continued

INTRODUCTION

THAT urge to pictorially record the world you live in is nothing new. Your aboriginal ancestors expressed that same urge through their cave paintings long before the Chinese concluded that "one picture is worth a thousand words" as a vehicle for conveying facts and ideas.

The mass popularity of photography has been accelerated by the development of instruments and materials that have made this means of expression so effortless. If one's interest goes no farther than the mere recording of a monochromatic image of a landscape, an individual or an activity, he needs remember only a few simple rules, press a button and the record is captured.

Others who have leanings toward the more artistic have found satisfactory expression for their creative instincts through photography, in lieu of attempting to become even pleasingly proficient in the fine arts. Some of us have no talent for so-called art mediums; most of us haven't the months and years of time necessary to develop such talent as we may have.

Now that photography in full, natural color has been made available, and its practice made so easy through the medium of Kodachrome, a wholly new and infinitely bigger world has opened up to and for the photography enthusiast, whether his interest be in the scope of the creative or the more literal recording of fact. The bounds and bonds of monochromatic, two-dimensional limitations have been broken by this new medium of color. Few if any of us realize and appreciate the full import of its potentialities. In our modern day sophistication we look upon such scientific "gifts" as something to be expected, if not demanded, and too often our perception as to what is worth-while and what is trivial is dulled by that same sophisticated nonchalance.

To me, this addition of color to our abilities in photographic expression is one of the greatest contributions of the times. Without deprecating monochromatic photography in the least, this new medium of color can bring a greater enrichment to the lives of the millions, with less effort, than any other single cultural or emotional stimulus. It is as though all our

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BRYCE CANYON NATIONAL PARK

Few landscape subjects present the color photographer with such a myriad of color moods as does Bryce Canyon. Its general color characteristics change with every hour of the day, and from every new angle of view or angle of incident light.

This color shot demonstrates very effectively the maximum use of reflected light. The camera looked almost directly into a sun that was only about forty five degrees above the horizon. Not only was reflected light the sole source of illumination for the foreground formations, the significant fact is that this reflected light was *colored* light—light reflected from the walls of the Canyon. The result is more saturation of color than is present as purely local color in the formations themselves.

DATA: The shot was made on 4x5 cut film Kodachrome; Camera, Speed Graphic; Lens, 5¼ inch Zeiss Tessar. The reproduction is four color, 200 line deep etch offset lithography.

music of by-gone days had been confined to one or two simple instrumcnts and now, for the first time, we can enjoy the full scope of complete orchestration.

It has been said that color photography is a statement of fact—that every element in a composition must be as completely and perfectly portrayed as though it were the subject itself. This theory is sound only to the extent that such often pleasing practices of monochromatic photography as out-of-focus backgrounds or diffused outlines seldom if ever produce a satisfactory color result. But this does not imply that every color photograph must, to be a good color result, reproduce every color spot and area down to the last stitch and pin, with fidelity and absolute realism. That is a common fault of too much present day color work—everything in the composition competes for attention to the extent that one loses sight of the "theme" of the picture.

Color photography, even professionally, is still but little beyond a rather elementary development as an art medium. Color photographers, amateurs and professionals alike, are still mired down in the mechanics of the medium. To many amateurs the alpha and omega of a good color photograph is nothing more nor less than a good exposure. When one starts, rather than stops with that procedure properly accomplished he can then devote his mental processes to what really makes a color picture; how to create one or how to frame and compose and get the best out of what is before his lens. Mastery of the mechanics of one's tools is a first essential, quite naturally.

We will produce better color pictures (correct exposure taken for granted) when we apply known simple rules of color and art to color harmony and balance; to color emphasis; to color composition. It is my conviction that the real progress in the development of artistic quality in the color work of the next few years will, and should be made by the serious amateur, rather than in the ranks of the professional. Remember that the majority of color shots made professionally and used commercially are created and/or dictated by the client or his representatives, and that there is little opportunity for the photographer to express more than his technical ability in lighting and exposure. And the exigencies of business leave him little time for experimentation.

The amateur is circumscribed by no such limitations. He is unhampered in the conception of his ideas, unhurried in the execution of the problem, and undisturbed by outside criticism that is irrelevant to the artistic merits of the result. So I say, the real contribution to the technique of the color photography of the future, and the development of a keener public appreciation of what is good color may well come from the rapidly increasing number of serious, capable non-professional workers.

This book has been prompted by that conviction and it is dedicated to that idea. Do not be alarmed by the necessity for study and practice. Remember, most art students want to paint a portrait or a landscape their first day at art school, but they later understand and appreciate that no future progress would have been possible had they not first mastered the rudiments of their field of art, however much some modern art may seem to contradict that statement.

If this book helps the reader develop a better eye for color; helps establish certain simple but axiomatic rules for work in color; and above all, if it stimulates the reader's imagination and quickens his creative instincts it will have more than justified its existence.

All the world about you is color. It is yours to capture and enjoy through the medium of Kodachrome and Kodacolor.

CHAPTER 1

COLOR AND ART

THIS book is not an art course. But if we are going to take color photography seriously we should realize that we are dealing with many new and unfamiliar factors that have not entered into our calculations in black and white photography.

There is art aplenty that does not depend upon color for its enhancement — sculpture, etching, lithography, and of course, the better monochromatic photographic illustration. These things are the media for the expression of line, form and the play of light and shade. The quality of the artistic result depends upon careful adherence to sound rules of composition such as interesting variety and arrangement in shape and mass; dramatic sweep of directional lines; the proper relation of subordinate elements to the central theme of the picture, and many, many others. We know and take into account all these rules when we express our story in monochrome.

What happens when we turn to color as our medium? We go *fortissimo* up and down the spectrum, from the most violent reddish purple to the most eye-splitting saffron yellow we can lay hands on. It is to be a color picture, isn't it, so why not have color and plenty of it?

What becomes of our sense of composition? Why is it no longer necessary to give the same careful attention to size and placement of form and line; to have the same regard for the emphasis on our central theme and the subordination of supporting details? The answer is that the introduction of color is no substitute for sound pictorial principles. A badly constructed picture cannot be made a good picture by the mere addition of color, dazzling though it may be.

What one must remember is that color can be used to give life and spirit to all the fundamentals of good composition. It should be obvious that emphasis can be secured more easily and can be made more arresting through color. For example, let us visualize a simple composition like a bowl of red apples against a flat blue background. It would call for much ingenuity to create emphasis as effectively in monochrome.

Further, color can help create a greater illusion of depth or distance; it can help accentuate texture; it can express a mood of warmth or coolness; it can produce subtle contrasts; it can give animation to otherwise lifeless forms; it can generate movement; it can be joyous or it can be somber.

While it is true that some people have an "eye" for color in the same way we speak of others having an "ear" for music, in both cases this faculty usually does not go beyond an ability to distinguish the good or pleasing from the bad or displeasing. Unfortunately this "eye" and "ear" talent does not equip the individual to create a good color composition nor to compose a piece of music. But before we carry this analogy too far you should be assured that one can acquire a good working knowledge of the fundamentals of color with a fraction of the effort necessary to acquire an equally usable groundwork in music. Above all, do not shy away from a serious approach to a study of color because it appears forbidding and ponderous. It is neither.

First, develop an eye for color. Analyze things that please or "jar" you, and try to discover why they do. Take critical notice of everyday scenes; your environment; interiors; shop windows; people on the street; houses; gardens; everything about you. You will soon commence to see things through different eyes, and this matter of what is good color and what is not will begin to make sense.

Just a hint or two will help sharpen your perceptions. One of the most obvious begin-

nings is to compare massed color with a "salt and pepper" intermingling of small spots of color. A flower garden, for instance. A bed of intermingled flowers of different sizes, shapes and hues may create a splash of color, but it is not pleasing because your eye jumps from bright spot to bright spot with no place to rest. It is a "dizzy" color scheme. Compare such a flower bed with one made up of rows or masses of all one color in each area and you will see the full effect of each mass of color, the extent of the effectiveness depending upon what colors make up the whole scheme, and what colors are adjacent.

Another clue. Notice the difference between an eye-arresting display window and another that may scream color but doesn't say anything you can remember. In the first you will find everything subordinated to the main theme, but subtly supporting it. This "atmosphere" enhances rather than detracts from the main motif of the picture. Such a prosaic illustration is offered as an antidote to any suspicion you may have that our discussion is going too "arty." Good color composition is good color and good art whether you find it in somebody's kitchen or in the Louvre.

Our last clue is that of developing an eye for color in one least noticed and seldom appreciated aspect of this ramified subject. It is, broadly speaking, "reflected" color or the color influence of one object or surface upon an adjacent one, through reflection. Examine a very obvious, commonplace example. Look down upon the top surfaces of a black automobile standing under an open sky. All surfaces turned toward the sky will be distinctly blue, as you have often noticed. And you are seeing the reflected sky color influence in a color (black) that supposedly absorbs *all* colors, for black, theoretically is the absence of light. Another instance is that of the very pronounced blue highlights in black hair when viewed under an open sky.

We have seen these phenomena time and again but have not given much thought to the fact that this same influence is present all around us. Every color has some influence on its neighbor. If you could step from the world about you into one in which all colors were "pure" colors without dilution or influence from surrounding colors, and without atmosphere, I think you would prefer to have things as they are and with no further complaint. Sometimes these influences are troublesome, but we must first learn to see them and analyze their effect on our picture. There are many ways to eliminate or control them, which we will discuss later.

Failure to "see" these influences gets us all into situations from which we endeavor to extricate ourselves by placing the blame on mistaken causes. To carry this "sky influence" a little further, let us say dad takes a color shot of young daughter sitting outdoors under a clear blue sky. She is dressed in white, posed with face slightly upturned to eliminate harsh eye and chin shadows. The Kodachrome comes back from the processing laboratory and dad hits the roof because "they have ruined another one of my shots in processing." Dad and mother didn't mind a little blue cast in the hair because some of the hair (on the side turned away from the sky) looked "natural," and some blue on the shoulders and lap part of the dress was not so bad although it *should* have been pure white (so they argued), but that bluish flesh tint! Why did the processing laboratory ruin the peaches and cream complexion of their little daughter?

This little episode is no exaggeration; it happens every day. And all because the average human eye has not been trained to "see" color as it is.

This is not to imply that there is never anything wrong with film or processing, or with lenses and shutters. But until you learn to see and analyze causes and effects you will likely continue to grope through a succession of trials and errors that are disheartening to say the least.

Before you wonder why this part of our discussion is headed "Color and Art," and what became of the Art, let me remind you that the ability to see, analyze and compose good color compositions is an art in itself, to supplement the art of form, mass and line. And again I repeat, the employment of color in no way supplants any sound rules of good art. It is not true that you must "unlearn" good art principles, which you have proved and seen proved as good. You must only adapt a new technique to those sound fundamentals of good pictorial construction that always have been and always will be good "art."

CHAPTER 2

SOME CHARACTERISTICS OF COLOR

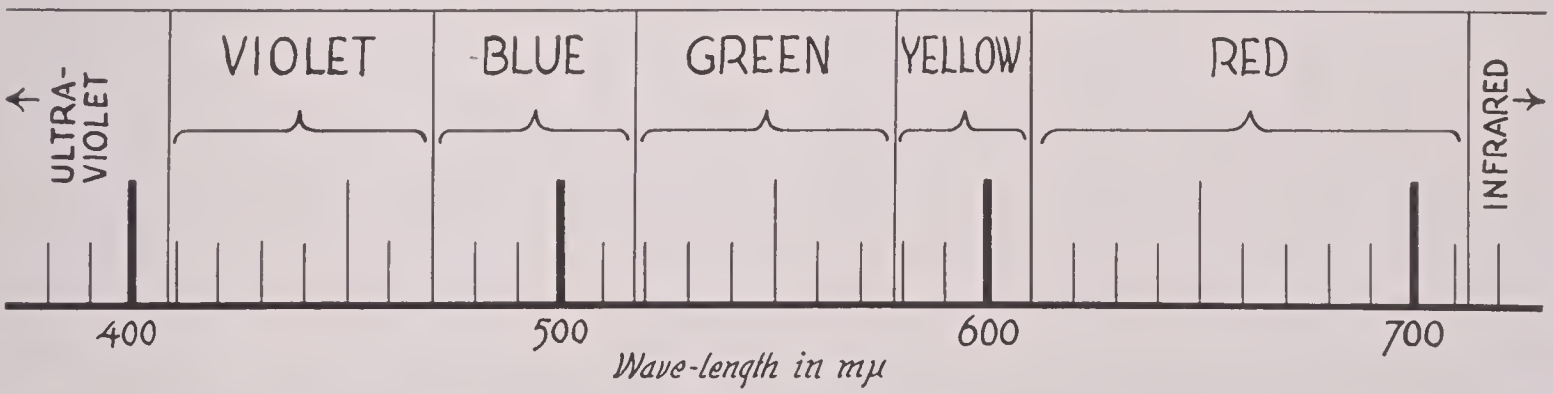
BEFORE we get into any discussion of the use of color it may clarify some of our thinking to consider, first, some of the properties of color.

Without going too deeply into the science of physics, from which I might not be able to extricate you, much less myself, there are a few more or less elementary laws of color that we can all understand and can put to good use.

Heading the list, and one fact to file away in your memory for rather frequent reference, is that nothing has any inherent color. There is no such thing as a green tree or a red apple or a yellow lemon. None of these nor any other object has color except as it is affected by light, (barring luminous objects, such as certain animal life, watch and clock dials, etc., which have no place in a discussion of color photography). The more light the more color *up to the point of full color saturation.* Decrease the amount of light and you decrease the amount of the object's color. Carry this to its ultimate conclusion by shutting out all light and the object loses *all* color.

Perhaps of next importance is an understanding of why a green tree appears green or a lemon appears yellow. Every colored object, or more specifically, every object that reflects color has the property of absorbing, practically speaking, all the colors in the spectrum except that color which we say is *its* color. For instance, the lemon absorbs all the incident white light except the yellow portion of the spectrum, which it reflects.

Incidentally, it should be remembered that an object's pure local color is reflected only when the object is subjected to pure white light. This "local" color of an object is altered by any change in the color quality or balance of the light source. The yellow lemon can be made to appear green or red or most any other color by lighting it with a colored light. As proof that even a white object is not "white" except under a pure white light source, make this simple test. Look at a white card under a weak incandescent light in a darkened room. The card appears to be white because your brain tells you it is white. Now suddenly move the card through a window or door opening into full sunlight. The card will appear quite bluish until your eyes become adjusted to the changed conditions. Or reverse the procedure, moving the card from sunlight to the influence of the incandescent light and the card will at first appear a decidely yellowish white.



1 DISTRIBUTION OF THE PRINCIPAL COLORS IN THE VISIBLE SPECTRUM

If you are sufficiently interested in analyzing the spectrum and in experimenting firsthand with a few simple demonstrations in this principle of absorption and reflection of color, you will enjoy performing the following tests:

1. Cast a spectrum onto a white card by passing sunlight through a simple prism. You did that as a youngster but the phenomenon meant little more than a series of brilliant color bands. It did not occnr to you that the color in the world about you was created by each objcct's ability to absorb some of these color bands and to reflect others. (The color bands in the visible spectrum occnpy the relative positions shown in Figure 1.)
2. Now that you have broken up or dispersed white light into its constituent parts you can reassemble those parts into a white light unit again by passing the spectral bands through a second prism, and the beam on the card will appear as a spot of white light. All sense of color has disappeared. That is simple enough bnt it proves that the hnman eye cannot sce the separate visible spectral bands in white light without some mechanical aid, such as the prism. The prism does it by dispersing the beam of white light into its constituent radiations because the amount of bending (or refraction) each color or wave-length suffers when it enters a glass at an angle is different. The red ones are bent the lcast and the violet the most.
3. Let us get at this matter of absorption and reflection—the "why" of an object's color. Go back to our two prism test. Interpose an orange glass in the path of the dispersed beam from the first prism and with the second prism collect this dispersed light, and the cast on your white card will be orange, the orange of the orange glass. This orange glass has passed the red, orange and yellow portions of the spectrum and the second prism has recombined them into the single color orange. In the process the orange glass has absorbed the purple, blue and green rays.

The volume of light transmitted or reflected by any colored object is less than the volnme of light that falls on the object, for a certain amount of that original volume is absorbed. In the case of the orange glass, the amount or volume of light transmitted is the original volume of incident white light from which has been *subtracted* the purple, blue and green portions. (The glass also dissipates some of its own color.)

In reflection there is still further loss. And the degree of this loss affects practically every color shot you make, as well as your calculations in determining proper exposure. This loss is dne to the fact that colored objects do not reflect their own color 100%, and the percentage of such absorption varies greatly between colors, and between different materials and textures of the same color.

Broadly spcaking, greens and blue-greens do the least efficient job of reflecting their own color, and yellow (omitting white as a color) reflects the highest percentage of its own color. For example, in the very intense dyes nsed in making color prints the blne-green color absorbs 45% to 50% of its own color. Do not ask me why, it is just the nature of the brute! But it does provide a very definite clne as to why greens in some of your close-up landscape shots appear dark and lack the color saturation or intensity which your eye sees. Greens at a distance are affected by a lot of other factors. Yon *can* record the greens as they are and as you see them, bnt a correct exposure for those greens wonld nsually be at the expense of the other colors.

Reds and yellows behave more as you would have them do. Some reds reflect as mnch as 90% of their own color and the best yellows go as high as 97%. Technically speaking, no color absorbs all of its adjacent colors in the spectrum, but that is getting too deeply into the science of the subject and too far removed from everyday practical applications.

Boiled down, the color characteristics we have been discnssing indicate that the volume of reflected light from each color in a varicolored composition (assuming it is evenly lighted) varies greatly. If our composition is equally divided into three areas of yellow, red and green, of the same material and texture, the yellow may require only half the necessary exposure for the green, for faithful reproduction of each. But these are not hazards that cannot be effectively controlled, as we shall see later on in our discussions.

COLOR COMPOSITION

IF YOU will permit another comparison of color with music I believe we can get away to a flying start in our consideration of what we mean by color composition or color arrangement.

First, color is a sensation recorded in or by the human eye mechanism and translated by the brain as yellow, red, blue, green, purple and so on. Musical notes are vibrations recorded by the ear.

Second, each color in the visible spectrum is, in a way, as distinctly an individual color as the individual notes of music. How many musical notes or tone vibrations can be recorded and distinguished by the human ear I do not know, but the visible spectrum has been broken up into more than one thousand separate color bands by the scientists. For some reason I am not able to explain, the untrained eye cannot make as sharp distinction between adjacent color bands as even the untrained ear can in distinguishing and identifying two adjacent musical notes. Thankful we should be that for our present discussions, at least, we need not carry our basic color divisions and subdivisions beyond the ten shown in the Color Wheel on the second page following.

Third, each of these colors, by itself, may be called a pleasing one; your preference for one above another being merely a matter of taste. In the same way one might say each note in a musical scale is just as pleasant to the ear as its neighboring note or as one an octave or two up or down the scale. At least each note is "harmless," so to speak, when struck alone. But a different situation is created when two notes are struck simultaneously. They may create harmony or discord. Strike three or more and your chance of discord is multiplied. If it is a discordant combination the resulting "clash" of an inharmonious chord drowns and prevents any possible pleasurable sensation that any one note of the discordant group might create when struck alone. The fault lies not with the individual notes or colors, but in the lack of any harmonious arrangement or combination.

By the same rule a one-color composition is practically fool-proof, at least to the extent that there can be no clash of colors. There is no such thing as a one-color composition, you say? Literally, you may be correct if you visualize some such thing as a piece of colored paper or just the expanse of a cloudless blue sky. But if we take a little liberty with what you might call "one color," there are many opportunities for such compositions and many pleasing ones at that, and ones that have subtle and unusual variations of color one could never secure by merely color toning a black and white print.

When we associate two or more colors in a single composition we create either discord or harmony just as surely as we do when two or more musical notes are struck simultaneously. One or the other result will inevitably follow.

If you want to shoot color pictures that are more than just loud splashes of color you should give some thought to the basic rules of color and good color arrangement. And the more thought the better, regardless of the seeming accuracy of your "eye" for color. Again I am constrained to repeat that this is not a course in art. It is merely a simple set of "formulas," if you please, to help you "see" color, and the exposition of certain elementary rules that will, with practice, become as automatic in your mental processes as your disciplined ability to construct a good pictorial composition or frame an interesting one from an average landscape.

We can illustrate many of these points more

effectively in the negative because, fortunately, there are fewer things "not to do" than there are possibilities for pleasant and satisfying results. In any event it should be understood that the color "diagrams" shown on the next few pages are *not* suggested color schemes. Many of them illustrate what to avoid in color selection and arrangement. Others emphasize certain color relationships.

The diagrams are used instead of actual color illustrations to purposely avoid any realistic suggestions of objects or things. No one should dictate color schemes for your use, for to do so would only circumscribe your own thinking and originality. And you surely want to do your own thinking. That is one good reason why you get so much personal satisfaction from this medium of photographic expression. It is a very personal expression—keep it that way—you will be happier and will make more real progress.

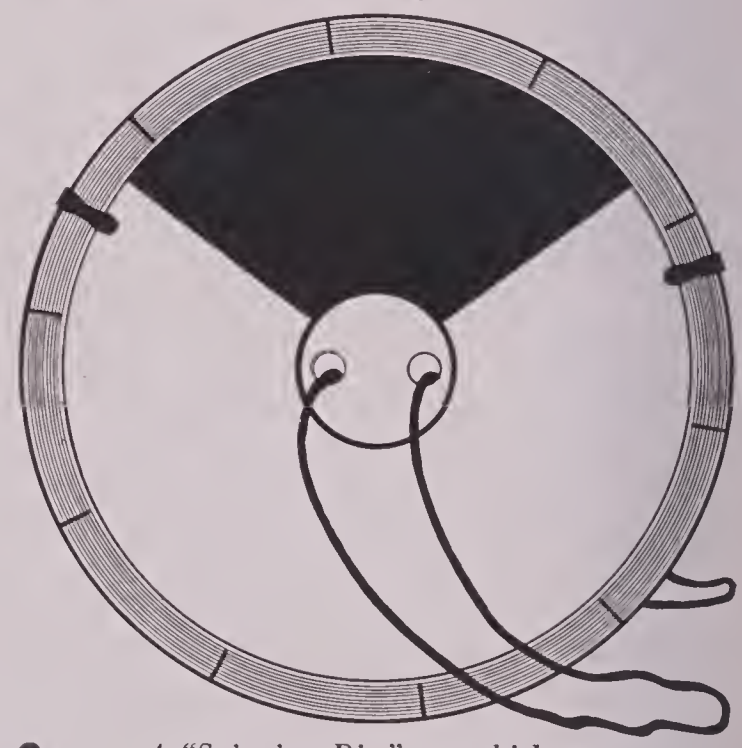
Further, to suggest definite color schemes would tend to limit your production of any color compositions to more or less literal copies or close imitations of the ones suggested. But, you say, if one assumes that the ten colors shown in the Color Wheel constitute a sufficiently practical division of the visible spectrum, the opportunity for variety *is* limited.

But there is no such limitation as may appear. There are something like eighty keys in a standard piano keyboard but there have been thousands of musical compositions written for the piano and no two of them exactly alike. There are several times eighty distinct and easily identifiable variations of our basic ten colors with which we can work.

Before we start any subdivision of the ten colors (or hues) incorporated in the Color Wheel on the opposite page it must be made clear that the limitations of flat color printing plus the added limitations of such a medium in creating the Intermediate colors through printing one Principal color over another Principal color cannot produce the exact color nor the maximum intensity of each color in any of the ten shown. The colors given must be considered only as "labels" to designate color names or hues. When we refer to Red we mean the purest and most intense Red that can be produced in pigment. And when we say Red we mean a Red that is neither on the Purple side (as is the red used in process printing, in color print making, and in Kodachrome dyes), nor one that is on the Orange or Yellow-Red side. It is just pure Red, unadulterated by its adjacent spectral bands. This holds equally true with the Yellow, Green, Blue and Purple, of course.

These five we call the Principal colors because they are the most easily identified bands in the visible spectrum and are the five colors you would instantly name as comprising the principal colors of the rainbow. There are more scientific reasons for this selection but a more thorough exposition of the Munsell Color System than is justified here would need be made to carry the explanation to its ultimate conclusion.

The intervening five colors, the half steps between the Principal colors, we call the Intermediates. These are all made, as you will notice, by mixing the Principal colors immediately adjacent. For that reason, and for definite identification of their origin we call these colors Yellow-Red, Green-Yellow, Blue-Green, Purple-Blue and Red-Purple instead of such confusing names as orange, citron, turquoise, violet and magenta.



2 *A "Spinning Disc" on which two or more colors can be mixed or blended. A simple method for testing color balance.*

Even the simplest phenomena are most easily understood when one can demonstrate such behavior as the mixing of two colors to make a third, as in the case of the five Intermediate colors in our Wheel. If you want to make such a test, cut a circle from heavy

THE COLOR WHEEL

This Wheel designates the five Principal Colors or Hues of the visible spectrum, which are Red, Yellow, Green, Blue and Purple (Violet). The five hues occupying the in-between segments are known as the Intermediates. All of them are made through mixture of the two Principal Hues immediately adjacent to the Intermediate which they create through admixture.

Many color theories employ twelve divisions instead of ten. The two extra hue divisions being a split of the above Yellow-Red into three divisions. The one nearest Red being called Red-Orange, the above Yellow-Red being designated as Orange, and a division between this and Yellow being known as Orange-Yellow. As a painter's pallette the twelve hue divisions are desirable, but such a split of the spectrum is confusing in proving scientific color balance.

In the ten division arrangement used here, hues directly opposite across the Wheel are known as Complementary Hues. That is, when mixed they tend to destroy the identity of each, and will produce a neutral gray when mixed in equal portions of the same Value and Intensity.

The "Hue" names used in this Wheel are those employed in the Munsell Color System. Neither the nomenclature nor this designation of "principal" and "intermediate" hues is to be confused with established "Tri-color" photographic and graphic arts theories and procedures.

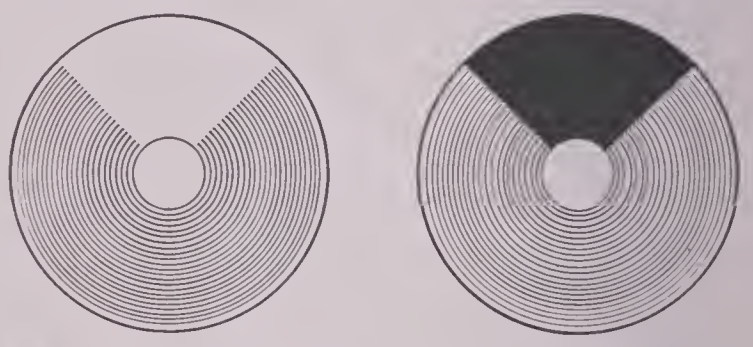
cardboard some six or seven inches in diameter, punch a hole a quarter of an inch on either side of center and run a four foot length of string through the holes and tie ends together. (Figure 2.) You now have the old button spinning trick every kid has done some time or another. It is the simplest device for whirling the card disc at rather high speed unless you have a small electric motor on which you can mount such a disc. If you have, so much the better because your perception of the mixed color will not be influenced by the pause when the card disc reverses direction on the string.

Now cut two discs of colored card in which you cut a radius so you can slip a portion of one colored disc behind the other, leaving portions of each color exposed. To start with you might try a Red and Yellow card, exposing half of each. When you spin the superimposed cards you will see only a definite Yellow-Red or orange color. If the resulting Yellow-Red mixtures appears too Red then the Yellow is not sufficiently intense to offset the intensity of the Red. To compensate, turn the Yellow disc to cover more of the Red and to expose more of the Yellow. You can continue such adjustments until you have produced a Yellow-Red that appers to be approximately half way between the Red and Yellow of the two cards. Now check the percentage of the exposed areas of the Red and Yellow. If one-third of the area of the complete circle is Red and two-thirds is Yellow it means that it has required two parts of Yellow to offset one part of Red.

Now that you have demonstrated the mixing of two Principal colors to create an Intermediate you have, in the process, established the origin of all colors, for any new color from here on ad infinitum must be made through mixture of two or more of these ten colors.

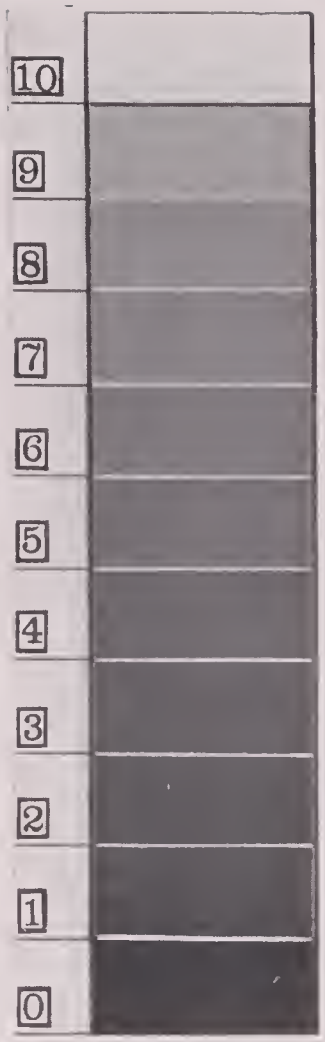
Color Values

But that seemingly endless variety is limited, comparatively speaking, until we introduce the two important "dimensions" of any and all colors. These two dimensions are (1) *Value* and (2) *Intensity*. By Value we mean the relation of any color to the amount of light it reflects or absorbs, or more properly, the percentage of the incident light it both reflects and absorbs. At that point where it absorbs all or most of those spectral bands "foreign" to its "natural" color and at the same time reflects the maximum amount of its own color is the point or step on the Value or Gray Scale we designate as that particular color's inherent Value. This assumes the light source is pure white light and that the volume of light is such as to strike this balance. In simple terms, and without regard for the element of Intensity, Value is the amount of light reflected by a color, and that amount varies in direct relation to the amount of incident light. For example, let us view a piece of sky blue fabric under a very weak white light. It will appear to be a much darker blue than when viewed under more normal light conditions; diffused sunlight, for instance. Now place the fabric under a strong, concentrated spotlight and it will appear to be a much lighter blue. But all the time you have been seeing the *same* blue, as far as color name goes, but your various light conditions have produced blues of three different Values.



3 *White mixed with Blue, when spun on the disc, will produce a lighter Value Blue. Black added will produce a darker Value Blue. It is still the same "kind" of Blue.*

If you want to play with the spinning disc toy again, you can very effectively demonstrate this principle of Value changes. If you want to use the blue we have been talking about all you will need in addition is a pure white card disc. (Figure 3.) Adjust the disc with only enough blue exposed so that when the discs are spun the illusion will be a faintly blue-white cast. That is the lightest Value of that blue, practically speaking. You create a blue of slightly darker Value by decreasing the amount of the white disc exposure and by exposing, automatically, a little more of the blue disc. When you have eliminated all the white disc you have the original blue color only. The Value of this blue, without addition of the white from the card is what we might call that blue's inherent Value. Now that we



4

All photographers are familiar with a Gray Scale, or Step-Wedge of Black and White tone values. One property or "dimension" of color is Value, and every color has a black and white value that closely corresponds to one of the eleven divisions in the Gray Scale represented here. More easily understood is the obvious fact that a color is "light" or "dark." That characteristic is known as the color's Value.

have come down the Value scale to the color's inherent Value we can then introduce a Black dise with the blue one and when the combination is spun we get a blue of darker Value; how dark depends upon the proportion of Black to blue. To preserve a color that can be identified as Blue it is obvious that we cannot add the same proportion of Black to blue as we can White to blue, and still distinguish the result as a Blue color. The addition of White is synonymous with adding white light. The addition of Black is as though we decreased the intensity of incident light, and as we approach Black we approaeh a eondition we can describe only as the "absence of light."

This simple addition and subtraction of light is what determines the Value of a color. And that same law applies to all colors regardless of their "inherent" Value or their intensity.

To keep these Value distinctions from becoming too subtle and thereby confusing, we can simplify our tabulations into nine orderly steps or gradations alongside a typical "Gray Scale," with White at the top, as the tenth step, and Black at the bottom whieh we will designate as Zero, since it represents the absence of light. (Figure 4).) The lightest Value of any color is represented by the gray scale step nearest white, and the darkest Value of that color corresponds to the gray scale step nearest Black. Alongside the gray seale we can now imagine a eolor step-wedge, similar in gradation to those of the gray scale except it is in color instead of black and white.

The Value of colors is such an important aspect of color photography that it deserves the separate chapter which follows, and is there diseussed in detail in its relation to exposure calculations, et eetera.

Color Intensities

Up to now we have subdivided our original ten colors only through the addition or subtraction of light, to create a whole new range of Values.

The second "dimension" of color, "Intensity," may, at first glanee seem a little complicated, but it is really quite simple and easily understood. That is if I can explain it so it can be understood. Do not confuse "Value" and "Intensity," for they are distinctly different color characteristics.

As a start on what we mean by reducing the intensity of a color nothing deseribes better what happens than the commonplaee expression "graying a color," or the resultant "grayed" color. You have used and heard the term repeatedly but few people understand what actually takes place in the proeess of graying a color, which is another term for reducing intensity.

First, remember the scale of "Values" of black and white; the Gray Scale previously illustrated and described. For simplification we divided that into eleven steps, white being at the top, then down the scale through nine steps of gray, with black at the bottom. This is a scale of gradations of gray and absolutely colorless, you understand.

Second, for the moment you will have to accept my word for the fact that every color at its greatest intensity has a Value that corresponds closely to one of the divisions in the Gray Scale. For instance a certain kind of Red, at its maximum intensity, corresponds in Value to No. 5 division of the Gray Seale. That is that Red's "Value."

(Continued on page 32)

The color diagrams on these pages are necessarily limited in scope due to the limitations of flat color printing, utilizing only the five Principal colors shown in the Color Wheel. None-the-less these elementary demonstrations have practical application in problems of color composition. The above diagrams emphasize the most uninteresting of color arrangements—that of equal areas of two (approximately) Complementary Colors of strong intensity. This association results in a clashing, vibrating and altogether displeasing effect.

In comparison with the association of equal amounts of intense colors a better arrangement is illustrated above. A small area of pure Green and a smaller area of intense Red is silhouetted against a larger area of weaker intensity Green. A third color of darker value, created through mixing the two Principal colors Red and Green, adds strength to the scheme. An arrangement of this sort gives variety in division and size of areas, as well as the effect of more colors than the two employed.

Two colors of light value or two of dark value, when immediately adjacent, visually "fuse" or blend where they meet, with a visual loss in the intensity of both colors. The more nearly they are complementary, the more this is apparent. If the two light colors are separated with a narrow band of black or a dark value color, each of the light colors immediately recovers its visual purity. Likewise, two dark colors similarly separated by a band of white or a light value color, stand out in their true color quality.

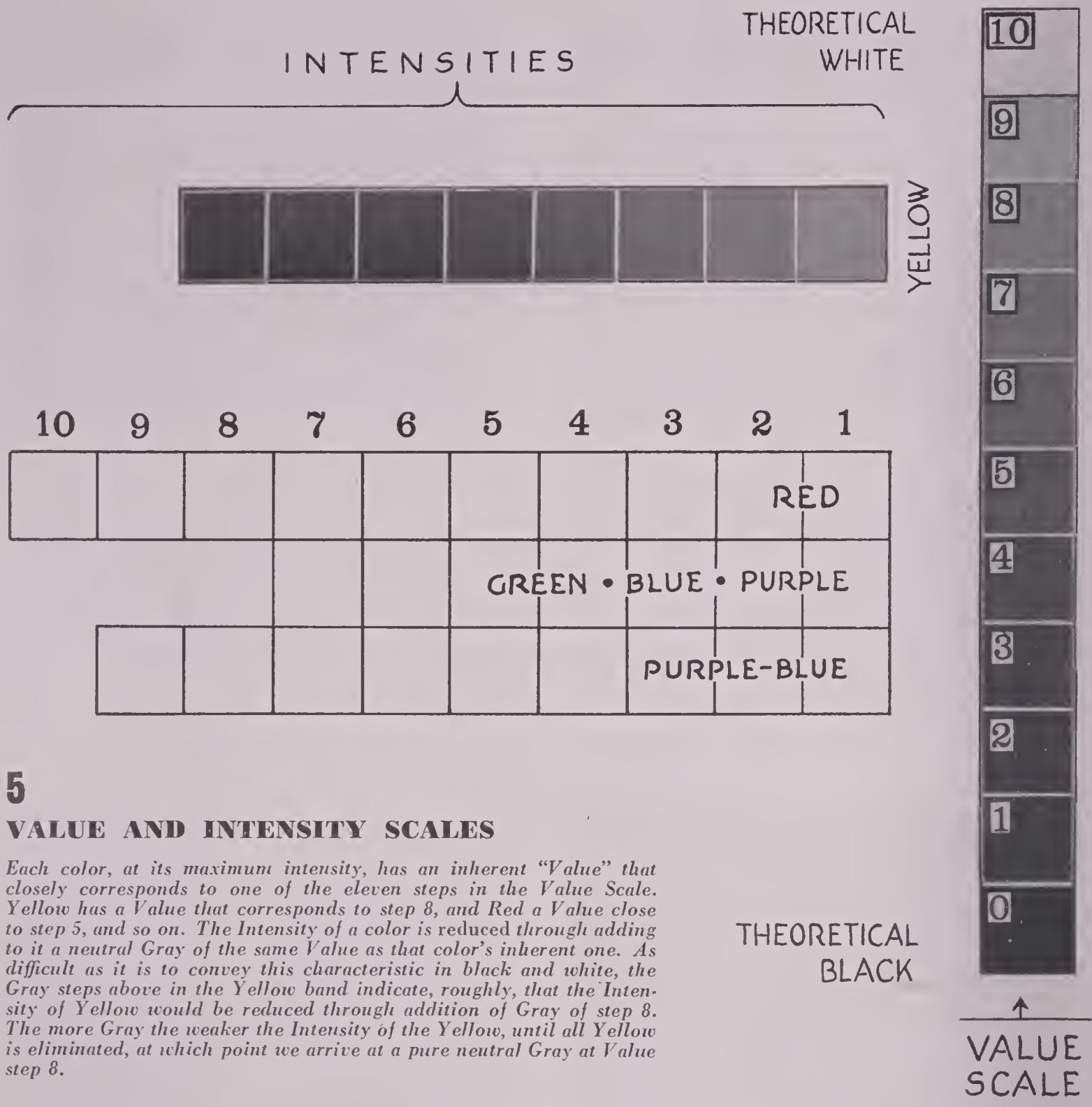
The above diagram rather effectively demonstrates the color harmony that may be secured through use of Related colors. If you will check this diagram with the Color Wheel you will note that it is made up of all colors from Blue to Yellow. The Blue and Green combine to make a Blue-Green, and the Yellow and Green combine to create a shade of Green-Yellow. The Blue, Green and Yellow are also employed as pure colors. Study the Color Wheel for other suggestions for Related color schemes.

This demonstration emphasizes that three pure colors in relatively equal amounts produce but little better color harmony than does the same kind of association of two strong colors. Of four or five, for that matter. One of the first laws of good color composition is an interesting division of color areas, and in such association that there is color emphasis on the principal points of interest. Any one of these colors alone may be pleasing, but they compete with each other unless properly associated.

This design employs the same three colors as the crude blocks of color at the left. But since these colors are all of light value, their purity and intensity can be accentuated by surrounding them with black. The same result, in a modified way, could be accomplished through the use of a very dark value color instead of black, although less effectively. Remember that the introduction of black, white or neutral gray does not affect color balance—it only changes the over-all value of the composition.

One characteristic of color that should always be remembered is that colors are, by their very nature, either "advancing" or "receding" colors. There is a subtle dividing line on certain colors, but the most obvious fact is that Reds are advancing colors and that Blues are receding ones. When a foreground object, like the figure above, is a receding color silhouetted against a background of an advancing color, the effect is the reverse of that desired. Reverse the color scheme and the figure would come forward.

The above is a very elementary illustration of a commonplace association of advancing and receding colors. The barn would retain its foreground importance in any kind of Red or Yellow-Red, or even in Purple-Red. The Blue (or Purple-Blue) hills of any landscape recede into the distance, further stepped back through the influence of the intervening atmosphere. What is true of color characteristics in expansive scenes is equally true of colors in closeup compositions, minus the graying effect of the distant atmosphere.



5

VALUE AND INTENSITY SCALES

Each color, at its maximum intensity, has an inherent "Value" that closely corresponds to one of the eleven steps in the Value Scale. Yellow has a Value that corresponds to step 8, and Red a Value close to step 5, and so on. The Intensity of a color is reduced *through adding to it a neutral Gray of the same Value as that color's inherent one. As difficult as it is to convey this characteristic in black and white, the Gray steps above in the Yellow band indicate, roughly, that the Intensity of Yellow would be reduced through addition of Gray of step 8. The more Gray the weaker the Intensity of the Yellow, until all Yellow is eliminated, at which point we arrive at a pure neutral Gray at Value step 8.*

Third, we now want to "gray" this intense Red, and while we are at it we will produce ten steps of Intensity of this Red. We will call the original Red step No. 10 (See graph above). To create the first grayed step, which we will designate as No. 9 we take, for the experiment, ten ounces of No. 10 Red and one ounce of Gray (neutral, colorless Gray), the No. 5 gray in the Gray Scale, because we have previously determined that our original Red has a Value of 5. But since we want the same resulting volume of grayed color each time, we will set that volume at ten ounces. So we pour off one ounce of the Red and then add the one ounce of the Gray to the remaining nine ounces of Red. The result is ten ounces of Grayed Red (of same No. 5 Value, mind you), which we call No. 9 Red.

For the next step we take only eight ounces of our pure Red to which we add two ounces of the original neutral Gray. We now have Grayed Red No. 8. For step 7 we use seven ounces of pure Red to three ounces of neutral Gray. For step 6, six of Red and four of Gray; for step 5 five of each; for step 4 four ounces of Red to six of Gray; for step 3 three and

seven; for step 2 two and eight and for step 1, one ounce of Red to nine ounces of Gray. You need not make the experiment to visualize that our new Red No. 1 is really nothing more than a "pinkish" Gray, and a Gray of the same Value as the No. 5 neutral Gray in the Gray Scale. It is also obvious that the next step in the "graying" process would be ten parts of Gray with none of Red. We have not changed the Value of the original Red because we have added neither more White nor more Black. While the foregoing test implies that it involves the use of artist's paints, the same results could be secured with the spinning disc idea, employing a combination of a Red disc with another of Neutral Gray, and accomplishing the comparable result of various steps of Grayed Red by starting with nine-tenths of the Red disc exposed to one-tenth of the Gray disc, and then eight and two, seven and three, and so on.

The procedure of "graying" any color, or any color of any value is the same. It means the mixture of the original color with neutral gray of the same value. To use a gray of a lighter or darker value than the color with which it is to be mixed confuses our thinking because in so doing we would change both the Value and the Intensity of the original color at the same time. Not that you cannot nor should not do so in actual practice, but in our consideration of the characteristics of color changes we should think in terms of each "dimension" (value and intensity) separately. It may be a little unscientific to state that the degree of Intensity of a color is the distance it is removed from a neutral gray, but the definition seems appropriate. This would merely be carrying our experiment in reverse, which is easier to think about than do, as you can readily appreciate.

It must be remembered that some colors, at their greatest intensity, are less intense than others because certain colors reflect a higher percentage of their own color from the incident light than do others. This fact has a very definite bearing on exposure calculations, as we shall discuss later. Also, every color can be carried to its greatest intensity at one definite value only. To illustrate, the most intense Yellow is high on the Value Scale, toward the white. (See Figure 5.) Red, at its greatest intensity is the most intense color of them all, but at its greatest intensity it is lower on the Value Scale than is Yellow at its maximum intensity. Certain Blues and Purples are most intense quite low on the Value Scale.

While all this preliminary consideration of color theories may seem somewhat irrelevant to the subject of Kodachrome photography, may I assure you emphatically that it is not. For best color results you must have good color arrangement. To be able to create and analyze good color arrangements you must know something of color, and just as important, you must be able to "see" color as it is and not just as you think it is. Remember, the film sees color "mechanically" as it has no brain with which to make compensations.

And I will venture the opinion that you will enjoy and appreciate the color everywhere about you; will get more of a thrill from subtle and especial color effects when, as and if you develop a better "eye for color." You will be more sensitive to harmonious or discordant color, and you will know what produces these results. This cultivated appreciation is all very worthwhile entirely aside from your use of the knowledge in your color photography. But perhaps more to the point, this knowledge will give new impetus and direction to your color picture shooting, and a sound foundation for intelligent analysis of the results of your photographic efforts.

Now that we have worried our way through what, at times, may have seemed unnecessary and burdensome details, let us try some color arrangements incorporating some of the theories we have been discussing.

One-Color Compositions

You may recall our previous suggestion that there is such a thing as a One-Color Composition, and you probably mentally challenged that assertion at the time. But now that we understand how we can "break-up" a single color into quite a number of variations through changes in its Value and Intensity, you can easily visualize what might constitute any number of pleasing one-color compositions.

For example, we might compose one of all blue but still have a wide range of apparent color differences or variations and still use the *same* blue. In the range of blues we could have one area of pure blue, another area of the same blue but of a lighter Value, and yet

(Continued on page 38)

THE FIVE PRINCIPAL COLORS (OR HUES) IN JUXTAPOSITION

The above color diagrams must not be construed as desirable or recommended color schemes, in the manner in which the colors are associated. Rather, this chart is a reminder of what effect one color has upon another when placed immediately adjacent. If you will follow through the diagrams you will notice that each of the five colors in the squares is bordered on two sides by one of the remaining four colors. In like manner you will find each of these combinations in reverse order. For instance, one Red square is bordered in Yellow, and one Yellow square is bordered in Red. In both cases the same two colors are adjacent, but the resulting effect is quite different, due to the difference in area each occupies.

The second color characteristic illustrated in these color blocks is the color that results from the mixture of the two colors in each square and border. The color dot on each square is created through printing the border color on top of the color of the square.

A third product of this association and mixture of two colors is the extent to which one color tends to dominate another, when one is inherently the stronger color. For example, Red on Yellow, or Yellow on Red produces a color much closer to Red than to Yellow, because the Red dominates the Yellow. In the case of a mixture of Blue and Green, neither dominates, but the result is a Blue-Green of a darker value than either of its component colors. A careful study of the chart will reveal many other equally interesting attributes of color association and admixture.

PINNACLE ROCK, MONTEREY BAY

This type of subject, in kind of color and in the reflective power of the surfaces (with the exception of the foreground tree) is an ideal one for Kodachrome. Even though the water is comparatively dark in color it reflects a maximum amount of light, considering its value. This fortunate condition brings the water's value closer to that of the light colored rock, thereby shortening the value range and bringing them within the possibility of faithful color rendition of both these principal areas in the composition.

The foliage of the foreground tree is in full, flat light, which helps preserve the color in such areas that would normally go too dark, especially in instances like this scene which calls for a shorter exposure than would an "average" subject.

More side-lighting on the rock would have given it better surface texture, but such break up in pattern might have detracted from the postcry feeling of the simple mass silhouetted against the more or less flat blue of the background. The shot was made in this light because it was felt that the foreground water pattern was a sufficient break up of the lower portion of the composition.

DATA: Exposed on 4x5 cut film Kodachrome; Camera, Speed Graphic; Lens, 5¼ inch Zeiss Tessar; Filter, Harrison Coralite C½. The reproduction is four color, 200 line deep etch offset lithography.

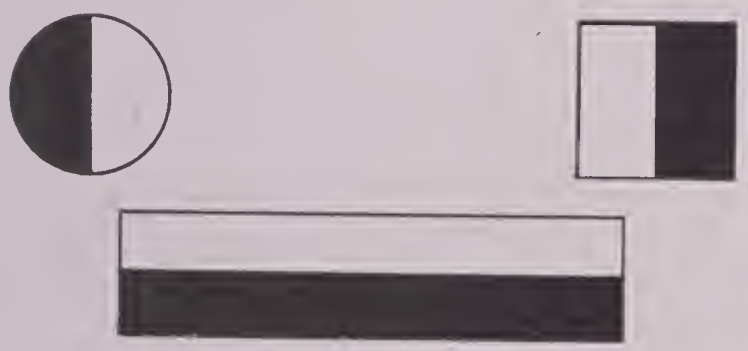
still another area of a still lighter blue which most of us would call a "tint." Toward the other end of the scale we could have a darker value blue, and on down toward blues of such dark value that they would be barely distinguishable in color. We could subdivide our color selections still further through the use of blues of different Intensities, of the same or different Values than those already used.

You may say that this isn't much of a color problem, but it is more of a problem than you think. Since you have no color contrasts in such a color scheme you must get your contrasts through use of extremes in Values and Intensities. And most one-color compositions can be strengthened by a judicious addition of white or black, or both, for accents.

Two-Color Compositions

For our present study we can group all such color combinations into two classifications. First, *Complementary* color schemes; second, *Related* color schemes. We must refer again to the Color Wheel (page 27) for selection of either type of color combination. To start with the Complementary group we find such combinations as Red and Blue-Green, Yellow and Purple-Blue or Green and Red-Purple and so on around the Wheel. You understand that each color's complement is that color directly opposite through the axis of the Wheel.

We will arbitrarily select the combination of Red and Blue-Green, but whatever is true of this combination applies equally to any other combination of complementary colors.



6 *As indicated more effectively on page 30, the most uninteresting association of color is that of equal areas of pure colors of equal intensity and value.*

From the standpoint of pleasing arrangement, whether in monochrome or color, we would never divide a square or circle or a rectangular area into two equal halves. (Figure 6.) That's the most monotonous possibility. To the element of monotony, when we place an area of one color of strong intensity alongside an equal area of its complementary color (of the same intensity), we not only have a monotonous division of areas in point of composition but we have two strong colors competing for attention on equal terms. The combination lacks a theme or point of interest, or whatever you wish to call it. The sensation created is unpleasant because there is no place for the eye to rest. Such a color arrangement might be called "loud," or "clashing," or "dizzy," depending somewhat upon what combination of complementary colors are used.

How can we bring order out of this noisy, competitive color situation? To go back to our musical comparisons again, we speak of some one playing a violin solo against a musical background provided by a piano accompaniment. If the piano accompaniment counter-balances the tones of the violin we do not hear the violin solo or the piano accompaniment, but two competing appeals to our auditory senses. We try to follow one, then the other, and hear neither satisfactorily.

If you will permit the rather unusual designation of the role of solo part to one color of a two-color arrangement (complementary colors, of course) and with the second color playing the "accompaniment," I believe we can quickly arrive at some ideas of pleasant color relationships. And we will do it in this way. Use a smaller area of one color, at its greatest intensity, against a background of the second color whose intensity has been "grayed" or reduced. These relationships can be arrived at with mathematical accuracy. For instance, equal areas or equal amounts of two complementary colors, of the same intensity, balance in the sense that when mixed visually they will produce a neutral gray. This is another law of color you can prove with the spinning disc demonstration.

We know that equal areas of two complementary colors produce a color balance but the area and intensity relationships are displeasing. But one part of Red at strong intensity and four parts of Blue-Green at about one-fourth intensity will also visually balance out as a gray *and* give us a pleasing color scheme besides. (Figure 7.)

It is well to keep this matter of color balance in mind for you do not always want a

7 *Using Complementary Colors in a Balanced Color Scheme. Illustrating the basic relationship—"that the intensity of a color should be inversely proportional to the area it occupies." The Red apples (intense color) against a weak Blue-Green background of large area. The green ivy "keys" in with the background. The other elements are white or neutral.*

balanced color composition and herein lies your clue to emphasis. To add emphasis to a given area you either increase the area or increase the intensity of the color occupying that area. Either will give you an out-of-balance color scheme with emphasis on that portion so increased in either area or intensity.

This theory of relationship of intensity to area can be worked out with scientific precision through employment of the Munsell Color System (see reference on page 27) but it is sufficient for our practical purposes to think in terms of "half the intensity double the area; one-fourth the intensity four times the area" or the reverse, "double the area one-half the intensity," and so on. But it cannot be repeated too frequently that this relationship of intensity to area is one of the very foundation stones of good color arrangement.

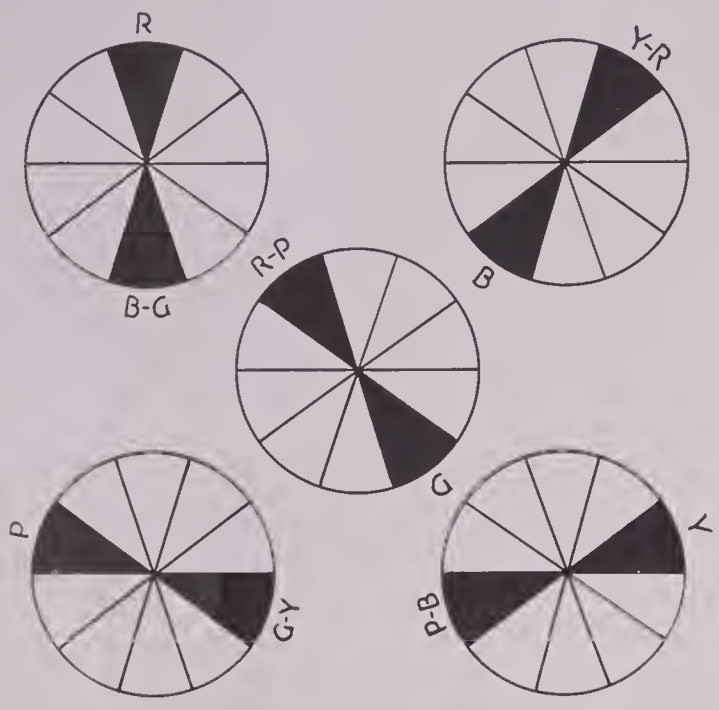
The foregoing rather sketchy suggestion of a two-color arrangement is only a very simple beginning. In a two-color scheme one need not have all of each color in a single mass or area. The same theory of balance holds true if there are two or three Red areas, of equal size or not, just so long as the *total* amount of Red in the composition is in proper ratio to the total of the area or areas of Blue-Green in the composition.

Once one understands the simple application of such color laws as form the basis for the Red and Blue-Green arrangement we have described, he can then expand and refine his creations with more subtle adaptions of these sound fundamentals—and with more pleasing results. Do not get the idea that I am recommending Red and Blue-Green as a color scheme. Personally I dislike such "crude" use of color, especially in any such over-simplified combination as I have outlined. Perhaps you feel an apology is due for this seeming imposition on your native good taste, for I doubt if many of you get any pleasurable sensation from any Red and Blue-Green combination. The explanation for this apparent bad taste on my part is that these two colors provide excellent color contrast, and variations in values and intensities of these colors are more easily distinguished than in such colors as Yellow-Red or Green-Yellow, or Yellow, when used with their complements. In suggesting the Red and Blue-Green combination I rather hoped that you might want to do a little experimenting in color arrangement and balance, and these two colors will serve very effectively in demonstrating the principles we have been discussing.

When once you have fixed firmly in mind some of these elementary rules you can easily develop no end of pleasing and sufficiently accurate two-color combinations. That word "accurate" suggests that one needs to hit the right color "note" as decisively as in a musical composition. Fortunately we workers in color do not have to develop color combinations that are in perfect balance. In fact a perfectly balanced color scheme can be too calm and quiet, with no point of color interest. Further, there are color combinations aplenty that are not in perfect balance but they are harmonious and pleasing, and in good taste. But you must understand how to make a balanced color arrangement before you can properly control emphasis in any color or area.

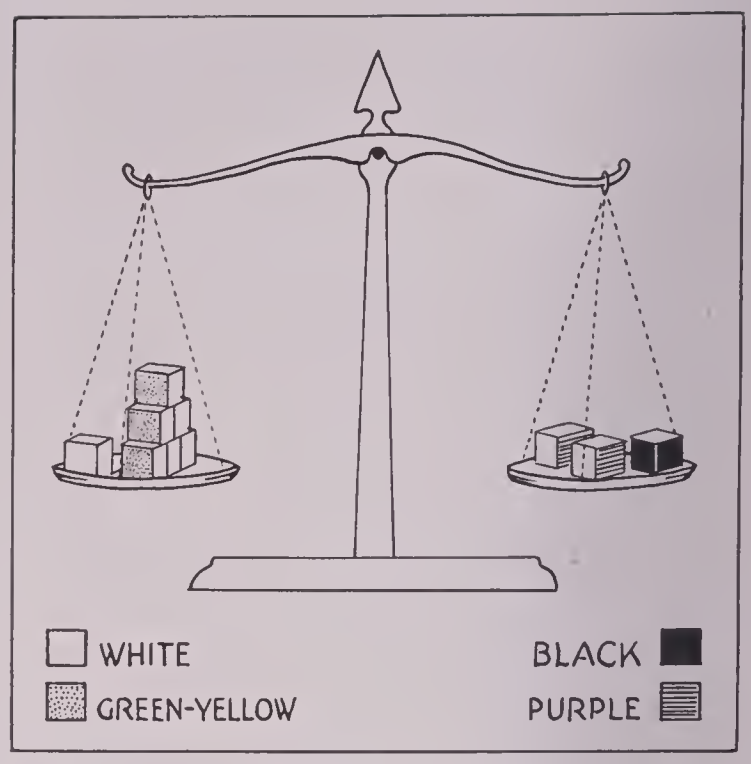
If you would like to get this Red and Blue-Green combination out of mind, and are in a mood to let your imagination play on new possibilities in two-color combinations, turn

back to the Color Wheel again and visualize some of the immediately obvious complementary arrangements. And do not forget that you can always introduce whites, grays and blacks without disturbing color harmonies. You will only alter the Value of the composition.



8 *A graph of the five pairs of Complementary Colors found in the Color Wheel. One color of each pair is a Principal Color, one an Intermediate.*

After this rather brief discussion of two-color combinations of complementary or contrasting colors we should take a glimpse at the other kind of two-color combination mentioned earlier—that of Related colors. Related colors are those immediately or closely adjacent in the Color Wheel. Red and Red-Purple, or Blue and Blue-Green are related colors, for instance, but they are too closely adjacent (for a two-color scheme) to give any contrast except through extremes in either values or intensities or both. We will secure more color contrast, and sacrifice no opportunity for contrasts in values and intensities when we select two colors like Red-Purple and Yellow-Red or Blue-Green and Green-Yellow. In selecting two adjacent Intermediate colors you *start* with one note of harmony in that all such adjacent Intermediates have one color in common, which gives them a kinship that is one of the elements of harmony. You notice that Red-Purple and Yellow-Red have Red in common, and Blue-Green and Green-Yellow have Green in common. And that fact makes



9 *A graphic illustration of color balance, produced through use of a greater amount of a weaker intensity color to balance a smaller amount of a color of stronger intensity. The addition of black and white does not destroy color balance.*

Related color schemes comparatively "safe," for they can never create any such discord as contrasting complementary colors can and will if not properly associated.

Three-Color Compositions

When we employ three colors we increase the possibility of discord but we also infinitely increase the opportunity for greater variation and more pleasing results. There is something more satisfying in the variety three colors permit, and varicty in color composition is as important as variety in forms and tone gradations in black and white, provided it is not carried to the point of confusion.

What three colors shall we use? Go back to the Color Wheel for suggestions of elementary combinations.

One kind of three-color selection is to start with any one color on the Wheel, such as Yellow, and then select for the other two colors the ones that are immediately adjacent (on either side) to the first color's complement, which in this case is Purple-Blue (the complement of Yellow). Then the second color of our three color selection would be Blue, and the third color is Purple, the color

on the other side of Yellow's complement. Or you can start with Red-Purple, with which you would combine Green-Yellow and Blue-Green. Such selections are but variations of complementary (two-color) combinations in that your second and third colors are closest to the first color's complement.

A more evenly balanced three-color combination is one in which we select our second and third colors *one step further* from the first color's complement. Starting this time with Red, our second color would be the Purple-Blue and the third Green-Yellow. Other selections would be made following the same rule.

A third type of three-color combination is one where all colors are selected from one-half of the Color Wheel. Such combinations are *unbalanced* although they can be brought into sufficient harmony by adherence to the laws of intensity, value and area relationship.

But, perhaps we do not want a balanced color scheme. Say, for instance, you want a decidedly *warm* color composition. Then your three colors should be selected from the upper half of the Wheel although you could dip one step on either side into the lower half through use of the Purple-Blue or Green-Yellow.

By the same rule you can create a definitely *cool* color effect through restricting your selections to the lower half of the Wheel.

It is advisable to keep this *warm* and *cool* aspect in mind for it makes possible the expression of color moods that no amount of juggling of values and intensities alone could ever accomplish.

It is not necessary to go to extremes in this matter of warm and cool colors, and here again our understanding of what creates balance is the starting point in our swing toward a predominance of warm or cool effect. Perhaps one of the simplest examples of the effect of color in creating a "temperature" in a composition is the comparison of a brilliant snow scene in black and white, with the same scene in a blue-toned black and white print, or a Kodachrome of a similar snow scene.

Now that we have generalized on this subject of color selection it might stimulate our thinking to work out a specific problem or two, adapting the three principles of color composition we have discussed in the foregoing pages.

Closely Related Colors in Groups of 3	*Distantly Related Colors in Groups of 3*
Red, Yellow-Red and Yellow	Red Yellow Green
Yellow-Red, Yellow and Green-Yellow	Yellow Green Blue
Yellow, Green-Yellow and Green	Green Blue Purple
Green-Yellow, Green and Blue-Green	Blue Purple Red
Green, Blue-Green and Blue	Purple Red Yellow
Blue-Green, Blue and Purple-Blue	
Blue, Purple-Blue and Purple	
Purple-Blue, Purple and Red-Purple	
Purple, Red-Purple and Red	
Red-Purple, Red and Yellow-Red	

10

Four factors enter into the creation of any correctly balanced color composition. We must (1) select the colors to be used; (2) determine their intensities; (3) and find their value (how "light" or "dark" they are) before we can determine the other factor (4), the area each color is to occupy, which is another way of saying the "amount" of each color to be used.

In passing we should remember that in many color problems the procedure must be reversed, in that the area each color is to occupy is fixed and predetermined. Or the areas and kind or name of colors (as Red, Blue, etc.) may be fixed, in which case our problem must be solved through manipulation of values and intensities only.

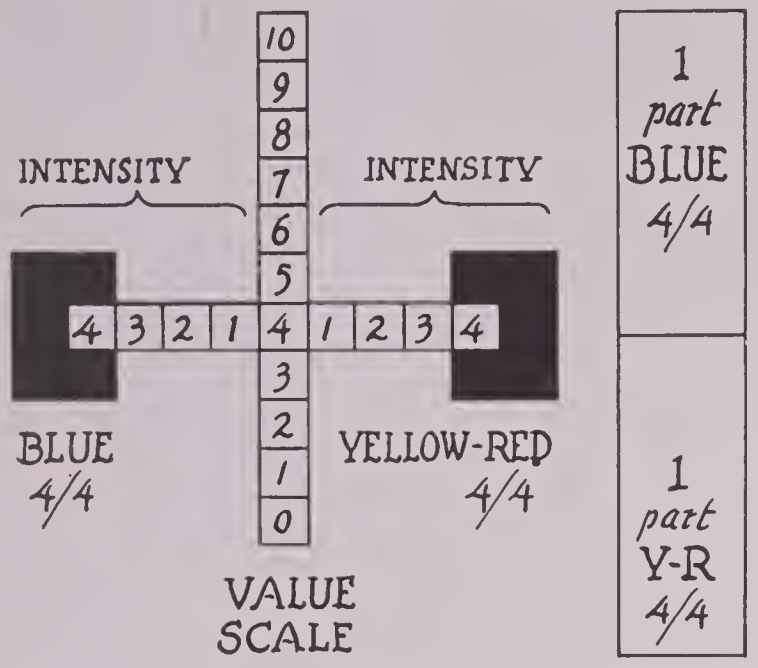
A most common problem would be one in which the area as well as the value and intensity of one or two colors are already established for you. Then your only recourse is to select the remaining one or two colors of proper value and intensity to fill in or to become "background" for these fixed colors and areas with which you start.

It will order your thinking for the moment if we do a little diagraming of some elementary problems.

For simplicity we will start with a two-color combination, using the complementary colors Blue and Yellow-Red. We have seen that equal areas of two complementary colors, of equal intensities and of the same value, bal-

ance to make a neutral gray. This is expressed in Figure 11.

We have color balance, but we also have a balance in areas, which is a monotonous divi-



11 *A balanced two-color scheme, using equal amounts of complementary colors of same value and intensity.*

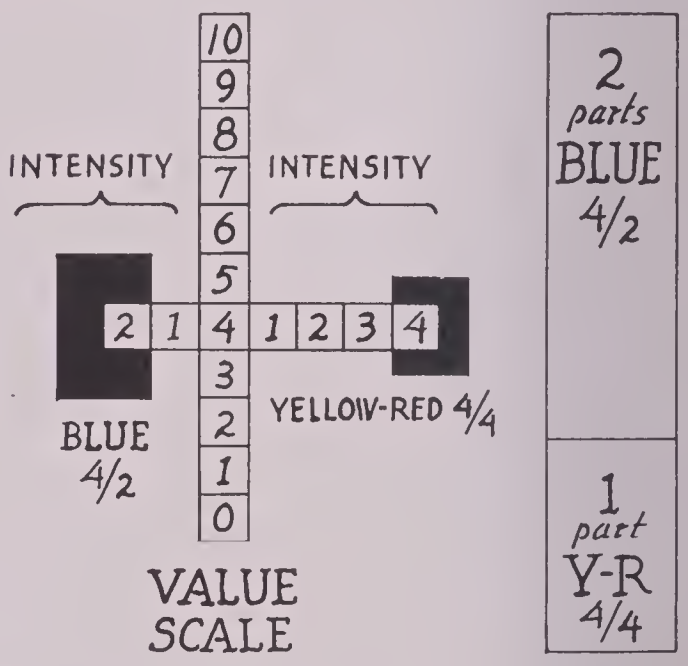
sion of an area. The colors being of equal intensity and at the same value tend to "vibrate" and clash. All in all this is a most unsatisfactory start on color composition.

To break this monotony let us first get a better division of the total area. A proportion of one to two will at least be an improvement over the equally divided area. We will use the Blue in the larger area, the Yellow-Red in the smaller one. But we cannot use the same blue and still keep any semblance of color balance, so we apply the law of "twice the area, half the intensity," etc. (Figure 12.) That means we will need a Blue closer to a neutral gray, or as we stated before, we will "gray" the Blue. To be accurate we use a Blue of one-half the intensity of the one originally used.

To add final proof to our mathematics it will be necessary to dip briefly into the Munsell Color System which has been previously referred to, and which is, incidentally, the finest exposition of the theory of color you can hope to find. I do not want to go beyond the simplest examination of the theory here, but it will be necessary to utilize Munsell "measuring sticks" to prove our point. (I want to dispel instanter any suspicion that I "invented" the principles underlying the theories we are discussing. Would that I had. Mr. Munsell spent more than thirty-five years developing and proving the theory, and it is internationally recognized as scientifically accurate. So you are not being asked to accept anything embryonic or unproved.)

You recall the Value and Intensity Scale shown on page 32. In the mathematics of the theory every color (in all its range of values and intensities) can be located in such divisions of value and intensity, and the particular "square" of each color is designated by a numerical fraction, the numerator indicating the Value of the color in any particular "square" or subdivision of a color, and the denominator indicates the Intensity of that same color.

To express the Blue and Yellow-Red combination in the first graph in these fractions, the Blue is Value 4/ and the Intensity is /4, hence the fraction 4/4. The Yellow-Red is the same fraction 4/4, being at the same value and of the same intensity. Obviously these are balanced if areas are equal, values and intensities the same, and the colors are complementary.



12 *A balanced two-color scheme, using two parts of weaker intensity color with one part of a stronger intensity color, both of same value.*

Now refer to the second graph in which we used a Blue of half the intensity of the original one, so our new color is Blue 4/2 (still value 4 but the new intensity is 2, or half the strength of the original Blue). Our Yellow-Red remains as 4/4. With these known fractions we can determine at once the relative areas each color must occupy in order to

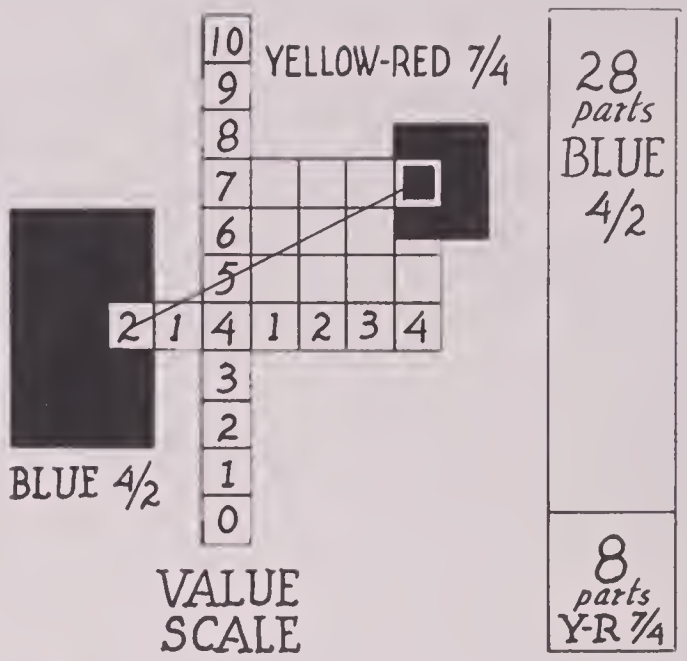
preserve color balance. To arrive at these relative areas we multiply the Blue fraction 4/2 (4×2=8) and then the Yellow-Red fraction 4/4 (4×4=16). The relationship of areas is the relationship of the products of our multiplication, but *inversely* so. In this case the area to be occupied by Blue is 16 (the product of the Yellow-Red fraction) and the area for the Yellow-Red is 8 (the product of the Blue fraction). Or in simple terms we find we need 16 parts of Blue 4/2 to 8 parts of Yellow-Red 4/4, or still more simply, the ratio is 2 to 1. That elementary mathematical formula is the proof of our previous statement of "one-half the intensity, twice the area."

So much for this easily demonstrable fact, and it does seem quite simple, doesn't it?

We started out with a combination that was monotonous in division in areas and further monotonous in that both colors were of equal intensity, and both being at the same level in the value scale there is no contrast of any "light" against "dark." We did improve the composition (in the second graph) by using a larger area of a grayed color with a smaller area of a more intense color (more intense by comparison).

Let us see what we can do about altering the Value of our Yellow-Red, to get still greater variety as well as a little more "zip" and color contrast. Refer to the graph (Fig. 13) and notice that we are leaving the Blue at Value 4 and Intensity 2. Without resorting to theories or graphs we know that a "lighter" (higher value) Yellow-Red will give more contrast with the Blue than will the darker Yellow-Red we have been using. Our problem is to first determine what value our new Yellow-Red should be if we are not going to disturb its intensity. To determine where in the Value scale a Yellow-Red of this given intensity will fall we draw a diagonal from the "fixed" Blue 4/2 through the axis of the Value scale which we see to be Value 5. The extension of this diagonal intersects Intensity /4 at Value 7/.

Our new equation is Blue 4/2 and Yellow-Red 7/4. Our second problem is to determine the relative areas these two colors must now occupy in order to affect a color balance. These areas will be the inverse ratio of the products of the two fractions. For instance the Blue 4/2 product is 8, and the new product of the changed value Yellow-Red is 28 (7×4=28).



13 *Securing balance with two colors, of unequal intensity and value, through change in the relationship of the amounts of each used.*

This means we now need 28 parts of the Blue to balance 8 parts of the new value Yellow-Red, as against 2 parts of Blue to 1 part of Yellow-Red when we used the two colors at the same value level.

I have no desire to bore you with involved mathematics and abstract illustrations but those of you who are interested in getting at the roots of the theory *and practice* of color will only have your appetite whetted for further and more detailed exploration of this tremendously fascinating subject. After all, what do you propose to do—merely shoot pictures in color, or do you really want to become proficient in the art of creating color pictures? There is quite a gap between the two aspirations. If you were interested in sketching in color, you most certainly would not feel that you were creating pictures just because you were able to get the paint smeared around on the canvas. Neither are you necessarily creating a "color picture" just because you properly expose a Kodachrome film.

If you will pardon a reference to my interest in this Munsell System of Color Notation I don't mind telling you that I made my first acquaintance with it more than twenty years ago and in all the years since I have never ceased to find new and stimulating adventures

in every excursion into the deeper intricacies of this theory.

Should you feel so inclined we might solve one elementary problem in handling a three-color combination diagramatically as we have just done with two colors.

We will go back to one of the three-color combinations we were discussing a moment ago, which was Yellow, Blue and Purple. Reference to the Color Wheel indicates that the Blue and Purple are the two colors immediately adjacent to Yellow's complement, which is Purple-Blue.

For simplicity we will assume that we have settled on the values and intensities of the three colors and now want to determine the area each must occupy in order to create a balanced color scheme. These three colors are, we will say, Yellow 6/8, Blue 4/6 and Purple 4/6. The product of the Yellow fraction 6/8 is 48. The product of the Blue and Purple fractions 4/6 are each 24. Remember that Yellow's complement is Purple-Blue and that the Blue and the Purple we are using combine to make Purple Blue, and it would be a Purple-Blue of the same value and intensity, or 4/6. If we were using the two colors Yellow 6/8 and Purple-Blue 4/6, we would know that we should use 48 parts of the Purple-Blue to 24 parts of the Yellow, or 2 to 1.

Now remember that Purple-Blue is but the admixture of Purple and Blue. It follows then that 24 parts of Blue mixed with 24 parts of Purple would add up to the same thing as 48 parts of Purple-Blue. That is very obvious when you think in quantitative terms such as ounces or pounds, for instance. If Yellow and its complement Purple-Blue were used in combination the mathematics of the equation we have just considered would look like this:

Yellow 6/8 (or 6×8) = 48	24 parts of Yellow
Purple-Blue 4/6 (or 4×6) = 24	48 parts of Purple-Blue

Since equal parts of Blue 4/6 and Purple 4/6 make a Purple-Blue 4/6, we use only half as much Blue and half as much Purple to balance the 24 parts of Yellow, like this:

Yellow 6/8 (6×8) = 48	24 parts of Yellow
Blue 4/6 (4×6) = 24	24 parts of Blue
Purple 4/6 (4×6) = 24	24 parts of Purple
	48 parts of Purple-Blue

I wouldn't for a moment expect you to go through any such mathematical calculations before you make every Kodachrome exposure, but an understanding of these laws will help you compose better Kodachrome pictures; will help you intelligently analyze your shots that seem to lack color harmony; and above all, will help you determine how to introduce a new color into existing color compositions, or alter ones that are partially predetermined for you. Suppose you want to include a brilliantly costumed figure in a landscape. Do you think you haven't much control over the addition of such colors in such an expanse as a landscape, with the object of creating better color balance? How about altering the area ratio of the figure to the landscape by having the camera closeup on the figure, or 20 feet away, or 100 feet? You *do* have plenty of control over such situations.

But to get back to our last equations and diagrams, the fact you should retain from these examples is that it takes two, three or four times as much area of a weak intensity, low value (dark) color to balance a complementary color of stronger intensity and higher value (lighter), the ratio depending upon the value and intensity of the colors used, of course.

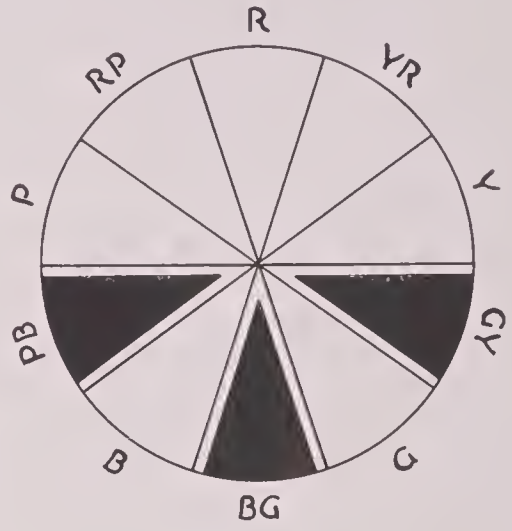
To fix these ratios in mind take a swing around the Color Wheel thusly:

Amount	*High Value Strong Intensity*	*Will Balance*	*Amount*	*Low Value Weak Intensity*
1 part	Red	"	2-4 parts	Blue-Green
"	Yellow-Red	"	" "	Blue
"	Yellow	"	" "	Purple-Blue
"	Green-Yellow	"	" "	Purple
"	Green	"	" "	Red-Purple
"	Blue-Green	"	" "	Red
"	Blue	"	" "	Yellow-Red
"	Purple-Blue	"	" "	Yellow
"	Purple	"	" "	Green-Yellow
"	Red-Purple	"	" "	Green

The tabulation shown above should keep you from getting confused with any such idea as that all Intermediate colors are weaker than all Principal colors, for instance, or that one always uses less of what seem to be the strongest colors and more of what seem to be the weakest ones, in the Color Wheel. If we always used each color at its strongest intensity we could set up ratio relationships between the colors that are most intense with those which are less intense by their very nature. But we seldom use a combination of colors at their greatest intensities. At least we should not do so, as we have previously demonstrated. The tabulation is presented only to emphasize that if you use a high value, strong intensity Red with a low value, weak

14

A three-color "Closely Related" color scheme, employing three colors that are immediately adjacent on the Color Wheel. Such selection can not be other than harmonious.



15

A three-color "Distantly Related" color scheme, employing three colors one step removed from each other. Such schemes will always be three Principal Colors, or three Intermediates.

intensity Blue-Green, for one example, it will take three or four parts of that kind of Blue-Green to balance one part of the kind of Red specified. But by the same rule you could reverse the order and have a high value, strong intensity Blue-Green that might require two or three parts of low value, weak intensity Red for a balance.

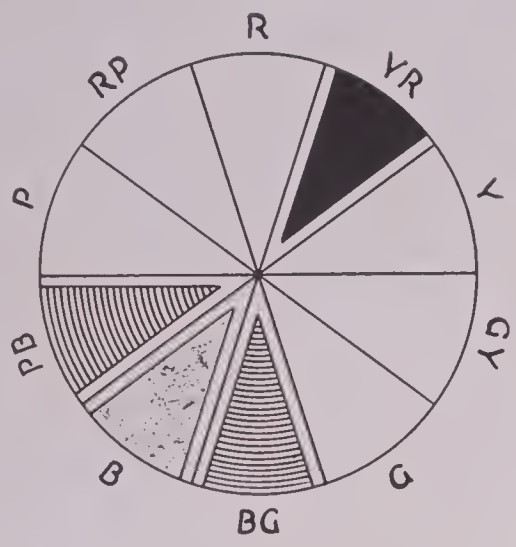
It will pay you to study the Value and Intensity Scale shown on page 32, to fix in your memory that certain colors, at their greatest intensity, are "stronger" colors than others at their greatest intensity. The maximum intensity of certain colors is being extended by science as new pigments are being developed, but the approximate relationship shown in the Scale above mentioned remains generally the same. It should be repeated that none of these Intensity indications should be accepted as definite and final steps in maximum intensity. The diagrams are shown only to indicate relationships and to explain what we mean by more or less intensity of a color at each step in the Value scale.

Creating Color Compositions

It is not assumed that many of us can or will work out, in infinite detail and exact color balance, the average color composition we photograph in Kodachrome. In fact no such laborious procedure is necessary.

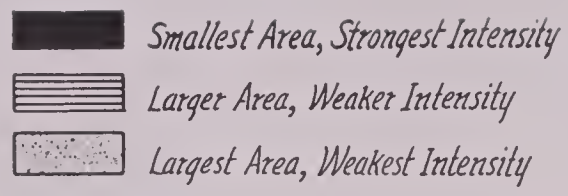
But our compositions will be much improved in the matter of color harmony and balance if we develop and practice the few fundamental rules of good color which we have been discussing. Once we have established, in our minds, the foundation for color harmony and balance we have a "yard-stick" by which to analyze and correct errors in our actual color picture problems.

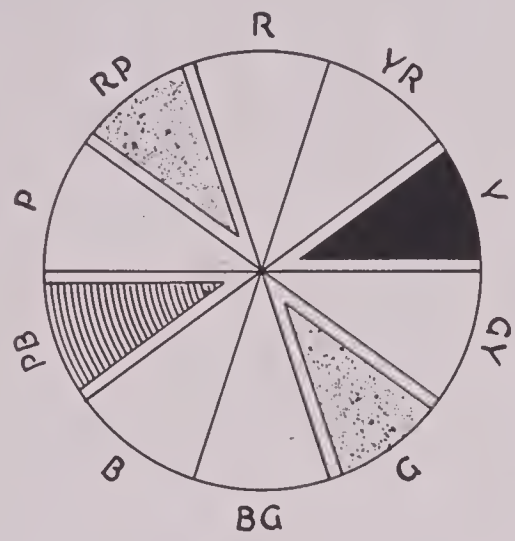
How should one go about creating a color composition? We have already touched on procedurcs for certain types of combinations, but it will not be amiss to review some of the aspccts already touched upon, and from there go on to four and five-color combinations. In creating any color arrangement we must start with something, so pick any color on the Color Wheel. Suppose we want a three-color composition. The safest and most elementary scheme is a Related one, as discussed in terms of a two-color arrangement on a preceding page. Suppose your starting color is Yellow. A Cosely Related scheme is one made up of colors immediately adjacent on the Color Wheel. Then our other two colors are Yellow-Red and Green-Yellow. (See Figure 14.) This



16

A four-color arrangement, using a pair of Complementary Colors, with two others immediately adjacent to one of the pair. It is a "Related" color scheme plus the color contrast of a color Complementary to one of the Related colors.





17

A four-color association that is more difficult to harmonize. A proper association of values, intensities and areas can make such a scheme very effective. The first problem is to determine which is to be used for color emphasis, then subordinate the other three colors to the central theme.

method of selection could be followed around the Wheel.

Or we could have another type of related scheme which we designate as Distantly Related because we skip one step on either side of our starting color, which in the diagram is Blue-Green. We have a relationship in this selection, in pairs, as the Blue-Purple and the Blue-Green have Blue in common, and the Blue-Green and Green-Yellow have Green in common. (Figure 15.) And this method of selection can be followed around the Wheel, giving one quite a variety of combinations.

In Related color schemes there is little contrast in kind of color but contrast aplenty can be secured through using one color of weak intensity and low value, another of strong intensity and high value, and so on.

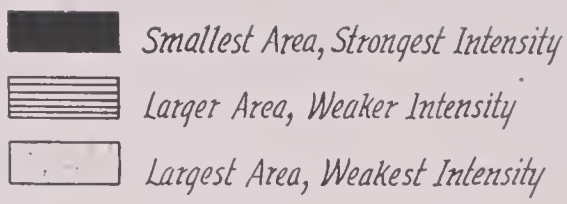
Four-Color Compositions

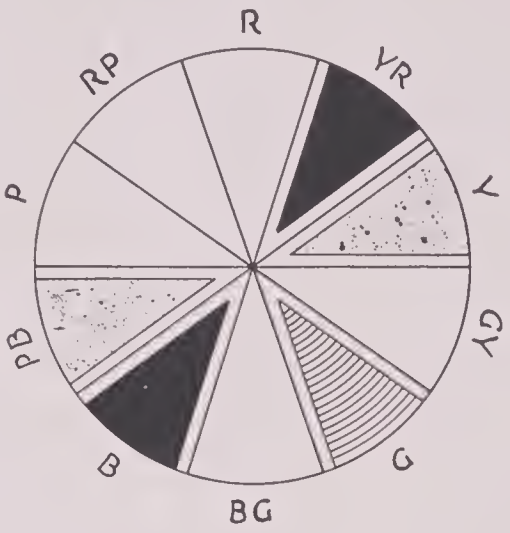
We have discussed at some length one-, two- and three-color compositions, and their selection is a somewhat easier procedure than the development of four- and five-color arrangements. The diagrams on these two pages are not to be construed as *the only* basis for such color selection, but rather to suggest some order and logic in arriving at the development of any multi-colored color composition.

In the first diagram we show our first selection as Yellow-Red. (Figure 16.) To give balance as well as some color contrast we need something on the opposite side of the Wheel, and the simplest procedure is to select the complement, which is Blue. We can now select two other colors on the warm side of the Wheel, between Red-Purple and Green-Yellow, or on the cool side, as suggested by the diagram. The next problem is to use the four colors in intensities, values and areas that will not only give us color and value contrast, but variety in areas. The rectangular diagram is one suggestion as to how we might accomplish this.

The other four-color diagram suggests we start with Yellow, then select its complement Blue-Purple. (Figure 17.) For the other two colors we might select another pair of complements, immediately adjacent to the first pair or a pair one step removed as the diagram suggests.

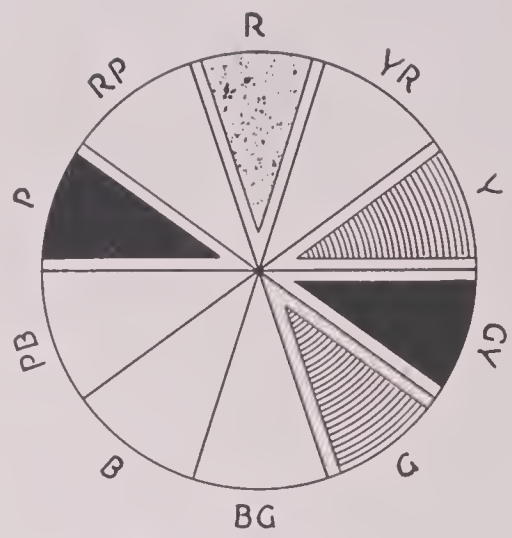
It is difficult to express or suggest a color sensation with diagrams in black and white, but if you will study the two rectangular layouts and the accompanying text you may "see" the possibilities in the suggestions. Better yet, you can prove that any such selection of colors, of proper intensities, values and





18

A five-color selection based upon the use of two pairs of Complementary colors against a background of a color falling between the pairs. One set of Complements would be used in small area, in strong intensity, the other pair being of weaker intensity.



19

A five-color selection that associates two Related colors with one of a pair of Complements, with an in-between color being used in weak intensity as a background for the other four colors. Degree of harmony would depend upon proper intensities and areas used.

areas will balance by laying out areas on a circular white card, painting them in line with the suggestions and then spin the card disc as we did in some of the other tests.

Five-Color Compositions

The two diagrams of five-color selection are merely suggestions, remember, and are not the only procedure one might follow, but turn these around on the Color Wheel, one step at a time, and then imagine all the variations of value and intensity one might use in each combination of five colors and there would seem to be little reason to feel any serious limitation in opportunity for almost limitless color compositions.

In the top diagram (Figure 19) we have started with a selection of the complements Purple and Green-Yellow. We have chosen to select as third and fourth colors the ones adjacent to Green-Yellow so we can achieve better color harmony by having a group of Closely Related colors as part of the composition. The fifth color could be Red or Blue, if we wanted something that gave a little more color contrast. The rectangular diagram suggests how such colors might be handled as to area relationship and proximity to each other.

The second diagram (Figure 18) suggests an amplification of a two-color complementary color scheme, in that we use two pairs of complements immediately adjacent, with a fifth color selected half way between, on either side of the Wheel (in this case Green) to serve as a background for our other four colors.

Keep in mind constantly that there are two basic relationships of color into which all color combinations can be classified, whether you use two, three, four or more colors. First, any two colors are related, closely or distantly, or second, they are complementary or near complements. Complementary colors, of strong intensity and of the same value or nearly the same value provide the greatest color contrast, and are the most difficult to harmonize. Related colors give little color contrast, at same intensity and value, and are naturally harmonious. Any two or more colors of weak intensity are harmonious in combination but they need value contrast to give such a composition strength. Fortunately any amount of alteration up or down the value scale on one or more of the colors will not seriously affect harmony or balance, but it will raise or lower the whole key of the composition. Prove this on the spinning disc.

Developing a Color Sense

It has been difficult to determine how far to go in this discussion of color. I have attempted to stop short of being too "arty," but have endeavored to carry this subject of color to a point where the suggestions advanced can serve as a basis for the development of a better eye for color, and some idea as to how one may make practical application of these elementary rules.

In practice this knowledge will help through serving as a guide for color arrangement, or the correction of badly out-of-balance ones. You can often alter the entire color effect of a composition through the introduction of a color, or a substitution for one that creates color discord, or by merely rearranging the elements already in the composition.

To use a very simple example—suppose you are making a Kodachrome shot of a group of three people, two of whom are dressed in weak intensity colors but the third individual is wearing a costume of brilliant, intense color. If you place the brilliantly costumed figure in the foreground, and if at the same time this figure partially obscures the other two weak intensity costumes you only aggravate an already badly out-of-balance color situation. On the other hand, if you place the brilliant costume behind and between the figures in weaker colors, so that all of the area of the weaker costumes are exposed, and they in turn block out half of the brilliant costume, you will be working toward better color balance. You will have increased the area of the weaker colors and decreased the area of the brilliant color, which is the law of ratio of intensity to area. This example may seem ridiculously simple, but such simple rearrangement often makes the difference between a harsh, unbalanced color composition and a harmonious one.

Another common possibility for quick, easy improvement in color harmony is to add a needed color to an otherwise uninteresting composition through the introduction of a colored fabric for background on indoor shots, or the use of a colorfully upholstered chair, or on outdoor shots, introduce a colorful jacket or other costume item, or you might put a colorful blanket on the ground upon which one or more of your subjects sit.

The application of such devices is too obvious to call for much elaboration.

Entirely aside from the factors of harmony and balance there is one overall rule for color that should be blazoned across every color worker's consciousness. That rule is "Keep your colors in mass as much as possible, and avoid too many small spots of scattered color." A solid color costume is better than a two-piece one if the two pieces are of different color. A two-piece one, if each piece is a solid color, is better than a two-piece one of a broken up color pattern. And so on down the line of diminishing area size. This applies equally whether your subject is a figure, a room interior, a landscape or whatnot. This idea of large masses of color in landscape is well illustrated in the Color Plates of Bryce Canyon and Grand Canyon, pages 18 and 143, respectively. Compare these with the Color Plate of the Flower Garden, with its more scattered "spots" of color.

So much for color composition. It is a big subject and one could not explore all its ramifications in months of study, much less do justice to it in a few pages in a book. If this discussion has stimulated any inclination for further investigation and experimentation it will have served its purpose well indeed. The extent of your further explorations depend upon whether you are merely satisfied to photograph things in color, or whether you seriously want to create and record beautiful color pictures. If there is any art in your soul there is a whole wide world of opportunity for the expression of that urge through the medium of Kodachrome.

Complete information regarding the Munsell Color System may be obtained from the Munsell Color Company, Inc., 10 East Franklin Street, Baltimore, Md., or Favor, Ruhl & Company, 425 South Wabash Ave., Chicago.

CHAPTER 4

VALUE CHARACTERISTICS

PERHAPS it may seem far afield to refer to color as having black and white value characteristics. But it is necessary to understand that the *color* of an object has less effect on Kodachrome exposures than the Value of the color. In other words do not seize upon the misconception that Red always calls for the same exposure in bright sunlight, for instance, or that there is a "set" exposure for Yellow, another for Blue, and so on. It all depends upon the Value of the Red, Yellow, Blue, etc. In fact many things affect this phase of color.

To establish a premise for examination of this black and white value range (brightness range, or whatever you prefer to call it) we will subdivide the subject into three phases:

1. Different colors of the same material and texture do not reflect the same percentage of the incident light.
2. Different textures of the same color do not reflect equal percentages of the incident light.
3. The value or brightness range of normally intense colors is greatest under strong light (as full sunlight) and the scale or range is shortened as the volume of incident light is decreased.

It will be less confusing if we get at these aspects of color one at a time even though we usually encounter a combination of all three in actual practice.

Relative Reflective Power of Colors of Same Material

We refer to certain colors as "light" colors and to others as "dark" ones. If we understand what we mean by such designation we are not far from a correct definition, unscientific though it may be. When we speak of a color as being "light" or "dark" in comparison with other colors in a group we assume, of course, that they are all, at the moment at least, fully exposed to the same light source. We do not take into account shadow areas or partially lighted colors.

Please do not ask me why, but it is true that certain colors, by their very nature reflect more of their own color than do other colors, as mentioned in the preceding chapter. In such pigments as the printing inks used in process color work we find such surprising variations in reflection as these:

—that blue-green reflects only 45% to 50% of its own color, while at the same time reflecting some red, which being its comlement, tends to "dull" the brilliance of the blue-green,

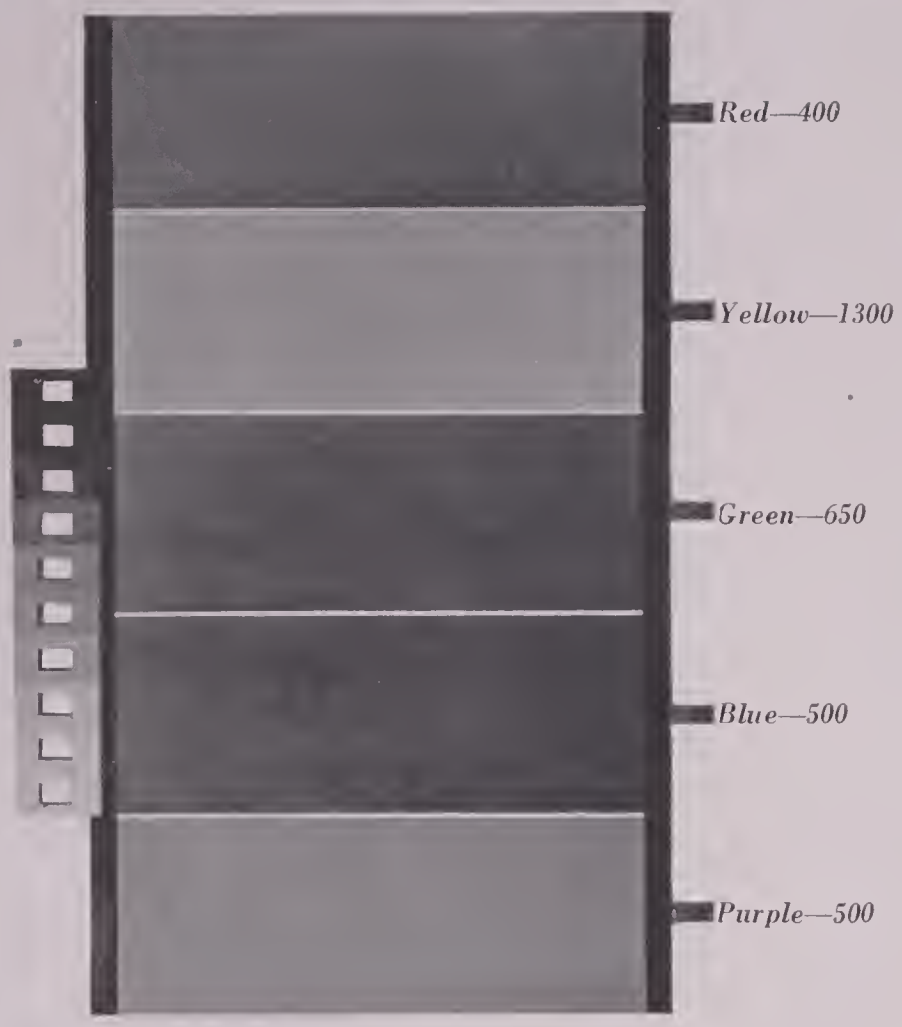
—that the magenta red reflects only 70% to 75% of its own color, which is "dulled" by reflecting about 20% of green, which it should absorb, and

—that yellow is the most efficient in that it reflects 80% to 85% of its own color, and some yellow pigments reflect as high as 97%.

Rather simple arithmetic indicates why some colors are "light" and others "dark," entirely aside from the factor of the amount of white or black they contain at certain values, or more properly, how they appear when exposed to *weak* or *strong* white light.

You may be interested in comparisons of this relative reflective power borne out by a simple test made with colored cardboard; each color near its maximum intensity. Using colors of the same material and surface texture confines the comparison strictly to *color*. In another table we will observe the relative reflective power of different materials and textures of the same color.

The table on the next page shows (1) meter



METER READINGS
from the
FIVE PRINCIPAL COLORS

20

Relative Reflective Power of Colors

This reproduction is from a panchromatic negative made from a Kodachrome transparency shot of these color swatches in full sunlight, exposed for the Red. It is interesting to note that overexposure of all other colors resulted in pulling together the monochromatic value of all colors. See text for amount of overexposure.

	Meter Reading	Relative % Reflection	INDICATED EXPOSURE Movie Film 1/30 sec.	35 mm. Film 1/25 sec.	Cut Film 1/25 sec.
Neutral Gray	1000	100%	@ f/18	@ f/20	@ f/22
Red	400	40%	@ f/11	@ f/12.7	@ f/14
Yellow	1300	130%	@ f/20	@ f/22	@ f/25
Green	650	65%	@ f/14	@ f/16	@ f/18
Blue	500	50%	@ f/12.7	@ f/14	@ f/16
Purple	500	50%	@ f/12.7	@ f/14	@ f/16

readings on each color, under identical light conditions; (2) the relative amount of light reflected, as compared to readings taken on a Gray Card which is taken to be 100% (for comparison only, because the gray card did not reflect 100% of the incident light, of course); and (3) what the correct exposure would be for Kodachrome Movie Film at a shutter speed of 1/30 of a second, and what it would be on both 35 mm. and Cut film Kodachrome, working at a shutter speed of 1/25 of a second. Readings and exposures were made in bright, noon-day sunshine. (Exposure calculations are for Daylight type film and at the following film ratings: Movie and 35 mm., Weston 8, GE 12; Cut film, Weston 10, GE 16.)

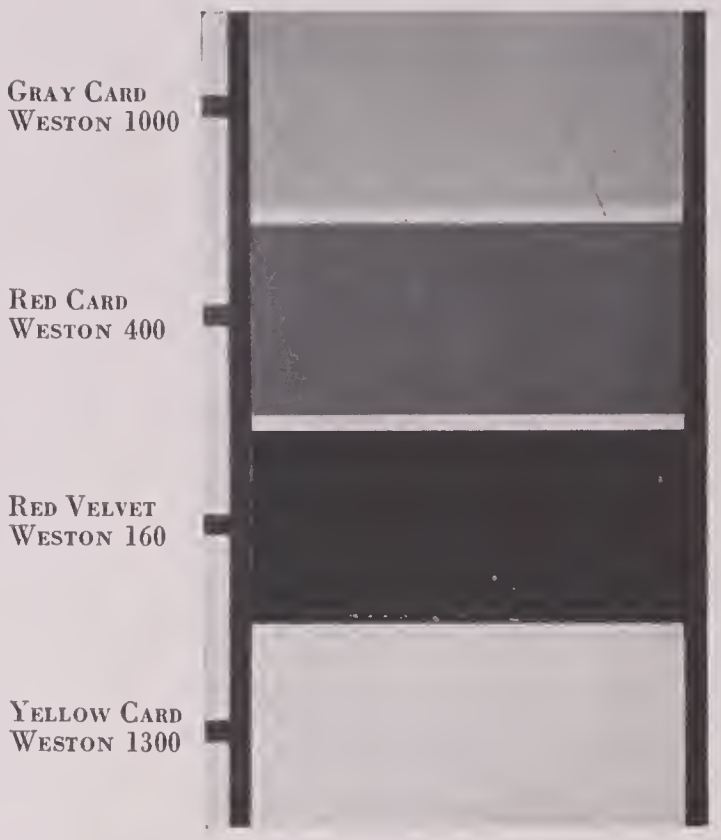
Cut Kodachrome was used for the exposure. The black and white reproduction (Figure 20) is from the exposure based on the meter reading for the Red. As you may suspect, in the Kodachrome transparency the Yellow is slightly "burned out," as it was overexposed almost two full stops; one and two-thirds stops, to be exact. Overexposure results in loss of color saturation, as you know. The Green, Blue and Purple were not affected unfavorably to any appreciable extent although there is slight evidence of overexposure, more noticeable in the Green, of course. But these latter three colors are well within the limits of "satisfactory results." By referring to the table you will notice that the Green was overexposed ⅔ of a stop (exposure

for Red was f/14 and it should have been f/18 for the Green); the Blue and Purple were overexposed ⅓ stop. While we are "splitting hairs" do not let anyone tell you that ⅓ of a stop variation does not affect color results. That fact becomes all the more important in helping you decide on "compromise" exposures, and practically *every* Kodachrome shot requires some exposure compromise. You should learn how to arrive at such compromises in order to secure the best average results, as well as to know how to faithfully record a specific part of your composition, when you so desire.

A word of caution about the exposure indications given in the foregoing table. They *must not* be considered as suggested exposures for normal subjects or for any situation except an exact duplicate of this test, light conditions and all. The meter readings shown are *excessively high*, as you may have noticed. They are high because these color swatches were mounted flat and turned directly toward the sun, and the material's reflective power is much higher than that of "normal" subjects. In your usual color composition only a small percentage of the surfaces are in a flat plane and at right angles to the light source. The balance are turned "every which way" and in consequence reflect back to the camera lens less of the total light emanating from your light source.

This ratio of the relative reflective power of these same colors and same materials could and would be altered by changes in volume of incident light; by changing the color quality of the light such as under a north sky in open shade; or a colored artificial light source.

So much for a demonstration of the fact that there is a difference in the relative reflective power of colors, other conditions being equal. Our second subdivision of this reflective variation is:



21 *One check of the relative reflective power of two materials and surfaces, of the same color, in comparison with a neutral gray and a Yellow Card of extremely high reflective power.*

Relative Reflective Power of Different Textures of the Same Color

Before we assume that color *alone* determines the percentage of incident light coming back to our lens, we must introduce another element—that of surface texture.

In making this "texture" test shown in the tabulation which follows, two different surfaces were used although these are by no means those that might represent the extremes in absorption and reflection. The hard surfaced Red cardboard (from the previous test) and a piece of Red velvet were the materials used. The *color* or kind of Red in both materials were as nearly the same intensity and value as could be found.

To have a direct comparison with the preceding test and tabulation, meter readings

(Continued on page 55)

	Meter Reading	Relative % Reflection	INDICATED EXPOSURE Movie Film 1/30 sec.	35 mm. Film 1/25 sec.	Cut Film 1/25 sec.
Neutral Gray	1000	100%	@ f/18	@ f/20	@ f/22
Red Cardboard	400	40%	@ f/11	@ f/12.7	@ f/14
Red Velvet	160	16%	@ f/7	@ f/8	@ f/9

THE THREE DANCING GIRLS

Color shots of figures outdoors, in full sunlight, usually present the very serious problem of unwanted, harsh shadows on face and figure. The usual devices for overcoming such hazards are reflectors or synchronized flash, to fill in shadow areas.

If you are so fortunate as to stage a color shot under a light fog or extremely light overcast sky, you will find such light conditions as desirable as any that can be created with supplementary light. This shot of the three girls was made in the middle of the day, under a high fog light. The quality of such light closely approaches that created by a diffusing screen. Sharp contrasts are eliminated (except for dead shadows), and the intensity of the light is but slightly diminished in comparison with full sunlight.

This study is an interesting demonstration of Kodachrome's ability to record, in full intensity, the three very interesting reds in the costumes, each so distinctly different from the others, as well as being several shades removed from the Magenta dye used in Kodachrome. It is a rather striking example of the subtle changes in colors that can be produced through the addition of even small amounts of the other two dye colors. Three colors create all the kaleidoscopic array of color of which Kodachrome is capable of recording.

DATA: Exposed on 4x5 cut film Kodachrome; Camera, Speed Graphic; Lens, 10 inch Goerz Dagor. The reproduction is four color process, letterpress; plates made direct from the transparency.

	Meter Reading	Relative % Reflection	Exposure 1/25 sec.
Neutral Gray	1000	100%	@ f/20
Yellow Cardboard	1300	130%	@ f/22
Red Velvet	160	16%	@ f/8

were made in the same light, under the same conditions, and the same neutral gray card was used as the 100% basic unit. (See Figure 21.)

The percentage of reflection, due to *surface texture* variation and *not* to color difference, is shown by the meter readings listed in the table on page 51.

In this test we find that the Red Velvet called for 1⅓ stops more exposure than did the cardboard surface of the same color. To further impress this fact of texture *and* color influence in reflective power let us take a rather extreme case and check the Yellow cardboard with the Red Velvet.

Using the tabulations on the Yellow from the preceding table we find a comparison like the above for an exposure on 35 mm. film.

This indicates an exposure range between the Yellow cardboard and the Red Velvet of 3 full stops, a wider range than can be captured on Kodachrome film, with its limited latitude. If one exposed correctly for the Yellow the Red velvet would be greatly underexposed and would appear so dark that it would reflect little if any color. If the exposure were made for the Red velvet the Yellow cardboard would be so badly overexposed that its color would be all but "burned out" entirely. It would likely appear a warm white.

A compromise exposure, half way between the extremes would record some semblance of both the Yellow and the Red, but far from faithfully, as at this exposure the Yellow would be overexposed 1½ stops and the Red underexposed an equal amount.

We could carry this comparison to greater extremes through use of some such highly reflective surface as a Yellow porcelain enamel table top along with the Red velvet.

These two tests—(1) relative reflection of different colors of the same material and texture and (2) relative reflection of the same colors of different textures—have indicated that there is a wide range of variation between the volume of our light source and the percentage of that light which is reflected back from objects and surfaces upon which that light falls.

This little demonstration should be the answer to those proponents of meter readings from a neutral gray card, to determine the volume of the incident light. Such procedure is an oversimplification of the problem of determining the amount of light reflected *back* to the camera lens. After all, it is the light reflected *from* our composition that exposes the film, and the amount of this reflected light does not have a constant or percentage relationship to the amount of light present.

We must not become confused by the illustrations just cited. We are not attempting to prove that *all* Yellows, regardless of material or texture, reflect a higher percentage of the incident light than do *all* Reds, regardless of their material or texture. On the contrary, we could easily find a highly reflective material in Red color that would reflect more of the incident light than a highly light absorbent material in Yellow color, for instance.

Neither do we mean that all "hard" surfaces of any color reflect more light than do "soft" surfaces, regardless of color. In the majority of cases hard surfaces would reflect more than soft ones, but there are exceptions to all rules. One exception could be a very dark value Purple-Blue cardboard (hard surface) and a very high value Yellow loosely woven wool fabric (soft surface).

Then why all this talk about "light" colors, "dark" colors, and all the combinations of color and surface texture if there are no rigid rules? There *is* a rigid rule—the rule of learning to "see"—to see things as they are, and to untangle them from fixed impressions and unsupported assumptions. Too many of us acquire too many unprovable "facts" that become fixed guides, without question, in our practice of color photography. We need to critically examine many of those things we know "for sure" that may not be true.

This rather lengthy discussion is an attempt to help you analyze your color subjects—to

22

This picture was taken in the middle of the day, with no light except that from outdoors through the windows. Objects in the room fall into their natural value scale under such even illumination, and hold their true relationship better than if they were in full, direct sunlight.

23

This is the same room, late in the day, when the volume of incident light is much diminished. Although this is a rather trite example, it does illustrate the point that the weaker the incident light the closer together are the values of all objects under such light, regardless of their value relationship in full, direct light.

help you translate colors and textures into terms of "light" and "dark"—to help you judge the black and white value range of your subjects. And what is more important, to help you determine what is the "average" value of the subject, for that must become the basis for most of your exposures. Also, as you learn to analyze your compositions, in terms of values (or brightness, if you prefer), you will detect any portions that are beyond the range of the film, because they are too light or too dark.

Do not forget that your Kodachrome film is three layers of superimposed "black and white" emulsion, prepared in such way that each layer records a definite portion of the spectrum. It is only through processing manipulation that it finally becomes a color transparency. The film has to "see" the subject in terms of "black and white" values, and you will get better results when you commence to see your subjects through the same "eyes."

Now just a word about the third phase mentioned previously; the fact that the value scale or brightness range of a color composition is shortened as the volume of incident light is decreased. By the same token the range is lengthened, or the value contrast is increased by any addition to the volume of incident light. To carry this procedure still further, the brightness range is lengthened by the addition of "surplus" light, as we will see in just a moment.

First, we need no test beyond commonplace experience to remind us that all colors are pulled together in value in a darkened room. Recall some colorfully furnished room—colorful, that is, when it is flooded with light. In the strong light one sees great contrast in value or brightness between light colored

walls, brilliantly colored drapes and dark colored upholstery or floor coverings. (Figure 22.) Then walk into the room at twilight and the light walls will appear to be dark gray, the brilliant colors of the drapes may retain some semblance of color but will appear very dark in value. (Figure 23.) If there is sufficient light in the darkened room the dark furniture and floor covering will not appear as much darker than normal (in full light) as will the normally light, high value colors, such as the light walls.

This absence of light is another proof of the law of values discussed in an earlier chapter. All objects in the room retain all their properties of color but they must be subjected to sufficient light to make the color apparent. Again it will not be amiss to repeat that color is an object's ability to absorb certain portions of the visible spectrum and to reflect others from the white light falling on the subject.

While we are on this phase of the subject we should keep in mind that we can make a "dark" color of a "light" one by simply decreasing the volume of the light in which it is viewed. That is what takes place in the darkened room, all colors have become "dark" in value. It is not so easily understood that "dark" colors can be made "light" through increase in the volume of incident light. With "surplus" light we can carry such colors to a lighter or higher value than we usually consider their normal value or brightness.

Just a word or two about what we mean by the addition of "surplus" light. I would term "surplus" light as that volume beyond the point where a color seems to be brightest and at the same time retains all its "local" color. Another term might be "point of saturation." This is most easily proved with such colors as a lemon yellow. For purposes of illustration we will use an actual lemon because its color is intense and its surface is highly reflective. You have probably noticed that a lemon does not appear as intense in color in brilliant sunshine as it does under a slightly diffused sunlight—fog light or under the roof of a greenhouse. Some place in the scale of light volume the lemon absorbs all or most all colors in the visible spectrum except the yellow portions, or bands, we call the lemon's "local" color. In the brilliant sunshine the yellow loses some of its intensity of color. It is "burned out" because of "surplus" light. It merely means that the lemon is being subjected to more light than it can handle. Since the "saturation" point has been passed, the lemon then reflects all it can of yellow but it also reflects a percentage of the incident white light as *white light*, a dilution of the pure yellow color takes place. The result is much the same as if one added some white paint to a yellow paint similar to the lemon's yellow.

"Surplus" light will not burn out normally dark colors so easily, as the addition of "surplus" light will only make a dark blue appear as a lighter blue, for example. The same will hold true of all dark colors.

What have we learned from this rather detailed consideration of the black and white value characteristics of color? I hope you will agree that the following facts seem obvious.

1. That, even in Kodachrome, we do not photograph "color" but rather the *amount* of colored light reflected back from a color subject. The object's color is dependent upon the volume of incident light, but the film's emulsion is affected only by that portion of colored light which the object has the ability to reflect. The fact that the film records "color" is due to the sensitivity of one or more layers of the Kodachrome film to that color.
2. That the value or brightness range of any color composition is what determines exposure, and not what colors are used.
3. And last but by no means least, that since Kodachrome film has less latitude than does single layer emulsions used for black and white work, the most satisfactory rendition of *all* colors in a composition is secured when the scale of values or brightness is comparatively short—no extremes of light and dark values in the same composition. An ideal color composition, from the standpoint of exposure only, is one that is all in low key, or all medium key, or all high key. Exposure compensation is then made for the "key" of the composition. And when we say Value or Brightness we are only using a term to express the *amount* of reflected light. Remember the com-

24

A "Light-Colored" Subject. This scene is light or "high-keyed," due to two factors. First, the colors of the surfaces are yellows, tans, pinks, etc.; second, reflected light opens up most of the shadow areas which shortens the tone scale of the entire composition.

parison of the Yellow cardboard with the Red velvet, and that texture, or the power of reflection or absorption has as much to do with the result as does the color itself. Oftentimes more.

I can imagine some of you saying, "Enough of this abstract stuff. Why not get out and take some pictures, to learn whether or not there is any sense to these ideas."

Bryce Canyon

Nothing could please me more. The first adventure will be with a subject that has caused no end of color photographers no end of difficulties—Bryce Canyon National Park. (Figure 24.)

Suppress for a moment your awe and wonderment at the spectacular panorama before you, and analyze the subject in terms of what we have been discussing.

As colors go, it is apparent that the overall color of the Canyon is "light," very light. Yellows, Pinks, light pastels that reflect back an unusual percentage of the incident light. We know that such colors call for at least one (1) stop less exposure than would green grass, green trees, dark earth colors and so on. The very nature of the color is "light," mental comparisons tell you instantly. Refer to the Color Plate of Bryce Canyon, page 18.

Now another factor influences our analysis —that of surface texture. The surfaces are vertical and parallel, with a higher than usual percentage of planes that catch and reflect light back to your lens. For this factor we would stop down ½ to 1 stop, depending upon the angle of light, what we are including in our composition, etc. The result of the combination of "light" color and reasonably high reflective surface suggests an exposure of 1½ to 2 full stops less exposure than we would give an "average" subject. The foregoing assumes we are photographing in more or less flat light and are not concerned about making compensations for shadow areas. This Bryce subject is an extremely interesting example of a "high-keyed" landscape, and the approach we have just made to the subject concerns only an exposure that will record faithfully the subject's local color. It is not, however, the best procedure for getting an effective color picture of Bryce Canyon, as we will see in later discussions.

25

A Slightly "Darker Than Average" Subject. Dark water, dark trees, dark rock cliff and no surfaces reflecting light onto other surfaces.
All surfaces except the water being of an "absorbent" rather than "reflective" texture combine to make this an "average" subject on the "dark" side, and sufficiently so to justify a little exposure compensation.

Agate Beach

Now for a subject with quite different characteristics. (Figure 25.) This scene is along the Straits of Juan de Fuca in the State of Washington. Analyzing this subject first for color, we have a dark blue sky because we are shooting North; the water is an especially dark blue; the trees are dark, warm green; the cliff is dark earth color; and the gray pebble beach is a darker tone than the average sand beach. From a color standpoint we have no light, "high-keyed" colors except in the figures and they are too small to demand any exposure compromise.

In comparison with Bryce, we recognize that this composition is made up, primarily, of "dark" colors. The surface textures are average, or on the "absorption" side rather than more "reflective" than normal. We must let the sky take care of itself. We are shooting the water at such a low angle that it does not reflect back as much light as water does when viewed from a higher angle. The cliff and trees reflect back less than an average percentage of the incident light. (The Color Plate "Mt. Baker," page 125, is another example of large areas of dark and "light absorbent" colors and textures.)

Here, then, is a subject of slightly "darker" than average colors, with also a deficiency in the reflective quality of surface textures. While these "deficiencies" from normal are apparent it is also apparent that they are not as extreme in the opposite direction as those found in the Bryce illustration, and our compensations for "below normal" will not need to be so great as for the unusual "above normal" conditions at Bryce.

However, our beach scene is a darker than average subject. The factor of "dark" colors calls for about ⅓ wider stop, and the below normal reflective quality of the surfaces suggests about another ⅓ stop compensation.

To be specific let us see what our exposures would be on these two subjects in comparison with what we might use on a normal subject.

	Movie 1/30 sec.	35 mm. 1/25 sec.	Cut Film 1/25 sec.
Normal Subject	@ f/8	@ f/10	@ f/11
Bryce Canyon	@ f/14	@ f/18	@ f/20
Beach Scene	@ f/6.3	@ f/8	@ f/9

In our analysis of these two subjects we have used as a basis the two factors discussed

in this chapter—that of the black and white value range of colors *and* the character of surface textures. These two illustrations are given only to help fix in your mind that there *is* practical application of these rules that will prove themselves more fundamental as your color experience expands.

In a following chapter we will discuss exposure calculations in more detail, giving consideration to other factors that will help you make more critical analyses of your Kodachrome problems, with consequent better results, you may be sure.

SUNLIGHT CHARACTERISTICS

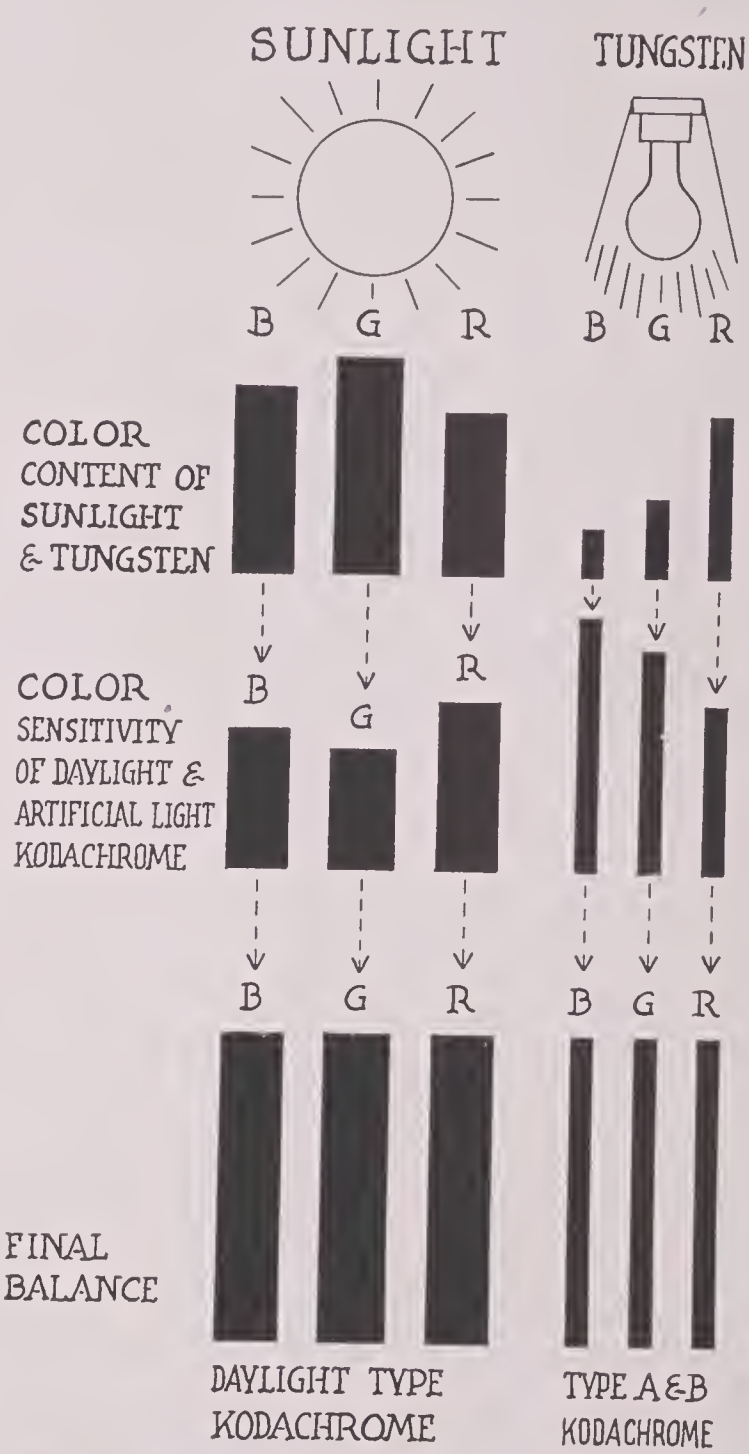
THROUGHOUT the preceding chapters we have attempted to organize our basic thinking about the relationship of colors to each other—we investigated complementary colors—related colors—color contrasts and color harmony; and we learned the importance of the brightness range or the black and white value of a subject.

If we have succeeded in establishing a basis for good color composition the next logical step is a better understanding of our light sources. For the present we will restrict the discussion to the various aspects of sunlight, or more properly, daylight conditions.

Sunlight is sunlight, you say. That is only partially true, for there are variations in the color quality of sunlight from morning to evening; sometimes from day to day; and from atmospheric conditions that are not always easily detected. When we say the "color quality" of the light changes we mean that during these changed or off normal conditions some one band of the spectrum predominates, even though slightly. Our problem is to learn how variations in this color quality produce interesting, and sometimes troublesome color effects.

The color of an object is changed by variations in the light source, as you may have proved with the "white" card experiment suggested in an earlier chapter. We found then that we see things in their "true" color only under pure white light.

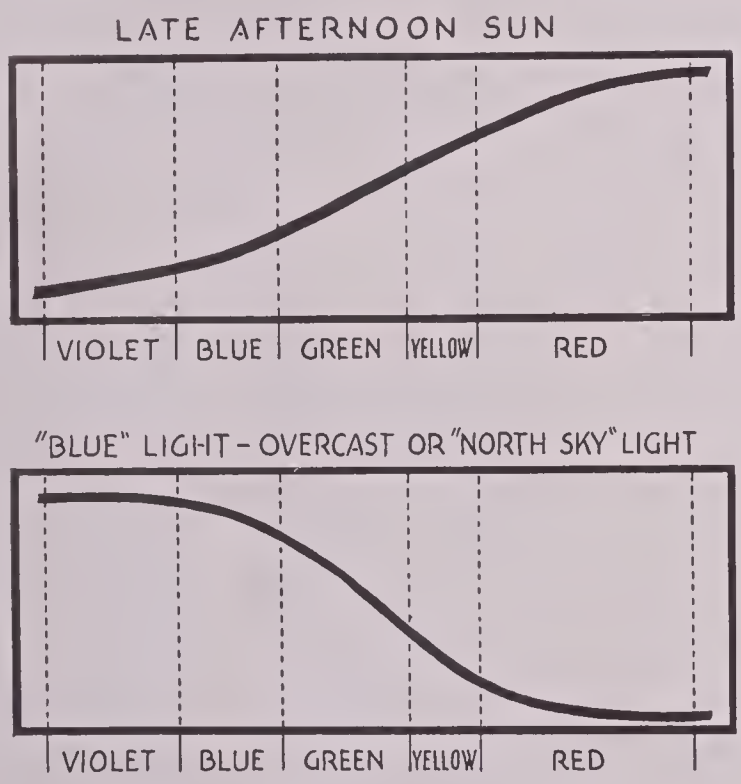
Since we are working in Kodachrome we should have an understanding of what takes place when you expose a Kodachrome film to a color subject. The graph at the right shows roughly the difference in the "color balance" of sunlight and artificial light. We are concerned only with the three spectral divisions



26 *A graph showing the "color balance" of light sources, and how the sensitivity of Kodachrome film is balanced to compensate. The three color bands, Blue, Green and Red are indicated because Kodachrome, in negative state, is sensitive to these three colors. See text for explanation of the negative-positive color balance.*

of the light source because the three layers of emulsion of a Kodachrome film are sensitive to the complementary colors of the three colors that finally make up the Kodachrome transparency you view. The emulsion nearest the film base responds to red light, the middle emulsion to green, and that at the surface to blue. In the process of reversal and dye coupler development the bottom or "red" layer becomes the blue-green portion of our final picture, the middle layer becomes the magenta and the top layer the yellow. If you are interested in following the process in more detail such information is available in the manufacturer's literature.

Our concern is to understand that these two types of films (Daylight and Artificial Light) are balanced for a light source of fixed balance. If you will examine the graphs (Figure 26) you will notice that the Blue band of the light plus the Blue sensitivity of the film equals the final balance. The same is true for the green and red. Now it should be obvious that if one color predominated in the sunlight the resulting transparency would show an excess of that color. By "predominate" we mean that there would be more of this color in the light, in relation to the other two colors than in the light source for which the film is balanced.



27 *The above graphs demonstrate why late afternoon light is so minus in blue and green, and why "sky-light" is so minus in the warm colors. Kodachrome will record the "color" of the light present. It cannot compensate for this out-of-balance.*

The two graphs (Figure 27) illustrate more forcefully than words what happens to the color balance of daylight (and to your Kodachrome result) when you shoot a color picture under out-of-balance light conditions. In the one extreme we have illustrated the color quality of heavy overcast and in the other the color quality of early or late sunlight.

To repeat and be more specific, regular or daylight type Kodachrome is balanced for mean, noon-day summer sun in Washington, D. C. If you are doing your color shooting where normal light conditions are different in color quality than that for which the film is balanced there may be an appreciable difference in your results, most noticeable in distant landscape scenes, of course. On close-up or nearby subjects this influence will not be so easily detected.

While it is obvious that the film's relative sensitivity must be balanced to some standard light source, it is just as obvious that the film cannot automatically adapt its reaction to an out-of-balance light source. It cannot, for instance, hold back the excess red in sunset light and record the colors, on which this "reddish" light falls, as they would appear if photographed in the middle of the day.

Although all variations of sunlight as a light source are not out-of-balance ones, this matter of color quality is a factor in every type of sunlight condition. Some of these variations make no practical nor appreciable difference in our results. Others must be given serious consideration.

To simplify consideration of the more common variations in "types" of sunlight conditions we will restrict our discussion to six major conditions: (1) Early and Late Light; (2) North or "Sky" Light; (3) Reflected Light; (4) Diffused Light; (5) Transmitted Light; and (6) to general "Out-of-balance" Light.

1. Early and Late Light

You do not have to be reminded that the sun looks redder a half hour before sundown than it does during the middle of the day, and that it gets still redder and redder as it approaches the horizon. We accept such phenomena without thinking much about

why this change in color. The sun's brilliance hasn't decreased any, of course. It is just as bright as at noon. It is only that the sun's rays are being cut down or retarded by something interposed between us and the sun. This sounds a little too elementary, doesn't it? Perhaps so, but we do not always realize that it isn't just the sun that appears reddish. Everything about us is being seen illuminated by the same "color" of light as we see the sun. But again we are confused by the conflict between what our eyes see and what our brain tells us is the color of the objects around us. In the case of the sun both our eyes and brain tell us it is red, but our brain tells us green trees are green, that flesh tints are flesh color, and so on.

How does the color quality of sunlight at this time of day change so radically? The more obliquely the sun's rays strike the Earth's atmosphere the redder or "hotter" the light. The extra thickness of atmosphere, full of dust particles close to the Earth's surface, filters out, holds back or scatters (as you prefer) a considerable percentage of the blue and purple (violet) rays. The thicker these dust particles the redder the sun looks. This effect is especially apparent when you see a sunset through some factory smoke. In the cleaner air of high altitudes the sun at the horizon is more yellow-orange than red.

Early or late in the day our light source is, literally, reddish-yellow, and objects reflect the "quality" of light which falls upon them. Well and good if you are shooting a sunset, but if you are photographing flesh tones, whites or light colors, this early or late light will give everything a "warm" cast (varying with the quality of the light), from a faint tinge to the strength of a firelight glow. If flesh tones appear badly "sun-burned" do not blame Kodachrome. It recorded what it saw.

This effect of reddish light is too obvious to warrant more than a reminder of what we already know. But another effect of this *warm* light that few color photographers seem to recognize is its influence on the greens and blues. Refer again to the Color Wheel and note that the greens and blues are complements of the warm colors. You remember that mixture of any two complements produces a gray. Likewise, when you add a little of one color to its complement you tend to gray the complement. When you add "reddish" light to blues and greens you "gray" them—you reduce the purity and intensity of their color. If in your shots, made early or late in the day, green foliage appears brownish-green, or dark and colorless, it is due to this influence of reddish light on its near complement, green.

If you wish to correct for this excess red in such light, two groups of filters are available—Eastman filters CC3, 4, 5, and 6, designed for use with Eastman's Color Temperature Meter, and Harrison's "Blulite" filters Nos. 2, 3, 6, 7, and 9, for use with Harrison's Color Meter. (See Chapter on Filters.)

2. *North or "Sky" Light*

The most obvious example of "sky" light is the light in the open shadow on the north side of a building. Since no direct rays of the sun can reach the area the light reaching this area is reflected from the sky plus a relatively small amount from surrounding surfaces that may reflect some light into this shadow area.

But there are a thousand other conditions where "sky" light affects certain areas of a composition and sometimes creates an overall effect that results in a bluish-cast in our Kodachrome result. Not realizing the effect of this sky cast we are inclined to blame the film or the processing rather than the light source. You may recall a mention on an earlier page about the blue highlights on a black automobile when viewed from a high angle. If that sky light affects the black automobile it also affects everything in a composition, but usually not to an objectionable extent.

Have you ever taken color shots of figures in north or sky light? If so you probably posed the figure against the north wall of a white house (in open shade) to eliminate the hard eye and chin shadows overhead sun would cast. This north light is soft, diffused, and gives pleasing modeling to face and figure. But this light is "out-of-balance," strong in blue—blue reflected from the north sky. In your Kodachrome result white will appear bluish; strong bluish high-lights will be noticeable in the hair, dark hair especially; and the pink tones of the flesh will be slightly neutralized (grayed) by this excess blue.

To partially overcome this excess blue, some authorities suggest the use of Wratten No. 1

filter for slight correction, or Wratten No. 2A for extreme conditions. I have secured results more satisfactory to myself, at least, with Eastman filters CC14 and CC15, or Harrison's "Coralite" filters No. C½ and C1.

Another evidence of the effect of bluish, north light will appear in any surface facing generally north—rock walls (as in Yosemite, Zion Canyon, certain angles in Grand Canyon)—and the north walls of buildings, on boats, and to some extent in back-lighted figures. Open shadow areas in your landscape shots will appear bluish also because their sole source of illumination is from the sky.

I only want to emphasize that this "north" light is a light condition; a change in the color quality of light falling on your subject. Sometimes this is objectionable, oftentimes it enhances the quality of your result. Whether you try to correct for it with filters, as in the case of the figure in open shade, is very much a matter of choice and personal taste.

While we are discussing the problems of excess blue in our light, it might be well to mention that the light at high altitudes (5,000 feet and above) is usually "cooler" than the light at or near sea level, and of course, cooler than the light for which Kodachrome is balanced. The atmosphere is freer of dust particles at high altitudes, and the sundown condition proves that the more dust the sun's rays must travel through the warmer the light. In the clearer atmosphere we also get more direct sky influence because there is less dust and haze to scatter and diffuse this "blue" sky light.

Without going on record against the use of a Haze filter in high altitudes, I do suggest that better results will usually be secured by using Eastman filters CC13 or CC14, or Harrison's C½ or C1.

3. *Reflected Light*

It may seem misleading to designate this as a "variation in light source." But we are considering results from the standpoint of *all* light that falls on our color composition or subject. In fact *every* subject is influenced to some extent by reflected light. The surfaces of your composition pick up light and cast a part of it on other surfaces, with some influence on what we term an object's "local" color. It also affects our value range. This problem of reflected light from surrounding surfaces is one of the very serious ones of the commercial color photographer in studio work as colored studio walls will "kick back" their own color into his whole color composition unless he can shield his lights to keep them off such walls or other surrounding surfaces. You have the same problem in color shooting indoors by artificial light, as will be discussed in a following chapter.

To get back to more everyday occurrences, you may have noticed that a red shirt or blouse will cast a reddish glow under a chin or on the neck. White costumed figures seated on grass or against full lighted green foliage will pick up greenish tints in the whites. Perhaps most noticeable is the effect of bluish light reflected from water onto the under surfaces of a white boat. In many instances reflected light is only incidental and hardly detectable, being objectionable or not, depending upon how and what it affects.

Permit me to use Bryce Canyon as an illustration again (Figure 28), as this subject offers splendid opportunity for the study of reflected light as a partial or complete light source. The walls of the formations are highly reflective. In the illustration herewith the left wall is in full, direct sunlight, the right wall is illuminated almost entirely by light reflected from the left wall (plus some "sky" light, of course). The difference in volume of light coming back to the camera lens from the two walls was not too great, as proved by the "compromise" exposure; an exposure in between what meter readings of the two surfaces indicated for either surface alone. Because light reflected from an irregular surface like the walls of these canyons is greatly diffused there is less contrast and less apparent definition or texture in the wall upon which the reflected light falls. If you will refer to the Color Plate of Bryce (page 18) you will observe that reflected light was the *principal light source*, for this was a back-lighted shot insofar as the sun's position is concerned.

You can often make good use of reflected light from surfaces in your composition. For instance, a side-lighted figure posed next to a white wall, using the reflected light from the wall to light up the shadow side of the figure. In the illustration of the boy and duck (Fig-

UTILIZING
REFLECTED LIGHT

28 *In the Bryce Canyon shot the highly reflective character of the rock walls adds brilliant color to otherwise "dead" back-lighted surfaces. Note that planes illuminated by reflected light are less contrasty than those in direct light. The shot of the boy and duck illustrates use of reflected light to illuminate a back-lighted figure. Light is reflected from the concrete road.* **29**

ure 29), reflected light from the concrete road and from the white clothing provided practically the sole source of illumination for the boy's face. The wide brimmed hat cut off almost all overhead light, although some light was transmitted through the straw. If this shot had been made on a grass lawn or on some other weak reflective surface the face would have been badly underexposed.

Your own experience will suggest no end of possibilities in the use of reflected light, but keep in mind the *color* of the surface from which the light is reflected.

While we are on the subject of reflected light, something might be said about the artificial creation of reflected light, through use of reflectors and synchronized flash in Kodachrome photography. Perhaps we have not sufficiently stressed the importance of avoiding strong contrasts in the black and white value range of close-up subjects. Extreme value contrasts are undesirable in any color process, whether the medium used is Kodachrome, Kodacolor, Dufaycolor, "one-shot" or single separation exposures.

To reduce contrasts, get light into the shadow areas. Neither flash nor reflector (nor light reflected from a nearby wall) will have any appreciable effect if they are too far from the subject. If subject is in full sunlight you will not likely overlight the shadow areas by being too close. (See chapter on Reflectors and Diffusers and the one on Photoflash).

4. Diffused Light

When the sun is obscured by a heavy overcast we say it is a "gray" day. In fact it is a "blue" day. This heavy overcast breaks up the light and the resulting light is greatly diffused *plus* being predominately blue in character. We do not need scientific proof to know that this type of light is "cold" in comparison with direct sunlight, and especially cold in comparison with early and late "warm" light.

Everything in a color shot, made under such light conditions, suffers from this out-of-balance light, most noticeably in the "light" colors. Wratten filters Nos. 1 and 2A can be used for partial correction, but do not expect the result to look like "sunshine." You will more than likely just get a cast of the filter spread over the entire Kodachrome. The basic reason no such filter correction will simulate sunshine conditions is that the values of any composition are pulled together under

30

This shot was made in a weak fog light and although the sunlight meter readings were almost as high as normal, the "soft" light shortened the tone scale, or value range. This type of light is excellent for close-up color shots.

overcast skies and no amount of color correction will give the result the feeling of snap and zip it would have under normal sunlight conditions.

On the other hand, very light overcast, especially if it is a high, thin fog, produces a type of diffused light ideal for outdoor figure studies, flower shots and most close-up subjects. You will find, to your surprise, that this light will give you meter readings almost as high as in direct, full sunlight. In this softly diffused light your black and white value contrasts are reduced, and there is less likelihood of burning out highlights or extremely light colors.

So that you may have a comparison between the color rendition and the black and white value range of the same subject photographed under this diffused light the same illustration is shown both in color (*as a color plate on page 53*) and in the black and white above (Figure 30). The black and white negative was made from a Kodachrome transparency in order to translate the color shot into black and white values, for comparison. In both the black and white and color reproductions there are sufficient highlights and shadows to give the feeling of sunshine, but the range of values is well within the limits of Kodachrome.

Because diffused light is so much more desirable for informal portrait studies and the like, I am prompted to suggest to the more serious worker in color that he create his own diffused sunlight conditions with a canopy or screen of fine mesh cheese cloth or better yet, the same material used by studio portrait photographers to soften their lights. Used in combination with reflectors you can create an easily controlled light of the finest quality for color. (See chapter on Reflectors and Diffusers.)

5. *Transmitted Light*

Remember the soft, glowing light in the deep woods in the Fall? Much of that effect is transmitted light—light filtering through the colorful foliage. The illustration of the girl in the Aspen grove shows practical use of this light (Figure 31). The tree trunks immediately back of the girl got practically all their light by transmission through the brilliantly-colored leaves overhead. Otherwise those trunks would have been badly underexposed in any color shot. The trunks

were suffieiently darker in value, eompared to the foreground, to give "depth," but not so dark as to *press the latitude* of the Kodaehrome film when the exposure was based on foreground readings.

It is unfortunate that we cannot illustrate here, for eomparison, full color reproduetions of Kodaehromes of this Aspen Fall color photographed in flat light and by transmitted light. Those shots made in flat light are very eolorful and seem to be satisfying until put alongside other shots made back-lighted, or more literally, by transmitted light. The flat lighting gives good eolor saturation but with a feeling of "flatness" as though the brilliantly-eolored leaves were made of colored paper. The eolor of the leaves by transmitted light is mueh more intense although more toward an orange-yellow than the more lemon-yellow east of the flat-lighted result. Also, in the transmitted light shots there is mueh more subtle color variation, and a feeling of translueence in the foliage. You will note the same effect in any foliage that is sufficiently transparent. See Color Plate on page 215.

If you like to experiment with the dramatic, use eolored parasols or those colorful, transparent rain eaps or eoats for transmitting color high-lights or color accents on faee or figure. Many such simple aecessories can be utilized for exciting adventures in color.

For those of you interested in flower photography may I offer the suggestion that instead of shooting flat-lighted (sun directly back of you), make your shots side-lighted or even more into the sun than at a right angle. If you expose eorreetly, you will get more brilliant eolor due to the light that is transmitted *through* the petals. A little study of your subject will indieate the correct angle for most brilliant eolor. Results will warrant some experimenting. (See chapter on "Flowers and Gardens" and the Color Plate of the Garden seene, page 179.)

Proof of the color brilliance whieh transmitted light adds ean be demonstrated with one of your own Kodaehrome transpareneies. View it first by transmitted light, then lay it on the whitest, most refleetive surfaee you ean find (like a white enamel table top), and under the strongest of lights. This illustrates, crudely perhaps, why you cannot expeet eolor

31 *Transmitted Light Opened These Shadows. The figure and foreground tree are in full, direct sunlight. The tree trunks in background got practically all their illumination by light transmitted through the brilliantly colored overhead foliage.*

prints made from Kodachrome transparencies to be as "brilliant" as the transparencies from which they are made. Not that the prints are less brilliant than prints can be made. It is merely that you get *all* eolor, in a print, by reflection—light going through the dye or pigment image on the paper support and then being refleeted back through the dye or pigment, to your eye. The paper support absorbs much of the incident light, still more of it is "trapped" by the eolor image, espeeially if the image is pigment.

6. *Another Unbalanced Light*

It may seem that we have about eovered the range of changed or unbalanced sunlight conditions but there is another general condition that seems to belong in this discussion.

This most annoying eondition is the "eolor" of the atmosphere when one is obliged to shoot distant landscape seenes at any angle *toward* the sun in any latitude in the United States, even when the sun is most direetly overhead. And by "toward the sun" I do not mean "at the sun," but at any angle into the South. The lower the sun in the sky, as in the Winter months, the more notieeable the

"off color" result. The condition is distinct from what we usually term that of a "backlighted" subject.

The scientist explains the color of "haze" by telling us that the size of the dust and moisture particles in the air determines the color of haze, fog, smoke and so on. If these suspended particles are relatively large, as the moisture particles in fog, all wave lengths of light are affected, some of the white light is transmitted, some scattered, giving the fog a white or milky cast. The point is that *all* wave lengths are affected. Blue haze is blue because the atmospheric particles are relatively smaller, passing the red, yellow and kindred wave lengths but obstructing and scattering the shorter blue wave lengths, creating a diffusion of blue light.

We all know that infrared pictures often show more distant detail than the eye can detect when on the scene. Infrared rays, being of longer wave length than the rays of the visible spectrum, pass through atmospheric particles that would obstruct and scatter light of shorter wave length.

But we cannot take "infrared" pictures in Kodachrome, and this problem of haze color is really a serious one in long distance shooting in color. We still find no answer to the difference in the *amount* or degree of this bluish haze cast between shots that are made into the North and ones into the South.

I can give no more authority for my conclusions as to what causes this difference than my own experience and deductions from several hundred color shots made under such conditions. The only explanation I can advance is that whenever we make a color shot toward the South (at any angle south of an east and west line drawn through the camera position), we are actually seeing the "backlighted" side of every dust and moisture particle in the air, and even though these particles are individually infinitesimal, in the aggregate they constitute a bluish film or screen through which both we and the camera view the scene. Of course we know that any haze pulls the distant values closer together, with loss of contrast in the scene, but the condition is also one of "color" as well as value.

I do want to caution you against expecting the same color brilliance or color saturation, when shooting "south," which you would get when your camera is pointed at some angle *north* of the east and west line mentioned.

Regardless of the general color of your landscape subject the Kodachrome result will be "cooler" than the eye sees it. The same sort of overall cast one would expect from the use of a very light bluish filter. This condition is cited also to give you a clue as to why some of your Kodachrome transparencies may seem unnecessarily "blue" in cast. Why not get out some of your shots that have distressed you because of their "blue" cast. View or project them and recall in each instance the direction your camera pointed, and the angle in relation to the sun, and the sun's height in the sky. You may find the answer to some of your difficulties. Other aspects of these atmospheric conditions will be discussed in the chapter on "Landscapes."

In color photography it is imperative that you learn to "see" and appraise the conditions under which you are working. In black and white photography we are concerned, primarily, with *volume* and *angle* of light. In color photography our results are dependent upon both these factors *plus* the *color quality* of the light with which we are working.

Variations in the Color Temperature of Sunlight

Light Condition	*Degrees Kelvin*
Mean noon sunlight at Washington, D. C.	*5,400
Direct sunlight about noon in midsummer may rise to	5,800
Sunlight plus light from clear sky about noon, as high as	6,500
Light from a totally overcast sky may be as high as	6,800
Light from a hazy or smoky sky may range from	7,500 to 8,400
Light from the clear blue sky	12,000 to 27,000
Sunlight, early or late, in winter may drop to below	5,000

(Data from A. H. Taylor, Trans. Ill. Eng. Soc., 1930, 25, 154-160)

* The color temperature, or color balance, to which Daylight Kodachrome is balanced. Remember that the higher the color temperature of the light the "bluer" or cooler its color; the lower the color temperature the warmer the light.
In high altitudes, under a cloudless sky, the color quality of sunlight is excessively cool, due to the clearer atmosphere and to sky reflection. See chapter on "Filters and Color Meters."

CHAPTER 6

OUTDOOR EXPOSURE CALCULATIONS

THIS book is going to violate all apparent tradition by not reproducing the exposure data furnished by the manufacturer. You get that with every roll or box of Kodachrome you buy.

Before we get into this subject of exposure calculations I should remind you that I am omitting tables for movie exposures because they would only duplicate some of the tabulations. Movie enthusiasts can refer to the "1/25" or "1/30" shutter speed figures (depending upon the shutter speed of their make of camera) given for 35mm and Bantam roll Kodachrome, as the speed ratings for these and movie Kodachrome are identical.

In this matter of exposure it is self-evident that even though our composition and color scheme be everything desired, exposure will make or break the final result. How best to arrive at exposure calculations is no rule-of-thumb procedure, as many of us have learned through sad experience.

Even though proper use of one's tools should become as automatic as possible, this matter of proper exposure can never be taken lightly. Perhaps I approach every color problem with too much timidity and humility, but even after thousands of thoughtfully calculated shots in color I still find it necessary to appraise every situation about as carefully as though it were the first color shot I had ever made. And I keep a written record of every shot I make. There are several reasons for doing this. First, it gives me a check on the consistency of my shutter equipment. Secondly, it provides a means for sharpening my perceptions through study of results, and third, it gives me a chance to study the difference in fidelity of the various colors captured, through comparison of "duplicate" shots at slight differences in exposure.

If you do not keep such records of your exposures I suggest that it may be the means of acquiring quickly and surely a sharper eye for subtle variations in results. And remember there is always *one best* exposure for every shot you make.

Kodachrome Exposure Tables

Without in the least disparaging the exposure data supplied with the film, I venture the assertion that many of you have found no explanation in those tables by which you could trace obvious faults in exposure. Not that the tables are not accurate, as far as they go and if properly interpreted, but no "basic" table can cover every situation nor the endless subtleties that affect results. One would hardly expect the manufacturer to include a course in color photography with his product.

Our difficulty lies in the impossibility of adapting *any* set of brief rules to such a variety of conditions. For instance, the tables give exposure data for "average" subjects, and for others different than average. But just *how much* alteration in color balance and value range is necessary to make a subject qualify as a "light" or "dark" subject? Just *where* is the dividing line?

Still further, do *all* side-lighted subjects call for the same exposure compensation? And what about the endless variety of back-lighted subjects—are they all to be treated alike just because they are back-lighted?

If we follow any rules *blindly* we may soon find ourselves entangled in apparent contradictions from which only a mental Houdini could extricate himself.

As an example, one is supposed to use ½ smaller stop than "average" for light-colored subjects. And to open up ½ stop for side-

(Continued on page 73)

IN THE COLORADO ROCKIES

The two reproductions on the facing page are extremes in two respects—in light conditions, and in color mood. The shot of the lake and mountains is a "cool" color subject under any light condition, but especially so under the "sky-light" condition present when the shot was made. The sun had just disappeared behind the distant mountains, and the immediate foreground and the lake were illuminated only by light from the sky. This condition contradicted, in color effect, what one usually encounters in late evening light.

The contrast in this scene is not as extreme as might be suspected. Late afternoon light is weak, and the clear overhead sky reflected a very considerable volume of light. Hence less value contrast between the sun-lighted distant mountains and the sky-lighted foreground.

DATA: Exposed on 4x5 cut film Kodachrome; Camera, Speed Graphic; Lens, 6½ inch Zeiss Tessar. The reproduction is four color process, letterpress, plates made direct from the transparency.

THE PAINTED DESERT

Like many other landscapes that are principally composed of expansive colorful areas, the Painted Desert is splendidly colorful under ideal conditions, and disappointingly drab under conditions that "subtract" from the intensity of the local color.

The shot here reproduced was made on one of those favorable days when the earth was damp from a recent rain, and the atmosphere was exceptionally clear. When this earth is dry it reflects much less color, and on dry, hot days the distance is diffused by heat waves. This variation in color saturation of water absorbent surfaces is a characteristic of sandstone cliff or canyon walls, and such materials and surfaces. They are always most colorful when wet or damp.

The two scenes illustrated here are rather extreme examples of "warm" and "cool" landscape compositions. Practically all landscapes fall into one or the other classification, and such color moods can often be slightly accentuated through the use of color filters, as described in the Chapter on Color Correction Filters.

DATA: Exposed on 4x5 cut film Kodachrome; Camera, Speed Graphic; Lens, 5¼ inch Zeiss Tessar; Filter, Harrison Coralite C½. The reproduction is four color process, letterpress, plates made direct from the transparency.

lighted compositions. What does one do if the subject is both *light-colored* AND *side-lighted?* And do we make no allowance on back-lighted scenes for whether the surfaces are light or dark in color? And doesn't the angle of back-lighting (height of sun above the horizon) enter into the calculations? Shouldn't consideration be given to whether shadows are "dead" or "luminous?"

There is only one answer—*there is no substitute for thinking.* And no set of rules can be more than a springboard for analysis and deduction no matter how well intentioned nor from what authority they derive. You may understand, and correctly so, that I make no claims to having any set exposure "formula," and certainly I have no intention of misleading you with any idea that I have concocted an exposure "table" that supersedes any now extant.

All of which is a prelude to what I hope to convey about exposure calculations. May I repeat that the degree of your progress and success in color photography will be in direct ratio to your ability to see and interpret conditions that create all results—good or bad.

The film is a rigid, inert material, as incapable in itself of producing a picture as the canvas on the artist's easel. *You paint a picture on the film with light—colored light*—light reflected back from colored surfaces, if you please. Sounds a little forbidding, doesn't it? But you need neither the artist's ability in draftsmanship, nor his knowledge of "mixing" colors, nor his painting technique. Insofar as recording what the camera lens sees all you need know is the quality and intensity range of the light being reflected from the various elements in your composition, set a diaphragm and shutter speed, press a button, and the film does for you what has taken the painter years to acquire.

And may I say again, and parenthetically, that the next great advance in color photography should be in the direction of more "art" in color composition and lighting. Up to now workers in color have won their spurs almost entirely on mechanical execution and technical excellence. It is time these limited horizons were expanded.

To get back to the subject of this chapter, let us give some thought to this controversial subject of light meters—to use or not to use.

Is a Light Meter "Master" or "Servant"?

I must refer again to my own experience. I believe I am a fair judge of light conditions and their effect on exposure. But I never travel with less than two meters—one for a spare in case of accident, and to have one to check against the other when in doubt. However, it is not the fact that you have a meter that counts—it is how you use it.

A meter cannot think. And too many meter "addicts" do not. The average meter user makes a sweeping panoramic reading of the scene before him, with little attention to the angle the instrument is held (except to be sure he does not have it "hind-end-to"), and through some mental process I have never been able to fathom, tells himself that the meter "reads" 250 or 400 or 1,000—and makes his exposure accordingly.

If his "guess" is approximately correct, he is delighted with the resulting color shot. If he guessed wrong—well, the film must be defective, or the processing was bad—the fault could not have been *his* because he used a meter to determine exposure.

Which suggests that perhaps there is a right and wrong way to make meter readings. Each manufacturer furnishes complete data with his meter but most of us never wade through such detailed instructions. At least not until we have had a sufficient number of failures to suggest that it might be wise to learn how to use the instrument.

A few general suggestions may be in order. The best photo-electric meters are constructed so that the "viewing" angle of the cell is about the same angle as that of the more common focal length lenses. If the meter's angle is too great its cell is affected by areas surrounding that included in your picture. The most serious disadvantage of such wide angle meters is that they include too much sky reading in general landscape scenes, giving you an excessively high reading that bears no direct relationship to the average reading of light reflected from just that portion of the subject framed in or by your camera.

It is important to know the relationship of the angle of your meter and the lens you are using. This is so important that meters are made for exclusive use with movie cameras because most movie lenses have a much nar-

rower angle of view than do most of those used on still cameras. If you should use a movie meter with a still camera remember that your meter is not recording, in any one position, the full area to be covered in your still picture.

What *is* the proper way to go about making meter readings that will give you a real basis for exposure of the subject at hand? These suggestions will help.

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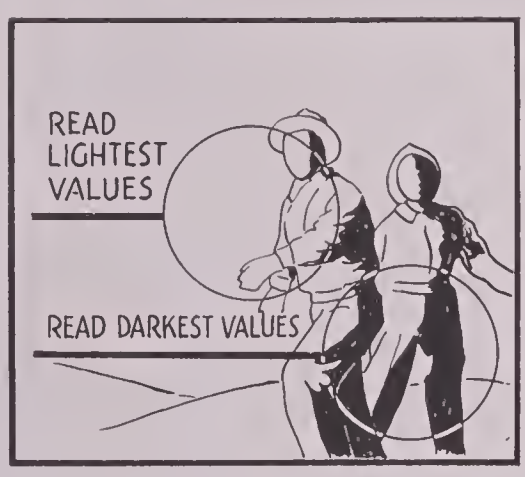
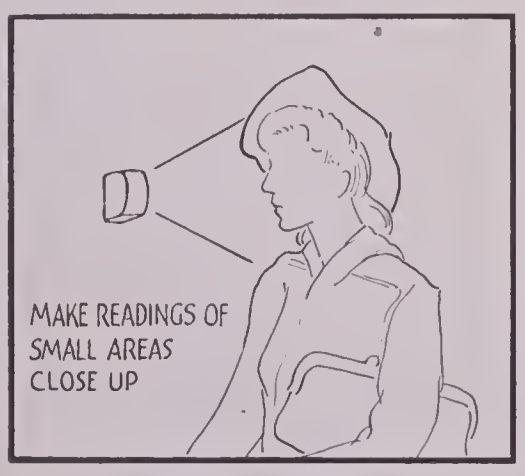
1. Be sure you have the meter pointed at the area the camera is covering. (Figure 32.)



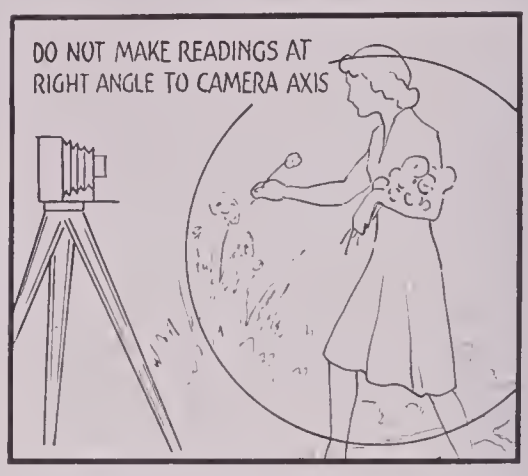
33

2. When possible make a "local" reading of each area in your composition, checking particularly the lightest and darkest values. (Figure 33.)



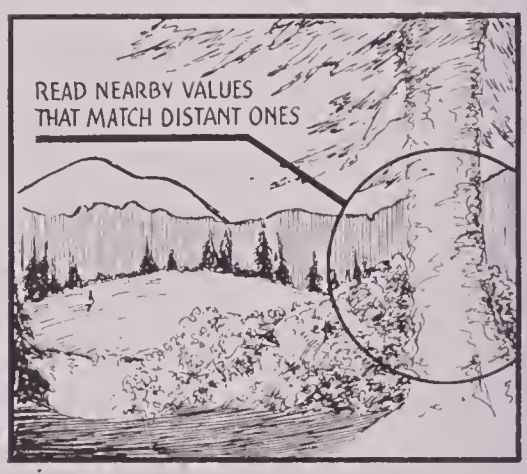
34

3. When you can get close enough to the areas in your composition, the best reading distance is one about equal to the average dimension of the area or object. That means about ten inches for readings on a face, for instance, and farther back in relation to the size of the larger areas or objects. (Figure 34.)



35

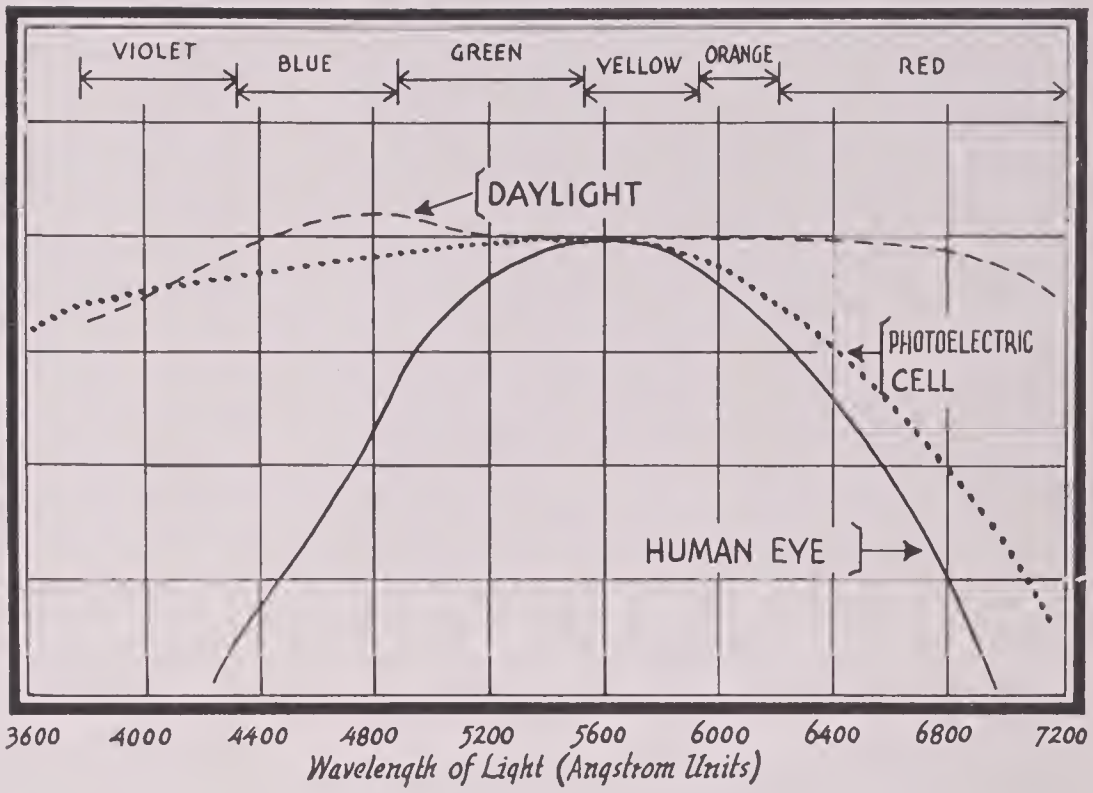
4. Do not make readings of surfaces turned away from the camera, and when you make readings of surfaces turned obliquely to the camera, measure them at the same angle the lens sees them and not at right angles to the camera axis. (Figure 35.)



36

5. When you cannot make "local" readings, as in distant scenes, take readings of nearby objects of same color and general value as the predominating colors and values in your scene. But more of that later. (Figure 36.)

Every composition has "light" areas, "dark" areas, and all the in-betweens. In our color swatch test (Chapter 4) we found as much as three times range in volume of light reflected by the red and yellow cardboards, and eight times range in the comparison between the red velvet and the yellow cardboard, and all these surfaces were in the same plane to the light source.



37

Graph showing the relative sensitivity of the human eye and a photoelectric cell to the energy in daylight. Note that the cell more closely parallels the daylight curve than does the eye.

Do Meters "Read" Colors Accurately?

We hear much discussion and a variety of opinion as to the responsiveness of photoelectric meters to the different spectral colors. Some say that such meters are several times as sensitive to green as to blue and red. Others insist that meter response varies so much from one color to another that their use is unpredictable if not positively misleading, when used for determining exposures for any kind of color photography.

I cannot agree with such extreme indictments. It is true that the curve of sensitivity of the photoelectric cell does not coincide exactly with the curve for daylight, but it follows it much more closely than does the human eye.

Pérhaps this confusion about meter response to colors is due to the fact that photoelectric cells are sensitive to certain wavelengths beyond the visible spectrum, especially the ultraviolet. It must be remembered that photoelectric meters were designed originally for black and white work, and many emulsions are sensitive to these "outside the visible spectrum" radiations.

If you will study the graph (Figure 37) you will observe that the human eye is rather deficient in response to both ends of the spectrum, and that the GE Meter cell sensitivity (upon which this graph is based) parallels the energy in daylight much more closely than does the eye.

If my own experience has been analyzed properly I find no fault with the accuracy of response of a good photoelectric meter in any color problem I have encountered.

Careful checking with numberless experiments on exposures of extremely light value subjects in brilliant light and the other extreme of subjects in very weak light indicates that one should discount both excessively high and low meter readings. Another way of saying it is that Kodachrome does not seem to be as "fast" as the meter in these excessively *high* readings and on the other hand Kodachrome seems to be "faster" than the meter on extremely *low* readings. Color does not enter into the calculation so much, as we do not get extremely high readings except from an intense, high-value color, and there is little intense color in unusually weak light.

By excessively high readings I mean above 1000 on a Weston Master or above 500 on a GE meter. One experience with such high meter readings occurred when I was doing some color shooting in the White Sands National Monument of New Mexico some time ago. The needle of my Weston Master whizzed past the 1600 mark as though it were going around a second time. A reading of the North sky recorded only 1000. The only areas comprising my composition were the wide ex-

panse of white sand, a distant range of mountains and a few scattered clouds over the mountains. *The picture* was the Sands, and one normally would disregard the sky and distant mountains in arriving at a proper exposure calculation. Since my experience had proved that this meter reading of 1600 (plus) should be discounted greatly, the only point was *how much*. Exposures were made based on Weston 800 instead of the 1600. The result turned out slightly on the overexposed side, but only about ⅓ stop overexposed. As a test shot I made one exposure based on Weston 1600, with an off-color result. The white sand was underexposed and in consequence showed a definite bluish cast—a registration of sky reflection.

One theory about why Kodachrome seems to be "slower" than the meter in cases of extremely high readings is that there is a certain inertia in film response. We might describe this condition as a "crust" through which light must break before it can actually and effectively record the image on the emulsion, or more properly, before it can affect the sensitivity of the film. If this theory is correct it is evident that an excessively short exposure (such as one based on a reading of 1600) does not allow sufficient light to reach the film to both break this "crust" and sufficiently expose the film.

I have found no authority for my deduction other than my own experience, but we do know that many old time black and white photographers "flashed" slow films before using them. The most common practice was to give the films an excessively short exposure with camera pointed at the open sky, or toward a white card. The theoretical purpose, at least, was to break the film's "crust" or "threshold inertia."

Why not do a little experimenting with this idea in Kodachrome? If you want to try it, use a white card, give a "flash" exposure of 1/200 at f/22 or a still faster speed at f/16. Then try duplicate shots of some colorful, closeup subject, one exposure on a "flashed" film and another on one that hasn't been flashed. Do not make any exposure compensation for the flashed film. The result will prove interesting, I assure you.

Now about discounting excessively low meter readings. Again falling back on my own experience I have found that Kodachrome is "faster" than the average meter in weak light, especially in readings at or below Weston 10 or GE 6. You should understand that I am not contending that the film is "slow" or "fast" under these extreme conditions. We are only trying to establish a relationship between the behavior of the film and meters under these conditions.

If one can say that any rule can be established, I suggest that

—when general overall readings for the main area of your picture (as in the case of the White Sands) is 800 Weston or GE 500, base your exposure on Weston 500 or GE 300; if the reading is 1000 Weston or GE 600, base exposure on Weston 650 or GE 350; if reading is above this and any place on up to the limit of the meter's scale, base exposure on Weston 800 or GE 450,

—and when meter reading is Weston 10 or GE 6 *or below*, close diaphragm ⅓ to ½ stop below what the meter reading indicates should be the exposure.

Permit me to qualify these statements with the admission that these deductions have been arrived at through my own tests, with my own shutter and meter equipment. The result of my experience is passed on to you merely to suggest an approach to this problem of recording in Kodachrome, colors and values at the two extremes of intense light and weak light.

Effect of Exposure on Color

You are familiar with the usual theory that *underexposure* of Kodachrome gives the result a bluish cast and that *overexposure* tends to wash out the blues and emphasize the reds.

The problem is not quite as simple as that, for if it were one could deliberately accentuate either the warm or cool visual appearance of the Kodachrome result, under any and all conditions, by the mere manipulation of over- and underexposure.

For a more thorough understanding of this blue and red influence we must recall the exposure test of the five principal colors of same material and texture, and remember that a correct exposure for Red overexposed the Blue slightly and greatly overexposed the Yellow. Keep that relationship in mind. If

we expose these color swatches one full diaphragm stop more open than the former correct exposure for the Red, we have overexposed the Blue about 1½ stops. But Red, being a naturally more intense color, still looks brilliant and intense, but Blue, being a less intense color to begin with loses its intensity rapidly as we "dilute" it by overexposure. The final result, in the overexposed Kodachrome, is an appearance of excess Red and a deficiency of Blue. We have not actually increased the intensity of the Red through overexposure, we have changed the "color balance" between the Red and Blue, and the Red predominates.

The reverse is true when Kodachrome is underexposed. Red loses its intensity quite rapidly as we lower its value (which we do in underexposure), but the intensity of the Blue is greatest at a lower value than where Red acquires its extreme intensity.

In underexposing a Kodachrome we increase the intensity of the Blue (up to the point where it loses intensity because of lowering its value too much), and we "degrade" the Red to the point where it appears to be a more purple-red, which, optically combines with the Blues to accentuate what we call an overall Blue cast.

The color character of the subject has much to do with these apparent off-color results due to over- and underexposure. My suggestion is that you use filters to *add* a feeling of warmth or coolness, if such effect is desired, rather than attempt any such alteration of color-balance through deliberate exposure manipulation.

It must be remembered that when you overexpose you are "diluting" the colors with excess light—you are raising their value beyond the "normal" value at which your eye sees them. We know from our previous discussion of value changes that the intensity of a color is weakened through addition of "excess" light.

When you underexpose Kodachrome you are lowering the value of all colors and degrading their purity and intensity through the subtraction of light—the same visual effect as adding black to a color pigment.

The term "saturation" is a good one to keep in mind when considering what exposure does to a color. A properly exposed Kodachrome

38 *Study the Color Plate of this subject on page 107, to observe the effect of reflected color casts on whites.*

will give maximum color saturation to those colors exposed "on the nose," so to speak. If the blues and greens in a composition in which you also have an area of high value yellow, have maximum saturation, the yellow will be somewhat washed out, as you know. You also know that if you correct the exposure to give the yellow maximum saturation, the blues and greens in the composition will appear darker and less intense than they appear in the subject. They are degraded through absence of sufficient light. Not a deficiency of light on those colors in the subject, but the shorter exposure has created a deficiency in the amount of reflected light necessary to record those colors on the film in full saturation.

Exposure of Light and Neutral Colors

In connection with this discussion of the effect of exposure on color results you should be reminded that faithful reproduction of whites, very light and neutral colors is a prob-

lem that causes no end of color workers much unnecessary distress. While it is true that such colors require more accurate exposure for faithful reproduction, that fact does not bother as frequently as a lack of understanding of what is "faithful" reproduction.

As a premise let us use a rather elementary illustration. You can put a drop of white paint into a quantity of bright red paint, stir it a bit and you would never know any white had been added. You have not changed the intensity nor value of the red any detectable amount. But add a drop of bright red paint to a quantity of white, stir it as long as you like and you cannot submerge the trace of red. You no longer have a white but a high value pink color.

The same is true with very light or neutral colors reproduced in Kodachrome, and it is no fault of the Kodachrome because it sees and records color casts you never saw in the subject being photographed. In fact it is surprising that the film can record these extreme subtleties.

But to get back to the difficulty of recording such colors. The real difficulty is in your mind and not with Kodachrome. Your brain tells you a white dress is *white*, but unless that white dress is shielded from all influence of light reflected from surrounding color influences, like grass lawn, shrubbery, colored walls and even the sky, that white dress is affected by *all* these surrounding color influences. All light and neutral colors are extremely susceptible to these influences in much the same way the white paint is affected by the drop of red. (Figure 38.)

It seems strange that we should rebel at these color casts in white or light colored objects in Kodachrome results, for unless there is an excess amount of unwanted color reflected into the white, it is these pickups of the influence of the white's surroundings that give it quality and charm. And how else could you secure any modeling or tone variation in the various planes of the white dress? The only other way, obviously, would be through use of tones of gray, and any such "gray" modeling would lack the color and crispness the incidental and accidental color casts give the white.

If an artist were making a painting of a white porcelain object, do you suppose he would paint in white and grays? He most certainly would not, and what is more he would likely use no pure white at all unless in a highlight, and perhaps not then. His pallette for the painting would be a kaleidoscopic array of perhaps a dozen colors, all in very high value. Through this range he would give not only form and character to his painting of the white porcelain, but he would relate it to its surroundings through this use of colors found in surrounding objects.

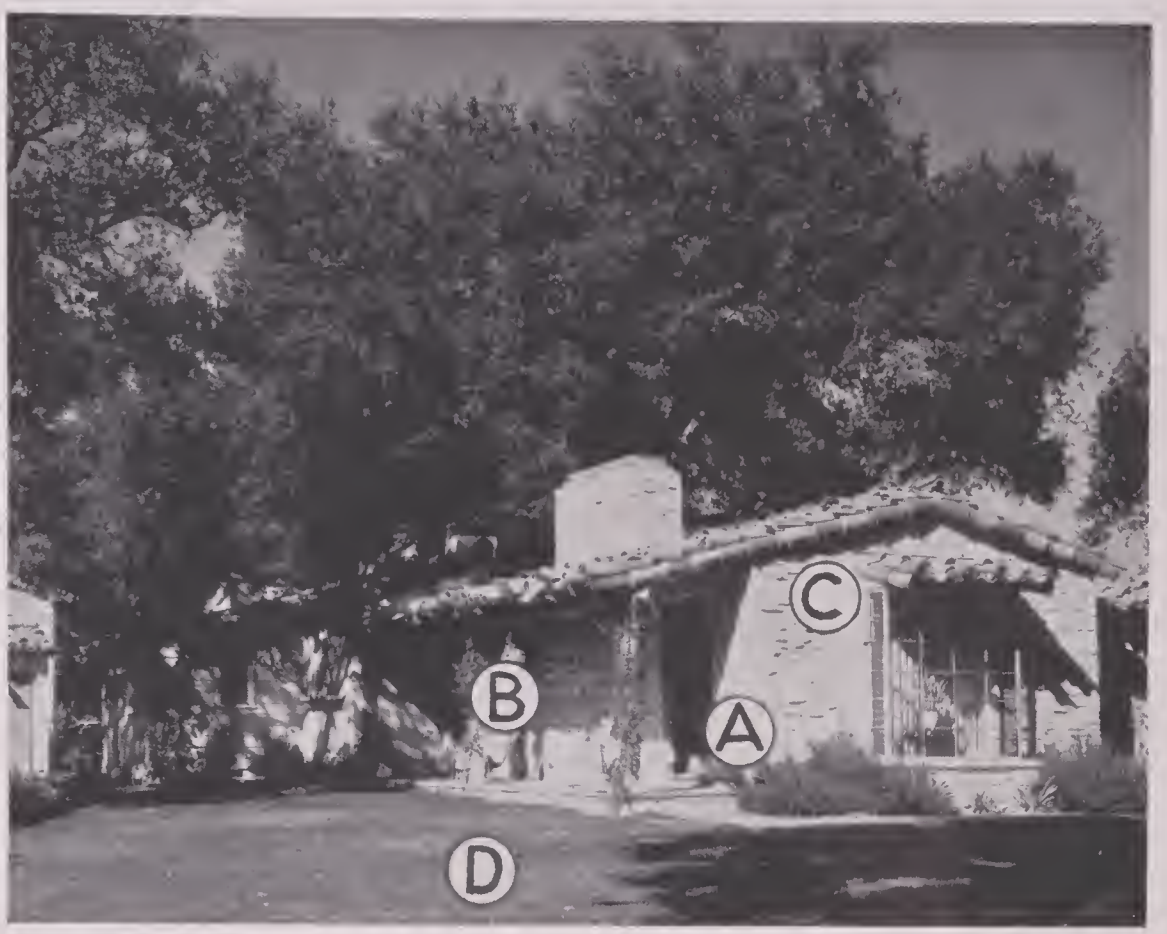
So do not be alarmed nor distressed because your Kodachrome result shows casts of other colors in the whites and high value neutral colors of your subject. Your concern can safely be limited to the prevention of strong color casts, such as greens reflected onto flesh tones, and excessively strong color casts, of a complementary color, on any color portion of your subject.

I have gone into some detail on this aspect of Kodachrome photography only because I have heard so many color enthusiasts attribute these effects to incorrect exposure. If I have made my explanation clear, you will understand that exposure has no more to do with these reflected color casts than it does in altering color balance in any composition of more intense colors. The principal thing to remember is that you do not notice these casts in a strong color composition—it is rather like the drop of white in the red paint. Instead of being alarmed at the problem of handling whites and light colors, learn to utilize these reflected color casts to enhance the beauty and color quality of your Kodachrome shots.

We have strayed a bit from our discussion of photoelectric meters but I am hopeful that the detour was both interesting and helpful. After all, everyone of these factors has a bearing on our Kodachrome results, and we will get better results when we understand what influences affect results and also when we learn what results to expect from certain conditions.

The Meter in Use

Let's put the meter to work—make a reading on an actual scene, arrive at a "compromise" exposure, and check results. (As a Weston meter was used on this shot all data applies to that meter. Any good meter would have recorded the same relative light values.)



39

Determining a "Compromise Exposure"

Meter readings on the principal elements in the composition were (A) 800, (B) 65, (C) 500 and (D) 160. Exposure was made on a basis of 200, with excellent results.

Using the meter on this house shot (Figure 39) was comparatively simple inasmuch as it was possible to make accurate readings of each area, and each area was large enough to give a purely local reading uninfluenced by any surrounding area which might be reflecting more or less light.

The readings ranged from 800 on the "hot" corner (A) of the house down to 65 in the deepest shadow area (B) under the porch roof. The end of the house nearest the camera read 500 on the white brick (C); foreground grass (D) read 160. Remember, all readings were taken close-up to "localize" them—the only accurate procedure.

Now to determine our "compromise" upon which to base our exposure. The house is the primary element in the composition (very much so, since this was an assignment for a magazine cover), so we use that as our "base" for computing our compromise. The house readings run from 65 to 800, a four full stop range—a spread beyond the capacity of Kodachrome to hold faithfully in both extremes in one and the same exposure. But we can risk "burning out" the hot corner (800 reading) because that area is relatively small. If our exposure is too short we risk "blocking up" the shadow area under the porch, and that is one of the spots that give atmosphere to the setting. We are helped, however, by the fact that this shadow area is luminous and it falls on a light-colored surface.

Because the shadow area is larger and will have a more critical effect on the general result *and* because we want to record the trees and grass as faithfully as possible, we decided upon a "compromise" exposure toward the lower readings. *The exposure was based on Weston 200*—about 1½ stops above our lowest reading and 2 full stops below our highest.

Exposure Result: The hot corner held detail; the 500 area shows good detail, helped by the strong surface texture; there is no appreciable loss of detail in the shadow area, and above all, it is not blocked up.

Color Result: Roof tiles lost a little color saturation, being in a flat plane to the sun; the trees and grass are excellent; and of course, the white brick are white, with no false color casts. It should be stated that *if* the house had been a very light or pastel color our exposure (based on a reading of 200, and if the light-colored surfaces had measured 500), would have resulted in apparent slight overexposure for such surfaces, with some

loss of color intensity. Since white is white it is difficult to burn out the color, so to speak. Overexposure would not wash out the white appreciably, it would merely destroy detail in texture. Keep in mind this difference between white and extremely light colors.

In checking the exposure tables furnished with the film, we find our shot was made in line with suggestions for "average" subjects. The tables say (for full, flat light) such exposure should be at 1/50 between stops f/5.6 and f/8 if we are using 35 mm. or Bantam Kodachrome roll film, or at f/8 if Movie at 1/30 of a second, or at f/9 at 1/25 if cut film Kodachrome was used. This is based on film ratings of Weston 8 or GE 12 for the 35 mm., Bantam and Movie film, and Weston 10 and GE 16 if cut film. The actual exposure was made on 4x5 cut film Kodachrome, with a Speed Graphic, 5¼ inch f/4.5 Zeiss Tessar lens with shutter speed of 1/5 second at stop f/22.

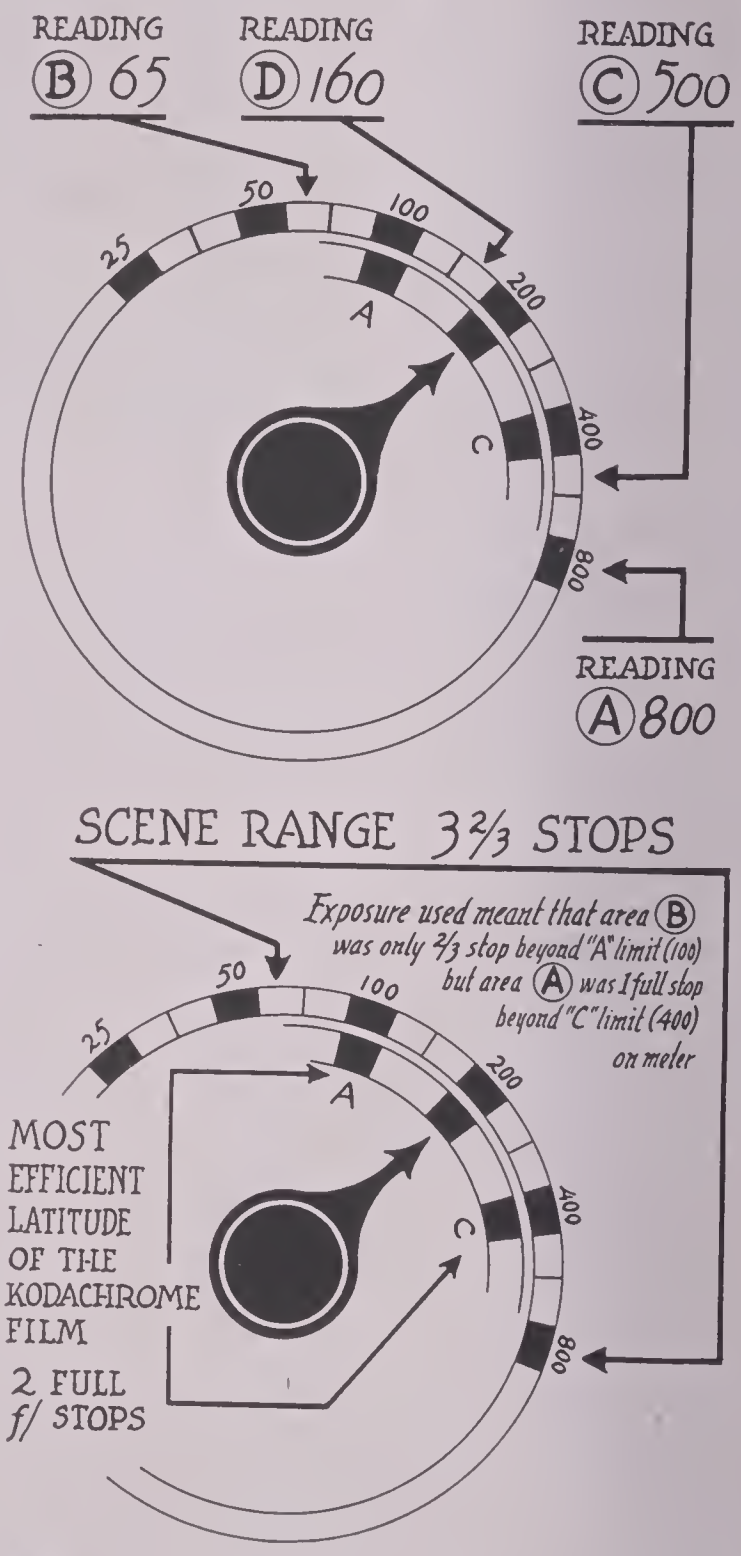
Then why bother with a meter? In this instance the meter assisted in analyzing the subject accurately, especially in helping to determine how far we could stop down before blocking up shadow areas. If we had followed exposure tables blindly and literally, one could easily assume that this subject should be considered as a "light-colored" one, since our interest is centered on the white house. Classified as a "light-colored" subject we would have used ½ to 1 stop less exposure, and such exposure would have tended to block up the shadows: the trees and grass would have appeared too dark, and we would not have effectively improved the fully lighted planes of the house. The result would have been contrasty in effect and the whole scene would have lost its sunshine feel.

Perhaps it will clarify the processes by which we arrived at this compromise exposure if the dial of the meter is diagramed and we can see at a glance what the various readings were, and in relationship to the latitude of the film. (Figure 40.)

In a general scene, and unless it is necessary to preserve full color saturation in the lightest areas, it is wise to favor the darker portions of the composition in arriving at a compromise exposure.

While it is safe to assume that you are not especially interested in making color shots of houses, the problem we have just analyzed is especially good. Its simplicity makes for a quick grasp of value ranges, an easy and accurate meter reading on each area. Also this subject contains several different textures—some highly reflective, others rather absorbent.

The same procedure for analyzing any outdoor scene can be followed with equal success. And you will have to take my word for it that this was a successful result.



40 *The above graphs diagram the meter readings secured and the exposure calculations arrived at in making the color shot illustrated by Figure 39, on the preceding page.*

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Underexposure is a common error on brilliant subjects similar to this one, for meter readings are too much influenced by the excessive reflection from the snow. An exposure based on snow readings alone would badly underexpose all other elements in the scene. Better to sacrifice the texture in the snow and properly expose the balance of the composition, unless the snow forms are side-or backlighted.

But all scenes will not be so easy to analyze. You cannot always get such accurate meter readings. And may I add that best results will not always be secured by merely taking a reading of the lightest area, another of the darkest area and then compromise on an exposure half way between the two extremes. To elaborate on the seemingly obvious, it all depends on what areas of the composition are most important, from the standpoint of color as well as pictorially. We will assume a composition that is made up mostly of dark colors or colors of dark value, to state it more precisely, but in the composition we have one area that gives a very high meter reading. If we base our exposure on a halfway between reading we will preserve the color, texture and detail of the light area better than if we compromised on an exposure that would favor the darker areas, but in preserving that light area we would badly underexpose the theme or main subject of our picture. Certainly the final result would be disappointing, for those portions that "made" the picture would not be faithfully reproduced and we would likely get but small satisfaction out of having preserved, rather faithfully, a mere incidental in our composition. I mention this only to emphasize again that it is never safe to follow hard and fast rules like the often recommended one of compromise exposures half way between lightest and darkest areas (highest and lowest meter readings). It all depends upon what makes the picture.

An example of this problem of deciding what to favor in making calculations for compromise exposures is any typical snow scene. (Figure 41.) The one shown above is typical enough to be used as an illustration, although in most snow scenes the snow itself will occupy a larger proportion of the total area of the picture. But that will have no bearing on our analysis unless you are after snow texture or special effects, in which case you would be obliged to disregard everything else in the composition, in making exposure calculations.

In making meter readings on the scene illustrated herewith the intention was to disregard any readings of the snow as the snow was so flat-lighted that it would have been impossible to hold any appreciable texture in the snow at any exposure. When we say we will disregard the snow reading we must be sure that we are not getting some influence in the meter readings of other portions of the composition. For instance, if in making the reading on the

trunk of the foreground tree, the reading were made from a distance of ten feet, the angle of the meter cell would include light reflected from the snow on both sides of the tree and the resultant reading would not be a meter reading of the tree at all, but of a snow area, the volume of which might and probably would be reduced somewhat because the tree cut across the light from the snow. Going back to one of the suggestions about procedure in making meter readings you will recall that readings should be made from a distance equal to the average dimension of the object being read. In this instance we should say "equal to the smallest dimension," which, of course, is the diameter of the tree.

The tree shadow on the snow, being a very definite part of the final effect of our picture, was considered equally important, from an exposure standpoint, as the figure and tree trunk. By "important" we mean the necessity for holding the "color" of the shadow, for its color is what added charm to the Kodachrome result. Mentally translate this black and white reproduction into terms of color and you will instantly realize that a shadow such as this, cast on snow under an open sky, is not just a lifeless gray shadow, but a beautiful clear blue as fresh and sparkling as the sky at high altitudes on a bright, sunshiny day.

The greens of the distant trees gave a meter reading within a half stop of that for the foreground tree trunk. The general reading of the figure was only about a half stop above that of the tree. The tree shadow reading was within ⅓ stop of the red jacket on the figure.

A combination of all these factors suggested that the compromise exposure should really not be a mathematical half-way point between the lightest and darkest objects (disregarding the snow) but that since the tree trunk color was such a pleasing color contrast to the white snow, blue snow shadow, distant green and the small portion of blue sky, the best color result would be had through an absolutely faithful color reproduction of the tree color. Since all areas except the snow were well within the limits of the latitude of the film the exposure was made for the tree trunk reading as though it were the only area in the composition. The resulting Kodachrome was brilliant and extremely faithful in color.

Before you suspect that I am suggesting that you "anchor" your exposure calculations to meter readings from tree trunks let me hasten to add that this tree was colorful—a rich, saddle-leather reddish-brown—a color of more intensity and richness than the green foliage by far. And that fact was reason enough for using the tree as the basis for our exposure, when the other factors mentioned were given consideration in relation to their degree of importance in our final result.

The two examples of suggested procedure in "Outdoor Exposure Calculations" by no means cover all the angles of the subject, but it is to be hoped that the discussion establishes a basis for your own thinking, and points to some of the "do's" and "don'ts" in this matter of analyzing any general scene that comprises a wide range of colors and values.

Up to now we have been concerned only with those situations where one can make careful, accurate meter readings of local areas. The more difficult aspect of outdoor exposure is presented by those compositions on which one cannot make local meter readings. Let's see if we can devise some formula for such problems that will be helpful.

Determining Exposure for Distant Scenes

For instance, what about a color shot in the mountains, or some other expansive composition where these "local" readings cannot be made? Published suggestions for "substitute" readings run the gamut of credulity—from reading the light reflected from the palm of one's hand (dirty or not, I do not know), to ones that are about as involved as taking a reading of the sky to which you add your age, subtract the day of the month, and divide by the change your wife overlooked in your trouser's pocket.

It might be well to remember that it is not the amount of light falling upon an object that determines exposure—it is the amount of light reflected back to the camera lens that affects the film. We know that so well it seems needless to mention it. Any device for measuring the volume of incident light is only a beginning, and often a misleading one at that.

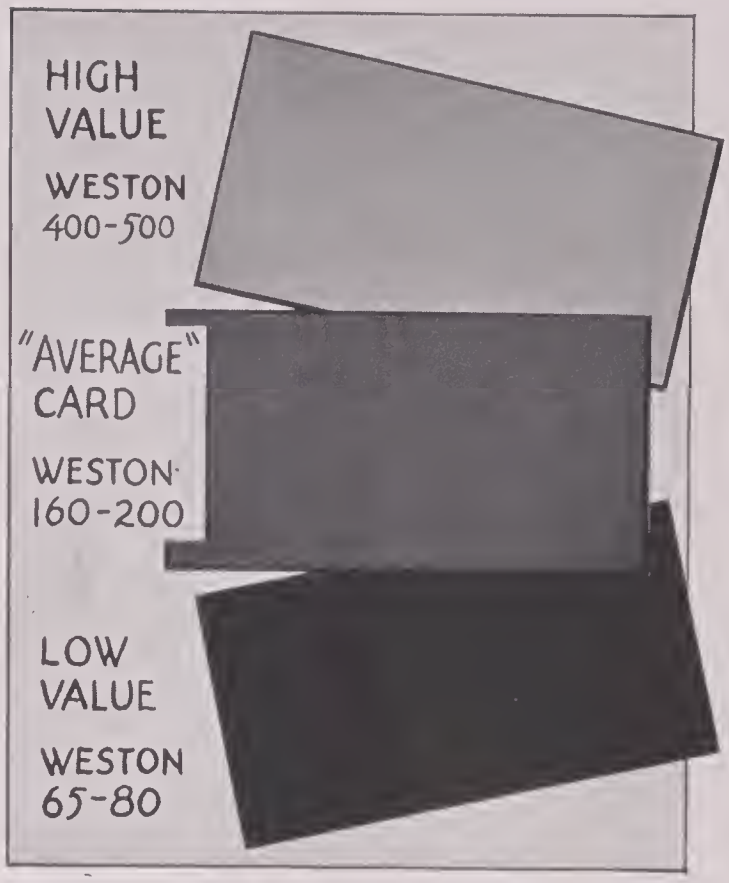
In most scenic shots there is a rather wide range of tone values. An exception is the Bryce Canyon illustration shown in Chapter 4. It is a type of subject that has an easily

recognized general tone, and the majority of the composition is made up of relatively close tone values. In other words it has little contrast, and in the value range is generally "high-keyed." Similar characteristics are found in desert and water scenes. In cases of such overall general tone, one has only to decide whether the scene is light, dark or average.

Even though most average scenes include a conglomerate distribution of light and dark areas, we *must* arrive at some exposure compromise. We cannot expose correctly for *everything* in the composition. But every scene has some "general" tone value—it is darker or lighter than the general tone value of an "average" one. Ordinarily I tab a scene as being ½ or 1 full stop darker than average or ¾ or 1½ stop lighter. When in doubt as to the accuracy of my estimate I use an adaptation of a gray scale, which, while helpful, must be employed with considerable judgment.

Instead of a single scale (like a photographic step wedge or gray scale) I use six 18″ by 18″ gray cards, each a different tone of gray, and of rough texture so they will not reflect a glare. (Figure 42.) Card marked "average" reflects a reading of Weston 160-200 in full, direct sunlight (proved by repeated tests). The next darker card reads 100-130, and the darkest 65-80. Of the three cards lighter in value than the "average" one, the first reads 250-320, the second 400-500, and the third 650-800. I use these as an artist sometimes uses paint on his palette knife to match the tone values of his mixed color to the distant area he is painting at the moment. He holds the knife at arm's length, squints his eyes until colors disappear and he sees both the paint and the distant object in tones of gray. I match the gray cards to the scene to determine what is the general black and white value being reflected by the scene as a whole. A little practice with such paraphernalia will prove it quite helpful—if you are sufficiently interested to assemble and calibrate the cards, through repeated test meter readings.

If there is reason to question the volume of incident light (as under light overcast) I make meter readings of the cards, held flat toward the source of light. If the "average" card, for instance, reads 100 instead of 160-200 (as it should in full, direct sunlight) I make mental note that the intensity of the light is about ⅔ stop less than "normal," and I base calculations accordingly.



42 *Refer to the adjoining text for suggestion as to use of neural gray cards to help determine exposure on distant scenes which cannot be accurately read with a meter.*

This card method may seem to be an unnecessary nuisance, but if you have difficulty in appraising the general value of outdoor scenes, to determine whether they are light, dark or average, use of the cards for a while will sharpen your perceptions rapidly. Once you have developed your eye for such analyses you won't forget what you have learned. And remember that this matter of general tone value has nothing whatever to do with the *color* of the scene. For instance, a distant mountain might be covered with dark green pine trees; that is they would appear dark green if you were close to them. But at two, three or five miles they probably will appear a light grayish blue, especially if they are flat lighted. If that mountain happens to be an important element in your picture, you must take its *value* into consideration when you are arriving at a compromise exposure that will also do justice to the foreground or objects nearer you than that mountain.

To elaborate on this point a little, let us set up a hypothetical case where all meter

readings of the immediate foreground are below Weston 160. We have no way of measuring the distant mountain. Any such distant reading, if it could be called such, would, of course, be primarily a reading of the sky. If it is a north sky or one opposite the position of the sun at the moment, go ahead with such sky reading, (read sky just above horizon, not at zenith), then squint your eyes at the distant mountain and see if you can determine about how much darker in value it is than the sky. We will assume that your sky reading is Weston 800, and that your appraisal of the value of the mountain indicates that it is quite a little darker than the sky. Because you cannot know positively what this mountain value is, you must "assign" it some value reading, and your best judgment says it is Weston 500.

Now to determine what exposure will do justice to the foreground and still save the mountain. If you will refer to the diagram on page 80, showing the meter dial, you will notice that if you moved the arrow to 160, the lower limit of the film's most efficient latitude would be 80 and the top limit 320. An exposure based on Weston 160 would overexpose areas above 320 and underexpose those under 80. This is the 2 stop range within which you get the most faithful reproduction of both colors and values in Kodachrome. If you make the exposure based on 160 the mountain will probably appear less distinct in the Kodachrome result than your eye sees it in the scene, for such exposure is overexposing the hill by ⅔ stop. Re-examine the foreground. If there are no areas except small shadows that will go dark or block up, raise the arrow on the scale until it is 1 full stop above the average foreground readings, which we will assume to be 100 to 130. You can safely set the arrow at 1 full stop above the 130 mark, which would be 250. An exposure at this 250 setting will make in the processed Kodachrome, all foreground objects some darker in value than they appear in the subject, and those that give a reading below 130, or especially 100, will be slightly underexposed. But on the other end of the film latitude (1 stop above 250) we have 500, which we assumed to be about correct for the mountain.

To reduce these calculations to a more easily grasped comparison, we will make the test exposures on 35 mm. Kodachrome (Weston rating 8), at 1/50 of a second.

Average foreground readings.....100-160
"Arbitrary" hill reading..... 500
Exposure (Weston 160).....1/50 @ f/5.6
Film latitude @ f/5.6 is.....f/4 to f/8
Reading 100 calls for.....f/4.5
Reading 500 calls for.....f/10

An exposure at f/5.6 indicates we are not using all the film's latitude in the dark areas, for at f/5.6 the film easily covers objects down to f/4. On the other end of the scale we are overexposing the mountain by ⅔ stop—the difference between the f/8 limit of the film and the f/10 stop the mountain requires for proper exposure.

By changing the basic exposure to Weston 250 we find this better compromise for the scene:

Exposure (Weston 250).....1/50 @ f/7
Film latitude @ f/7 is.....f/5 to f/10
Our scene limits are Weston 100.....f/4.5
and Weston 500 .....f/10

Our new exposure latitude or range covers the lower values in the picture to within a small fraction of a stop (the difference between f/5 and f/4.5), we have sacrificed nothing in those areas with a reading of 130 or above, and we have given the distant mountain an exposure that will register it as definitely as the eye sees it in the scene.

This rather roundabout procedure has been described at length because a common failing in general landscape shots is overexposure, rather than underexposure. One's tendency is to become so absorbed in determining the correct exposure for the foreground areas that he forgets all about the rest of the scene. Another contributing influence toward overexposure of the distant parts of the scene is that we forget that the film *does have* latitude, even though more limited than we might wish.

We can *press the latitude* of the film in these lower value foreground areas without sacrificing foreground brilliance, and at the same time record the distant areas effectively.

Just keep this one thought in mind—if you want to preserve the distant portions of your scene, work toward slight underexposure of the foreground.

I might add that the gray cards will assist greatly in determining the general value range of the distant portions of such scenes as the one used in the foregoing problem.

If this card method seems too cumbersome,

and *if* there are foreground objects of same color and value as distant areas in the composition, like trees, rocks, water, the ground, and so on, use readings of these objects as a guide to "estimated" reading of the distance. But be sure readings are from the same light angle as you will use in making the shot. Also be sure to remember that the same object a mile away will be much lighter in value than when viewed close-up, because of atmospheric haze—sometimes more, sometimes less, depending upon atmospheric conditions. You cannot do better than follow the painter's rule —squint your eyes at the foreground rock, for instance, and then look at the same type of rock in the distance with the same squinted view, and you will see a decided difference in the values of the two. After a little of this "squinting" practice you will soon learn to accurately appraise these more or less subtle value differences.

Since it is several pages since we explained what we mean by "value," let me remind you that, color or no color in the scene before you, your exposure must be based on the "value" (gray scale value) of the light being reflected back to your camera. We covered that thoroughly in an earlier chapter.

All general rules can be nothing more than just generalization, but these four are rather basic, as your experience will prove.

1. Close-up outdoor scenes have the greatest value contrast and all colors appear more nearly "normal" in intensity.
2. Distant outdoor scenes have less value contrast and all colors appear to be grayed. The atmosphere pulls the values together and at the same time dilutes the color saturation of all objects.
3. On close-up outdoor scenes, when in doubt tend to *overexpose* rather than underexpose, because shadow and dark areas are a definite part of most such scenes. Slight overexposure (⅓ to ½ stop) will keep color in all but dead shadows, in most instances.
4. On distant outdoor scenes, when in doubt tend to *underexpose* rather than overexpose, because you have no nearby shadow areas to save, and in the majority of cases the general scene is lighter in

35 mm. and Bantam (Daylight) Kodachrome *(Film rating Weston 8, GE 12)*

General Tone Value of the Subject	Shutter Speeds and Stops								
	½	1/5	1/10	1/20	1/25	1/30	1/50	1/60	1/100
Very Dark	f/18	f/11	f/8	f/5.6	f/5	f/4.5	f/3.5	f/3.2	f/2.5
Dark	f/22	f/14	f/10	f/7	f/6.3	f/5.6	f/4.5	f/4	f/3.2
AVERAGE	f/32	f/20	f/14	f/10	f/9	f/8	f/6.3	f/5.6	f/4.5
Light		f/29	f/20	f/14	f/12.7	f/11	f/9	f/8	f/6.3
Very Light			f/25	f/18	f/16	f/14	f/11	f/10	f/8

(Movie enthusiasts can use either of the two columns under 1/25 or 1/30, depending upon shutter speed of their camera)

Cut Film (Daylight) Kodachrome *(Film rating Weston 10, GE 16)*

	½	1/5	1/10	1/20	1/25	1/30	1/50	1/60	1/100
Very Dark	f/20	f/12.7	f/9	f/6.3	f/5.6	f/5	f/4	f/3.5	f/2.8
Dark	f/25	f/16	f/11	f/8	f/7	f/6.3	f/5	f/4.5	f/3.5
AVERAGE	f/32	f/20	f/14	f/10	f/9	f/8	f/6.3	f/5.6	f/4.5
Light	f/45	f/29	f/20	f/14	f/12.7	f/11	f/9	f/8	f/6.3
Very Light		f/36	f/25	f/18	f/16	f/14	f/11	f/10	f/8

These tables are based on averages arrived at through rather extensive experience with the medium. If you check the foregoing tables with your meter you will note that I give the roll film (35 mm., Bantam and Movie) credit for more latitude than I have found to be true with cut film—especially in the roll film's greater response to the very light tone values. I accept full responsibility for that statement, but it is a carefully arrived at deduction, however. The roll film also seems to have more contrast than the cut film, intentional no doubt, to give greater brilliance in projection.

value than you suspect anyway. Slight underexposure will give firmness and saturation to the lighter values and will give you a more pleasing result. True, the underexposure may give you a bluer cast than you like, but better a little too blue and have a picture, than a washed out result that records nothing.

You may find the foregoing exposure table a convenient and reassuring aid in quickly visualizing a variety of combinations in stops and shutter speeds, for various types of scenes. You will note again that we must think in terms of "light" and "dark" rather than in terms of color.

In many outdoor scenes or relatively close-up compositions the value range, from lightest to darkest areas, is beyond the efficient limits of Kodachrome. You compromise by basing your exposure somewhere near the middle of this value range, or you favor the darker or lighter side of the composition, depending upon what portion of the composition you want reproduced faithfully. In general, one might say we color workers are always shooting at the "middle" of the scale of values.

In black and white photography we usually get the best effects by exaggeration of tone values, and in consequence we work toward one or the other end of the value scale. Or we may expose for the highlights and let the shadows take care of themselves, or expose for the shadows and trust that we can save something in the highlights. Unless our black and white is just a record of the subject, we usually strive for effects.

In color we strive to faithfully register the subject as is, rather than an effect or an impression of the subject. In order to faithfully record any subject in Kodachrome, in its entirety, it is necessary that the value ranges of the composition be within certain known limits. In all my tests and experience in practice, I have come to think in terms of 2½ stops as the limit for this value range. And then base exposures, in general a little off center, so to speak, that "center" or exposure "axis" being 1 full stop above the darkest value meter reading and 1½ stops below the lightest value reading.

If darkest areas are more than 1 stop below your basic exposure they will be underexposed, and if lightest areas are more than 1½ stops above your basic exposure they will be overexposed. A simple table shown below may help fix in your mind the practical limits of value range in any composition, for best compromise rendition of all colors.

These calculations disregard small highlights and relatively small dark accents. Either might read outside these limits (if you could read them accurately) without damage to the final result. The exception would be light or dark areas that were extremely important to your pictorial and color result.

The ideal color composition, from the standpoint of exposure, is one that has both good color and value contrast, but with a value contrast within the limits of the table shown below. Oft repeated statements to the contrary, the best color composition is one that does not depend upon color contrast *alone* for separation of areas and points of interest. Some value range gives a feeling of solidity and depth not possible otherwise.

Exposing Side-lighted and Back-lighted Subjects

Such lighting is uncertain at best. Properly exposed results are often pleasing and now and then dramatic. By side-lighting, as the term is used here, we mean shooting at or near a right angle to the sun, and this is not to

Dark Area readings should not call for a larger stop than	IF YOUR EXPOSURE IS MADE AT ONE OF THESE STOPS	Light Area readings should not call for a smaller stop than
Stop f/3.2	Stop f/4.5	Stop f/7
Stop f/4	Stop f/5.6	Stop f/10
Stop f/4.5	Stop f/6.3	Stop f/11
Stop f/5.6	Stop f/8	Stop f/14
Stop f/8	Stop f/11	Stop f/20
Stop f/11	Stop f/16	Stop f/29

be confused with the usually desirable use of moderate side-lighting for modeling.

Side-lighted close-up subjects are usually too contrasty in tone or value range, but the extent of contrast depends greatly upon the color of the subject. It is obvious that a side-lighted figure in white is a "safer" subject than if the costume is dark red. Side-lighted or back-lighted dark colors lose much or all color in the shadow side unless apprcciably influenced by reflected light.

Side-lighting (less extreme than for good black and white) is very desirable for such distant scenes as mountains, to give them modeling, for otherwise they will look as flat as the old drop curtain at the opera house. If the side-lighted accents are relatively small (not more than ⅓ to ¼ the total area) and at a distance, you need not make any exposure allowance for them. Remember those shadow areas at a distance are not as dark as they would be if you were close to them, due to atmospheric diffusion. If shadow areas constitute one-half or more of such general scene, use ⅓ to ½ stop more exposure if subject is "light" in color; 1 full stop more if it is generally "dark."

This does not apply to close-up, side-lighted compositions, where it is imperative that you check *all* areas by local meter readings, and arrive at your compromise exposure accordingly.

Back-lighted subjects are, with few exceptions, seldom good color shots. If you cannot make close-up meter readings on the back-lighted areas, give such subjects 1 stop more exposure if the subject is light in color, and 2 stops more exposure if it is dark. That much more than you would give the same subject if it was reasonably flat-lighted, we mean, of course.

Important variables are "dead" or "luminous" shadows; the character of the surface of the object or subject; light conditions (full sunlight, light overcast, heavy overcast) and so on. Side-lighted and back-lighted subjects lose contrast as the volume of incident light is reduced, as under overcast sky, as you have often noticed.

Two faults are common to even "good" (and I say that advisedly) back-lighted shots —(1) true color is lost or degraded and (2) all areas in the composition that are in full light will be burned out. Skies are invariably washed out and colorless.

In closing this very important chapter I want to emphasize that no one can give you any general rules for exposure calculations that will ever be as helpful or as accurate as your own judgment, properly developed. The examples and tables given in this chapter have been presented only to assist you in formulating, in your own mind, certain basic mental processes by which you can develop your own formulas.

One fact should boldly headline any discussion of exposure problems, and that is that no amount of formulas or tables will help if your shutter equipment is out of time or is erratic. That is a subject in itself and will be covered in a later chapter. The foregoing data is all predicated, of course, on the assumption that our equipment is performing properly—that when we set the shutter for 1/25 or 1/50 of a second that it operates at *that* exposure time interval.

See page 184 for data on Calculating Exposure for Close-up Photography

BACKGROUNDS FOR HEADS AND FIGURES

These examples are exaggerated uses of two background color ideas. One is kin to flesh color, the other is a near complement to flesh tints. When warm colors are employed as a background for flesh or costume colors similar to flesh, either there should be rather strong contrast between the value of the subject and the value of the background (that is, the background should be a darker value warm color), or some device should be used to separate the face from the background, as illustrated.

If a contrasting color is used for a background (as in the lower illustration), value contrast or other separation assistance is unnecessary. The two backgrounds used here are often satisfactory for merely colorful effect, but both are too intense in color for pleasing portrait results. They attract too much attention to themselves, and offer too much competition to the more delicate flesh tones. The safest single rule for portrait background colors is to use those of weak intensity (grayed colors); the more nearly they are to being complements of flesh and costume colors, the grayer they should be, in order to enhance the beauty and delicacy of the flesh tones.

DATA: Exposed on 4x5 cut film Kodachrome, Type B; Illumination, Photoflood; Camera, Studio View; Lens, 10 inch Goerz Dagor. The reproductions are four color process, letterpress, plates made direct from the transparencies.

KODACHROME BY ARTIFICIAL LIGHT

MANY color enthusiasts have timidly avoided indoor Kodachrome photography because they have the erroneous idea that unless one has the expensive and complicated lighting equipment of the large commercial studio he cannot make successful color shots by artificial light.

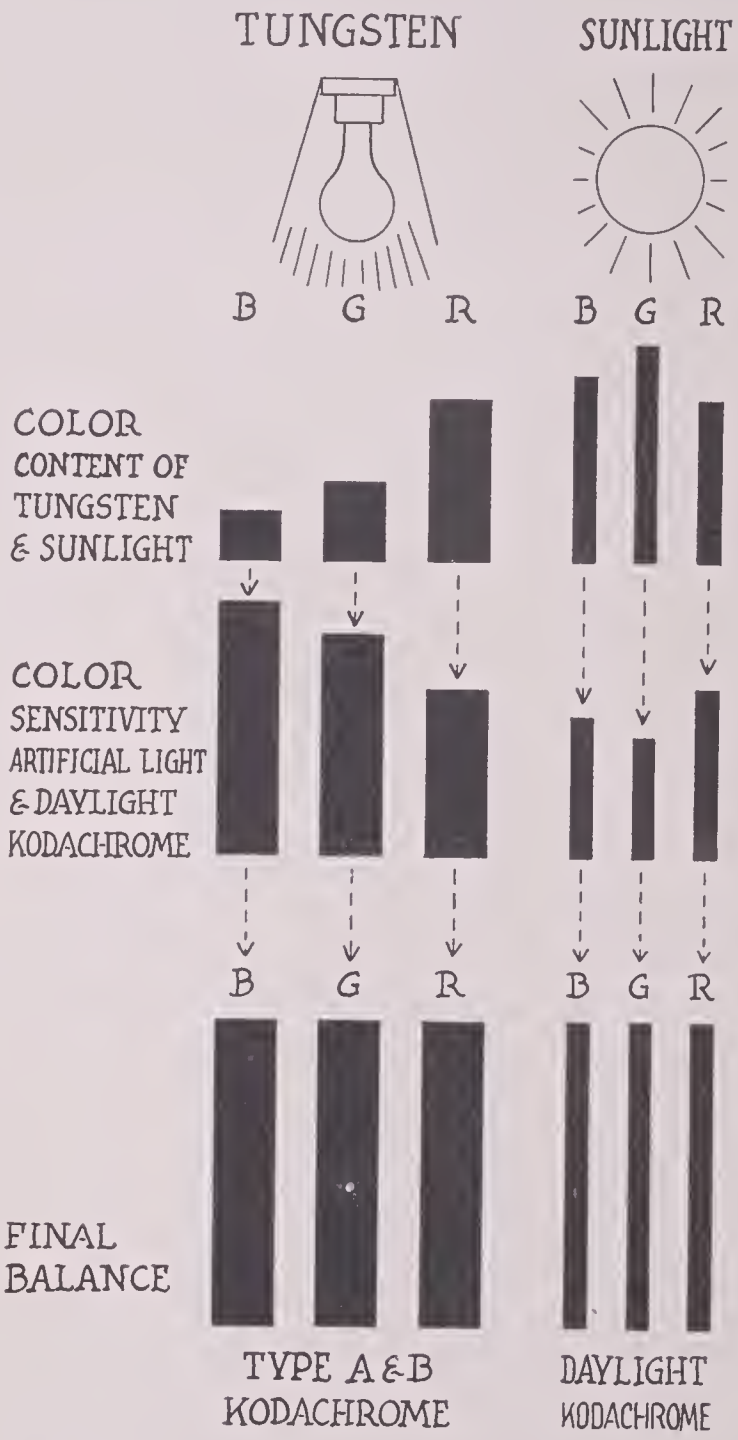
Such is not the case. While it is true that we always must have a sufficient *volume* of light (indoors or out), and that the light source must have the proper *color quality* or balance, neither of these necessities presents any serious problem in indoor color work. In fact one has the great advantage in that he can control both the color quality and volume of light; can control light angles and localized light effects. He can do none of these things as well when working outdoors, and some of them not at all.

Inasmuch as we can always add volume to our artificial light source, through employment of more or larger lamps, we should concern ourselves primarily with the matter of *color quality*.

You recall the diagram and discussion in the chapter on "Sunlight Characteristics," showing how the sensitivity of the three emulsion layers of Kodachrome film were "balanced" to compensate for the color balance of "normal" sunlight.

The graph is being repeated here, (Figure 43) with emphasis on artificial light characteristics. It shows the difference in film sensitivity between Daylight type and Artificial light type Kodachrome; and why the artificial light source must have the color quality or balance for which the film is balanced.

Do not become confused because these graphs mention only the Blue, Green and Red spectral bands of each light source. If you



43 *A graph showing the "color balance" of light sources, and how the sensitivity of each type of Kodachrome is balanced to compensate. This graph should make it apparent why the proper type of film must be used for each light source, and why light sources cannot be mixed.*

will remember that the Kodachrome film you expose is, after first development, a *negative*, and that it is also in *reverse* as to color, you will understand why such graphs consider only these three color bands. Kodachrome is a three color process, as you know, and all final color results are combinations of an infinite number of variations of values, intensities and amounts of the three final color layers *superimposed*. In the Kodachrome transparency the top layer is Yellow, the middle layer is Magenta and the bottom layer Cyan or Blue-Green.

Since your color image must first be captured in a *negative*, and since that, through reversal, becomes a *positive*, you also must think in *reverse* when you consider the color sensitivity of the film. By reverse we mean the opposite or *complementary* colors. As explained in the preceding chapter the Blue sensitive layer of the Kodachrome negative becomes the Yellow (or complementary color) layer in the final *positive* Kodachrome transparency; the Green sensitive layer becomes the final Red or Magenta one (Green's complement); and the Red sensitive layer of the original negative becomes the final Blue-Green or Cyan layer (Red's complement) in the transparency.

With that process clearly in mind we dispel any confusion the graph might at first create. The graph only serves to emphasize how deficient is artificial light in Blue and Green. Since the Red (and kindred color bands) predominate in the artificial light source, either the red in the light source has to be retarded by a filter or the speed of the Blue and Green sensitive layers must be stepped up to balance the red. Fortunately for color workers the manufacturer has chosen to speed up the Blue and Green sensitivity of the film. Otherwise the speed of the film would be greatly reduced, requiring a great addition to the necessary volume of the light source, or discomfortingly long exposures.

A little study of these charts will indicate instantly why the final color quality of the Kodachrome transparency is so dependent upon the color quality of the light source. Note that the color sensitivity balance of the film is, and must be, fixed. The film has no ability to compensate for color variations in the light source. You will also notice that the "Final Balance" is the sum of the addition of the "Color Content" bar (of any one of the three colors) to the corresponding color bar in the "Color Sensitivity" group.

It should now be obvious that consistently better color results can be secured with an artificial light source than under sunlight conditions. In outdoor Kodachrome photography you have no control over the *color quality* of the sunlight, and you can only alter color results through the use of compensating filters.

To get a better understanding of artificial light characteristics we are obliged to resort to the scientists' terms and measurements of light. The physicist designates the differences in color quality as color "temperatures" and these differences are denoted in degrees Kelvin. The lower the degree Kelvin the warmer or Redder the light source; the higher the degree Kelvin the cooler or Bluer the light source.

Light Source	*Color Temperature, degrees Kelvin*
An ordinary Candle	1,900
60 watt vacuum tungsten filament lamp	2,509
100 watt gas-filled tungsten filament lamp	2,865
500 watt gas-filled tungsten filament lamp	2,960
1000 watt gas-filled tungsten filament lamp	2,990
500 watt projection lamp	3,190
G. E. Mazda Lamp 3,200 degrees Kelvin	3,200
(for use with Type B Kodachrome)	
Mazda C. P. Lamps	3,380
Photoflood No. 4 (1000 watts at 115 volts)	3,415
Photoflood No. 2 (500 watts at 115 volts)	3,425
Photoflood No. 1 (250 watts at 115 volts)	3,440

(All Photofloods for use with Type A film, but Nos. 2 and 4 are preferable)

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Never mix daylight with artificial light, except in the one instance of Daylight type film and Daylight type artificial light, such as "blue" photoflood or "blue" photoflash. Daylight records as a blue light on Type A and B Kodachrome.

It is sufficient for our purpose to concern ourselves only with these differences in the Kelvin rating of various artificial light sources, and to know which of these balance with the color sensitivity of Kodachrome film.

The table shown at the bottom of page 92 gives these relative ratings and I have indicated the light sources recommended for both Type A and Type B Kodachrome. Artificial light type Kodachrome for movies, 35 mm. and Bantam is labeled Type A by the manufacturer; the cut film Kodachrome is labeled Type B.

If you will recall the previous reference to the relation of Kelvin degrees to the coolness or warmth of the *color quality* of artificial light you realize that a 500 watt gas-filled tungsten filament lamp (2,960 Kelvin) is much too red (or yellowish) for the color balance of Kodachrome film. On the other hand a new No. 1 Photoflood (at 3,440) is a little on the blue side as its temperature (when new) is higher than that at which the film is balanced.

Photoflood lamps and regular tungstens burn more toward the yellow (to reddish) as they get older, and old lamps will give a yellowish cast to Kodachrome transparencies taken with such a light source. You have noticed this yellow cast in old light bulbs around the house. The G. E. Mazda (3,200 degrees Kelvin) suffers only slightly with use, dropping no more than 100 degrees during its useful life.

At this point you may be interested in knowing that these 3,200 degree Kelvin G. E. Lamps are available in more than a dozen sizes, from 500 watts to 5,000 watts. For a comparison of light volume, a No. 4 Photoflood is rated at 1,000 watts, a No. 2 at 500.

In Kodachrome work by artificial light it is not advisable to mix lights on the same subject, unless, of course, you want a special color effect, and then you must know the color quality of your various lamps before you can be sure of your color result. That is, do not use an old, partially exhausted Photoflood with new Photofloods or a 3,200 degree Mazda. The old lamps will cast a yellowish tinge over the area they cover. But knowing this fact suggests effective uses for such old lamps for special effects, as well as the use of a new No. 1 Photoflood, for instance, with 3,200 degree Mazdas, as the Photoflood when new burns a little bluer than does the 3,200 lamp, as you will notice by referring to the table.

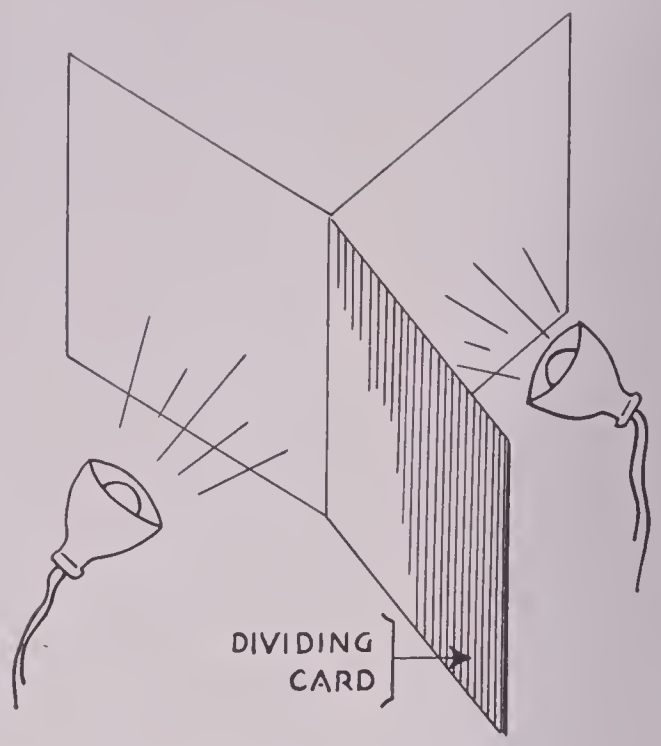
A further word of caution—do not attempt Kodachrome shots illuminated with regular household lamps—their color quality is far out of balance, and ordinary bulbs do not provide a sufficient volume of light. However there are times when you can effectively use Photofloods in table or floor lamps, for incidental light or for a special effect, as we will illustrate later.

And do not mix daylight and artificial light sources on indoor shots *unless* you use blue or "daylight" Photoflood lamps and make your exposures on *Daylight Type* Kodachrome. (Figure 44.) Such blue lamps are seldom available although one can have regular photofloods blue coated for use with daylight film for indoor work, and then can utilize daylight as a partial source of illumination. If you should attempt such an experiment you must base your exposures on careful meter readings as no regular exposure table for use with Photofloods would be of any value. The blue coating on the bulb would decrease its light output by 40% to 50% in all probability.

I mention this use of "daylight" Photofloods, with or without daylight as a supplementary source, only because now and then a serious color worker likes to test his skill in departures from conventional and orthodox methods. And I want to be the last person to discourage originality and courage in attempting logical experiments in new phases of this fascinating medium of color. Just as some workers feel that they get better color results in outdoor shooting by using artificial light type film, converted to daylight use with filters, there may be some whose experience with the "blue" or daylight type of indoor light source may develop a preference for daylight film for indoor work. Do not be afraid to experiment.

Do not confuse the experiment we have just suggested with the conversion of daylight type film to indoor use with filters. You can do that, at great sacrifice in film speed, but you would be limited to typical artificial light sources, and could not mix daylight with artificial light. Even though there is some merit, in some types of subjects, in converting artificial light type Kodachrome to outdoor use, I have never found it advisable to convert daylight type Kodachrome to artificial light uses.

To get back to why we cannot mix daylight and artificial light on indoor color shots, no explanation is necessary beyond reference to the graph shown on the first page of this chapter. Your artificial light type film is especially sensitive to blue, as you will notice, and daylight, in comparison with artificial light is excessively blue. In consequence, if daylight streams through a window onto a part of your subject area, that area will be extremely blue in color.



45 *A simple device for testing the color quality of photoflood lamps. One of known quality must be used as "standard."*

Testing Color Quality of Lights

The foregoing discussions should impress upon you the importance of using artificial light sources of the proper color quality—the color balance to which the film is balanced. We have also cautioned against mixing lights that differ in color quality, such as using old, partially exhausted Photofloods with new ones.

How is one to *know* whether or not one or more lights is burning too much on the yellowish side because of long usage?

The most accurate method of measurement of the color temperature of your light source is an Eastman Color Temperature Meter. But this instrument is rather expensive for any one except such professionals as do nothing but studio color work. This instrument is described in the chapter on "Filters and Color Meters."

A simple home-made device will serve the average individual's need and the method is sufficiently accurate for checking all but subtle variations in color temperatures of your lights. (Figure 45.) As this method is one of visual comparison it may require a little practice to develop your eye to the point where you can detect more than extreme variations. By referring to the diagram herewith you will note that the device is merely a V-shaped white card with an area on each side of the V of not less than 18″ square. From the apex of the V a dividing card extends toward the operator 18″ or more, as you prefer. This dividing card serves to restrict the vision of each eye to the area of the V card on the corresponding side. Now hold the lamps to be tested on each side of the V card, as illustrated, and in such position that the lamp on the left side, for instance, is not casting any of its light on the right side of the V card. With the two lamps in proper position hold the dividing card close to the face so that right and left eyes see only their corresponding sides of the V card. You will be surprised at how accurately you can detect a difference in the "color" of the two sides of the V card.

But you must start with one known factor, such as one new or nearly new Photoflood, against which you check the color quality of an old and questionable Photoflood. There is nothing complicated about the deduction you get from such test, as Photofloods only change in one direction in color balance as they get older, and that is toward the warm or yellowish side.

Controlling Reflected Light

Remember, in placing your lights, that light from them is reflected back from every surface they strike, whether such surfaces happen to be a part of your picture area or not.

This reflected "kick-back" from walls, ceilings, drapes, and objects in the room can be a help or hazard, depending upon the color of their surfaces, their reflective power, their distance from your lights and their proximity to the main object in your composition. (Figure 46.)

These reflected lights from walls, etc., are a hazard when they are from surfaces of strong color and when those reflected colors kick back unwanted colors into your picture. One

46 *Refer to the Color Plate of this subject on page 107, to observe the effect of colored light reflected from the pale green walls onto the white costume.*

example might be a figure in white posed in the corner of a room with green walls. The whites, the flesh tints and the hair (especially light hair) would all show traces of the green light reflected from such walls. Another vexing problem is close-up flower studies in which your whole effort is concentrated upon the most faithful reproduction of the color of the flowers. In your attempt to add a color mass to your composition you might use a colorful table cover as the base for your flower group. If your light and camera angle look down onto this table cover you will find the flowers very definitely influenced by the colored light reflected from the table top. These are only a few of the more obvious hazards of unwanted reflected light.

Such reflected influences can be helpful when the surfaces doing the reflecting are white or a high-keyed neutral color, for they help add overall illumination to your subject, which partially counteracts the "hardness" of direct, strong light sources.

47 *The use of a single front light, at or near the camera, creates hard shadows on the "offside" of face and figure, and usually on the background.*

If for some reason you want to eliminate all possibility of reflected light influences, place the figure or still life or whatever is your subject, in the middle of the room and set up a plain white or light neutral background behind the subject at right angles to the camera axis.

It is hardly necessary to elaborate further on this reflected light "help or hazard." Merely survey the surroundings before you determine on the location of subject and camera and the placement of your lights. It should be emphasized that the film will record these reflected light influences to an *apparently* exaggerated extent because the film cannot make the compensations and adjustments to these subtle conditions that your brain and eyes do. That is why we are so often distressingly surprised to find "color casts" in our transparencies that we did not notice in the subject before we made the exposure.

How Many Lights?

Before we discuss lighting arrangements and number of lights that might be used, we should consider the physical limitations of indoor photography by artificial light, at home or in improvised studios. There are limitations but they are not serious handicaps to the photographic efforts of most of us.

The first limitation is the lamp load we can put on the average house electrical circuit. The average house circuit is wired for only 15 amperes capacity, which will safely carry no more than two (2) 500 watt Photofloods (the No. 2's). In addition, the main house fuse is usually for a maximum capacity of 30 amperes, regardless of the number of separate circuits. Unless your wiring arrangement is such that it will carry a heavier load than just described, you are limited to the following light load:

No. of Lights on 1 Circuit	*Total No. Lights*
1—No. 4 Photoflood (1000 watts)	2—No. 4's
or	or
2—No. 2 Photofloods (500 watts)	4—No. 2's
or	or
4—No. 1 Photofloods (250 watts)	8—No. 1's

There is nothing alarming in this limitation as four No. 2 Photofloods in efficient reflectors will provide all the light volume you will ever want to use. And that number of lights give you no end of combinations and variations in your lighting arrangements.

Placement of Lights

As you have observed, most lighting diagrams for indoor photography (black and white or color) show the light or lights placed near the camera position. In this position all illumination is "front" light, which accounts for the "hard," flat look of many color subjects photographed by artificial light. (Figure 47.)

To confuse us still further, exposure tables for artificial light work are based on use of front light only, and with little consideration given for the effect of diffused or reflected light from nearby white walls or other highly reflective surfaces. There is no complaint that such exposure tables assume only front light, but only because they suggest that such light is always preferable. It is not, as we shall see. We should explore the desirable possibilities of more interesting lighting arrangements, and what effect they might have on exposure calculations.

The advocates of front lighting assume that the light or lights near the camera position will "flood-light" every plane and area seen by the camera, and that color contrast will provide sufficient interest in the color result.

I suggest you ponder this fact—that since we have the advantage of control over light sources in artificial light photography that we be a little less obvious in our approach, and that we make full use of this opportunity for an infinite variety of pleasant and dramatic effects.

While it is true that most outdoor color shots are illuminated by a single light source, the sun, practically all outdoor subjects as close up as most indoor subjects must necessarily be, would be immensely improved through use of reflectors, synchronized flash or supplementary light from highly reflective surrounding surfaces. To argue that it is unnecessary to have more than front lighting in indoor work because we have only one sun outdoors is no argument at all, as you can prove by critically examining the average run of close-up outdoor Kodachrome results. They are too contrasty; they include "black" shadow areas and too often many areas are degraded in color because of insufficient illumination.

Does this imply that we should avoid front lighting? Far from it, and no more so than to suggest that we should dispense with the sun in outdoor work. What we do mean to imply is that far more interesting color effects can be secured through the employment of lights that supplement our main front light source in very much the same way we use reflectors or flash to supplement direct sunlight. Keep in mind that light is light regardless of where you find it, and that balancing the illumination on an indoor subject is much the same problem as in outdoor work. And it is an easier problem as you have control over *all* light sources when they are on a light cord plugged into an electrical circuit. The sun is usually less amenable.

Using Front Light Only

I trust the foregoing criticism of the shortcomings of front light techniques has not misled you into false assumptions. There are many indoor compositions on which front light is sufficient, and in some cases, desirable.

Here are a few suggested applications of front light technique:

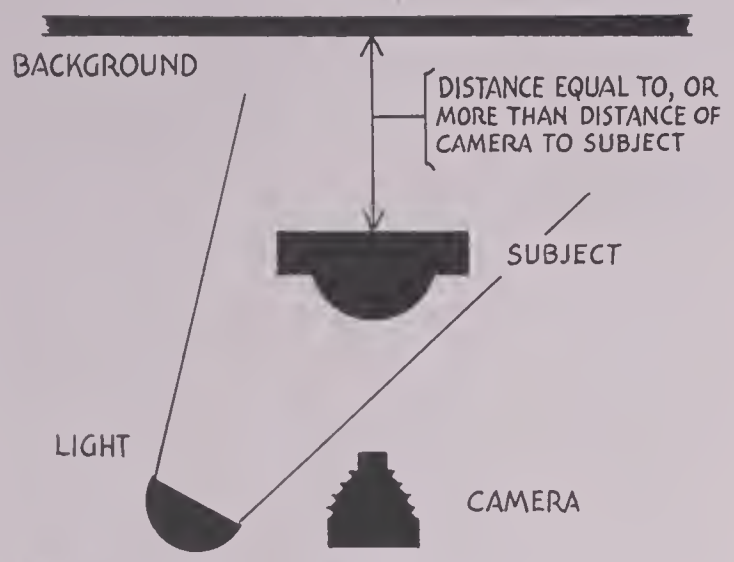
1. If you want an effect of a single light source, and shadow areas in the composition are a part of the effect you desire, then place

48 *Shadows created by a single front light can be modified through use of a reflector to fill in the shadows.*

the subject far enough away from *all* reflective surfaces so that no appreciable amount of light is kicked back onto the subject. You might want to use this type of lighting arrangement on a still life subject of geometric shapes such as pottery, a statuette, or in making a character study, or a close-up of a white lily blossom, for instance.

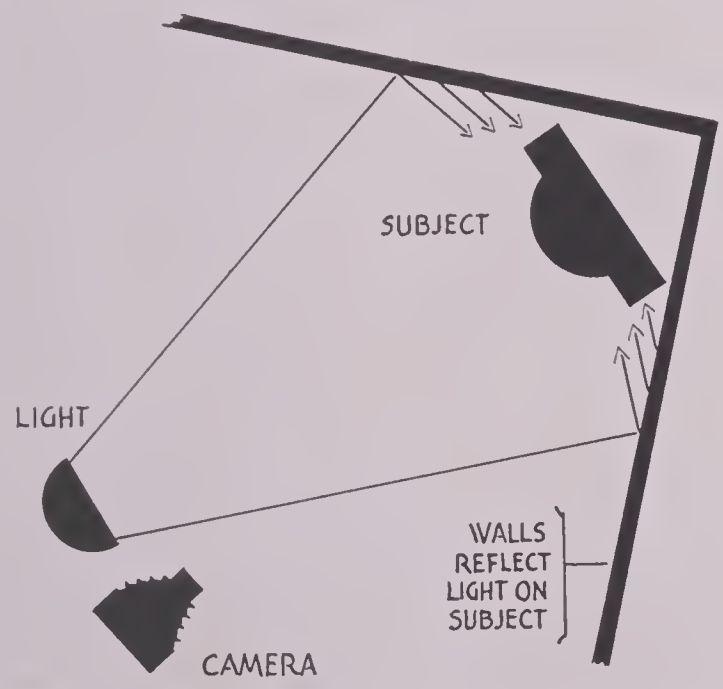
The relation of fully lighted areas to shadow ones can be altered by moving the light source farther to the right or left of the camera. Front light can still be called front light if kept within, say, 25 or 30 degrees of the line from camera to subject. In such a shot your background will go extremely dark or black, because of the rapid fall-off in light from the source. If you want to be sure of a black background for effect, the subject should be in front of any background surface at least a distance equal to the distance from lights and camera to the subject. (Figure 49.) For example, if light and camera distance to subject is six feet, background must be six feet, or more, back of subject.

2. A second variation of front lighting could duplicate everything suggested in the illustration just given *plus* the utilization of some surrounding surface as a reflector on the shadow side of the composition. If you cannot place the subject near a white or light neutral colored wall, you can hang a white sheet or use a large white card on the shadow side. (Figure 48.) The advantage in using a wall is



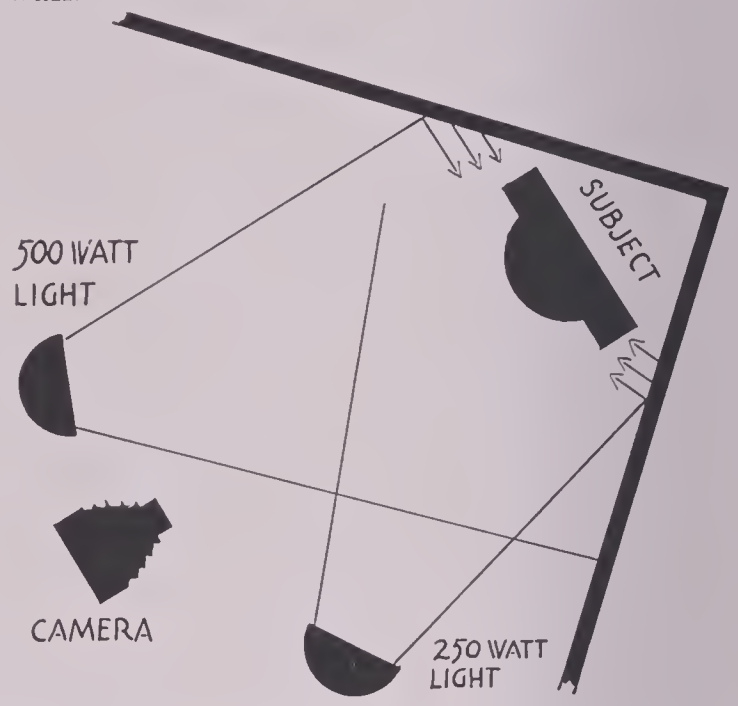
49 *If subject is well forward from the background, the background will be "underlighted" from a front light, and the darker background will "absorb" objectionable shadows to some extent.*

that you can include any portion of it in your picture you desire, and it serves the double purpose of reflector and part of the background. (Figure 50.) If you use a card or sheet you will want them beyond the limits of your picture. Then you must survey what is to be the background in the final color result. It might be a white wall some distance behind the subject, but you will be surprised to find it dark or black, in the Kodachrome, instead of the white you expected it to be. The farther it is behind the subject the darker it will be, due again to the lack of carrying power of your lights. This is a common error in indoor photography for as the room seems



50 *Walls can often be used effectively as reflectors, to provide more even and better diffused illumination from a single front light.*

light we see the white walls as white, although they are actually a dark gray in comparison with the full brilliance of our subject on which the lights are focused. We overlook such value ranges in judging light conditions because we have our attention so concentrated on the subject that we forget to check such seemingly unimportant details as the distant wall.



51 *Two front lights, at some distance on either side of camera, with walls as reflectors, provide very good illumination for indoor color work.*

3. A third type of front light can be provided with two lights, one on either side of the camera. (Figures 51 and 52.) You can follow either the "black background" technique of our first illustration or the second suggestion, in which we used walls or special reflectors for supplementary illumination. If your subject is immediately in front of a background, this divided and cross-light arrangement will create double shadows on the background with unpleasant results. Being an odd, unnatural effect, these "crossed" shadows assume an annoying importance in the pictorial result. If you use a middle value, or darker, background such shadows will be less conspicuous.

Three advantages of this divided front light arrangement are (1) that the lights "see" around the subject as does a two-lens stereo camera, thereby getting more light into side shadow areas; (2) you can have one light at a low position from the floor and the other higher than the camera, giving more oppor-

52

One of the most flexible lighting arrangements is the employment of one front light, high, and another front light, low. This use tends to give more even illumination for color photography, which requires shorter scale lighting than does black and white.

tunity for variety in light angles; (3) and by using one light of 1000 watts, for instance, with the other a 500 watt or 250 watt, you secure still further variety in light effect. In fact when two "divided" lights are used one light should, in practically every case, be twice the volume of the other, such as a 1,000 watt with a 500 watt, or a 500 watt with a 250 watt. If lights are of equal volume they will set up no end of conflicting highlights and shadows. There are exceptions to all rules and it is conceivable that you might have a subject which could be made more dramatic through use of two lights of equal volume.

In *all* front lighting you must expect some shadow problems, especially on backgrounds close to the subject. Also, all front lighting is "flat" lighting and there is always a tendency toward the lack of modeling, in the Kodachrome result, we usually associate with flash-at-camera exposures in black and white. It should be remembered, though, that color compositions, if they have any color separation, can stand a more flat light than is ever desirable in black and white work.

Never trust your eye to give you an accurate estimate for exposure calculations, nor the value rendition of the darker areas in the picture. In making exposures always follow a dependable exposure table for the number and kind of lights you are using, and faithfully follow directions as to distance of lights to subject. Errors in such distances are multiplied in the exposure result. If you have a light meter, use it painstakingly and accurately, measuring every area in the composition "locally" and not at camera distance. You will arrive at compromise exposure calculations in the same way we discussed in the chapter on outdoor calculations. You shoot for the "middle" reading if you are after an overall rendition of all colors, letting the highlights and the darkest areas take care of themselves, or you compromise toward the highest meter reading, or the lowest, depending upon which portion of the composition you want reproduced the most faithfully in both color and value.

As to the rendition of the value range of your composition, your eyes will always deceive you. The final Kodachrome result will be much more contrasty than you estimate the scene to be unless you have checked every area carefully with a light meter, in which case you will then know what to expect. Follow the rule of 2½ stop range between high-

53 *Indicated use of a front light at camera, high, and a side light, low, as diagramed in Figure 54.*

est and lowest meter readings, and keep in mind that any portion of your composition that gives a reading outside this range will be noticeably over- or underexposed, as the case may be. Also remember that indoor work is close-up work, and that in Kodachrome it is always advisable to keep the value range of close-up compositions within as close limits as possible just so long as you do not carry this "flatness" to a monotonous extreme.

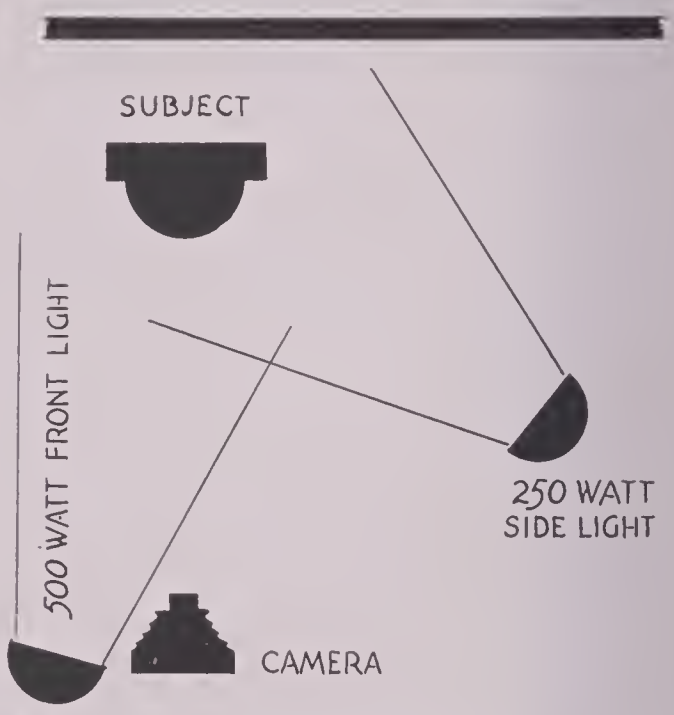
So much for front lighting.

Front and Side Light

Perhaps the most all around satisfactory lighting setup for home use is the combination of front and side light. (Figure 53.) To simplify our thinking let us assume that the front and strongest light is the "sun" and that the side light is a reflector or synchronized flash. With this in mind we first do the best possible job of lighting the subject with the front light and with the same care we would place a subject in direct sunlight, for best overall lighting. In daylight we would be obliged to place the subject to the source of light; in artificial light work we have the advantage of adapting our light source to the subject.

After you have satisfied yourself that you have the camera angle you want and the front light so placed as to give you an almost satisfactory picture with front light only, turn off the front light and start your experimenting with the side light to get the best possible side-light coverage. Try the light in several positions. It need not be at right angles to line from camera to subject. (Figure 54.) Also try raising and lowering this side light as well as changing its angle to the subject. When you have satisfied yourself that you have light on all the shadow areas that will be exposed in your composition, then turn on the front light and view the subject from camera position to be sure that your side light is properly placed.

Although you can use the same volume of light in both front and side lights (at the same distance from the subject), it is usually advisable to use *one-half* the amount of light for side-lighting. If you use lights of equal volume, as a 500 watt in each position, move the side light back about 50% further from subject than is the front light. The fall off in light will serve the same purpose as using a smaller wattage light.



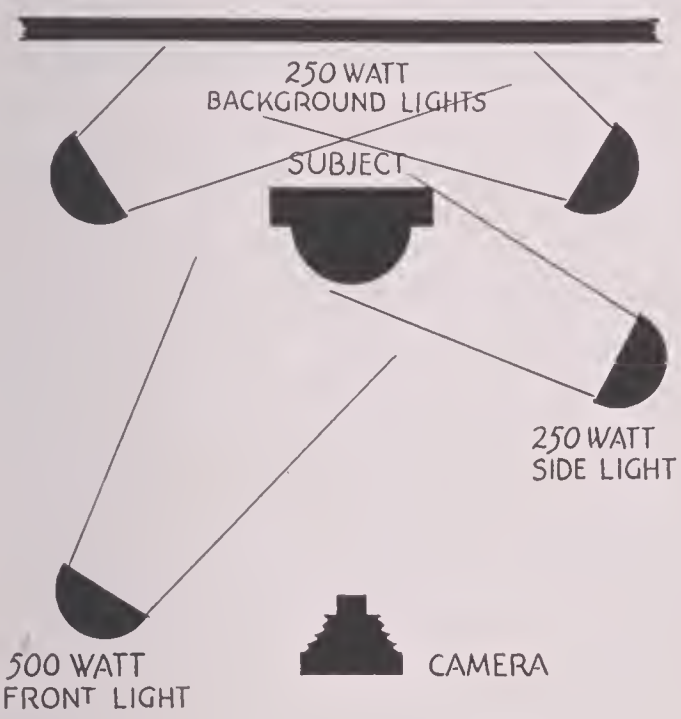
54 *Lighting diagram used in the illustration shown as Figure 53. Note that lights used were of different volume.*

If (and remember this "if") the volume of the side-light is less than the front light, and if this side-light is kept at near a 90% angle, then base your exposure on the front light only—either from an exposure table or a meter reading with the side-light turned off. If side-light is hitting many of the front planes, and adding to the volume of the front light, the only safe procedure is to make meter readings with both lights on the subject.

Lighting the Background

There are times when the background must be held, in color and value, as nearly "normal" as possible. Separate lighting of the background is the only solution as the front light will not provide sufficient illumination to hold the background in its proper relation to the subject. (Figure 55.) Light falls off rapidly, and if the distance of the subject from the background was only half the distance of subject to front light, the background will get only about half the proper amount of light to give it the same exposure as will be correct for the subject.

Another very good reason for using background lighting is to kill the shadow created by the front light. Sometimes you can so place the side-light that it will partially eliminate a bad shadow and in so doing of course it adds light to the background.



55 *Lighting diagram used in the illustration shown as Figure 56. The background lights eliminate background shadows, as well as raising its "key."*

In determining distance for background lights keep in mind the effect you wish. You want a background to be a background. If it is dark in both color and value it will need all the light you can give it; if it is light in color and value be careful not to overlight and washout the color. (Figure 56.) A light meter is almost a necessity for determining all these factors although you can soon learn to judge background lighting in relation to the lighting of your subject.

56 *This lighting arrangement is identical with that used in Figure 53 except for the addition of background lights. In black and white the effect is "flat," but the contrast range is about right for color.*

Back-lighting the Subject

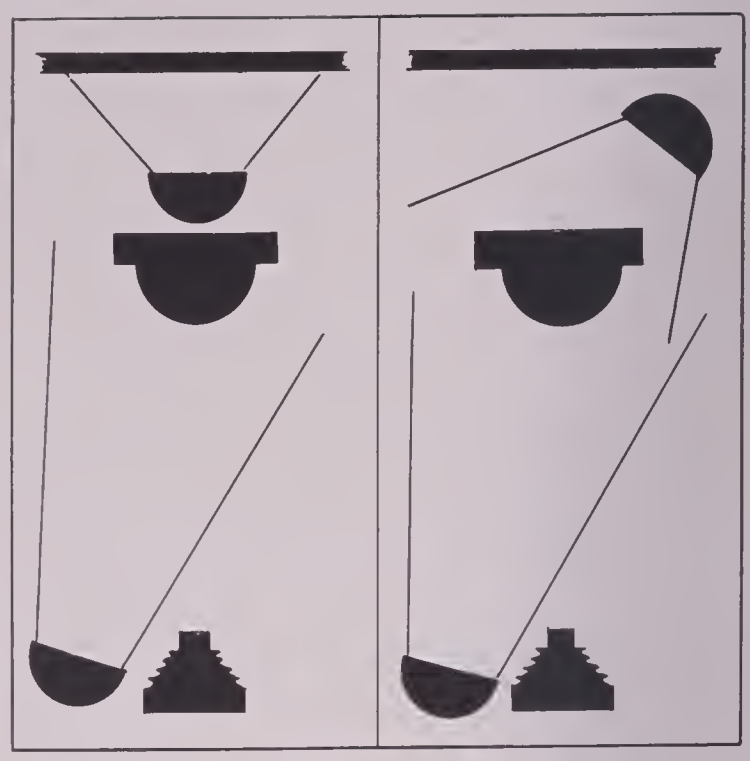
The two illustrations (Figures 57 and 58) and accompanying diagrams suggest a variation of what might be termed front lighting. In either case the front light should be twice the volume of the back-light since it is assumed that in practically all such situations the back-light would be much closer to the subject than would the front light. You want to avoid too much "competition" between your light sources, in back-lighting a figure, unless you are after a very noticeable effect of back-lighting. (Figure 59.)

It is difficult to suggest any formula for such arrangement as it all depends upon what you are trying to accomplish. For that reason this idea is merely suggested as a means of producing effects.

Never attempt to produce a back-lighted effect by underexposing the front of your subject if you expect to preserve anything like faithful rendition of color and value. It is preferable to over-light through back-lighting and that will not be so difficult to accomplish in effect as your background will go darker than it appears anyway, and that will help create the illusion of strong back light through value contrast.

Do not expect too much from back-lighting as you can accomplish little more than the creation of a "halation" around a still life, for instance, or a feeling of back-lighting in hair, in a portrait or figure study. Your first prob-

57 *Lighted with one front light at camera, and one light on background. Note tone value of background in comparison with that in illustration below.*



59 *Diagrams of the very simple lighting arrangements used in making the illustrations shown as Figures 57 and 58.*

lem is to keep the light hid from the camera lens, and this fact alone limits what may be done with such lighting.

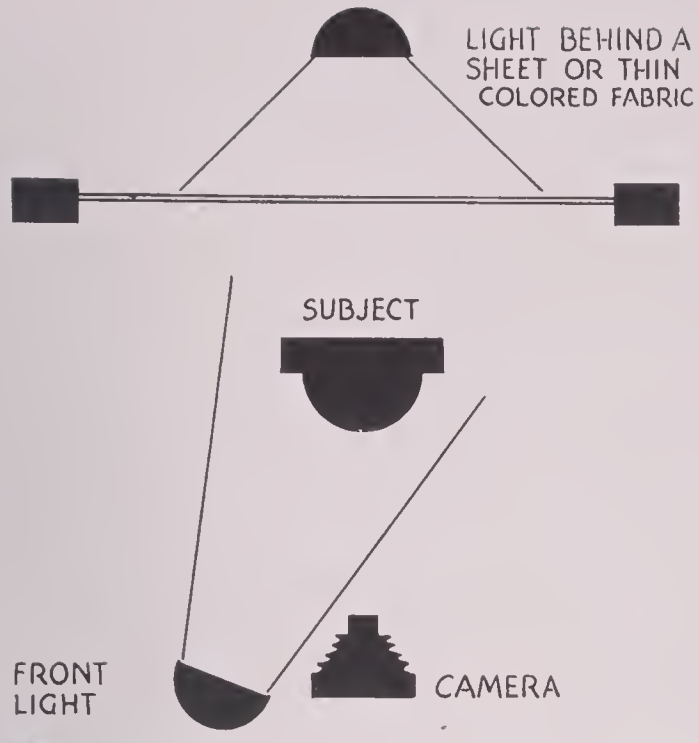
58 *Same front light at camera, but background light turned toward face and off the background, to create contrast on the face. This "highlight" value helps pull the head out of a dark background.*

Shadowless Backgrounds

A very simple device for creating shadowless backgrounds, and still have a light, high-keyed background, is to stretch a sheet or other fabric of equal transparency across a door opening and place a light behind the sheet. (Figure 60.) How much light you will need behind the sheet, or how close the light must be to the sheet depends upon the volume of your front light, distance of light to subject, and so on. Since all corrections in placement of lights can be made visually this matter of eliminating shadows on backgrounds, with this device, is really not much of a problem.

There are times when you want a little shadow effect, and this too is easily accomplished through moving the light back of the background still farther away until your front light gives you the shadow value you desire.

Do not misconstrue our references to front light as meaning that you cannot create shadowless pictures except with front light. You can, of course, use any lighting arrangement you wish, entirely independent of this backlighted background idea, and still incorporate the shadowless background lighting.



60 *A simple device and lighting arrangement for the creation of shadowless backgrounds. Also has many possibilities for interesting "luminous" color effects.*

Using Colored Lights

We have emphasized so repeatedly the necessity for using light sources of the proper color quality for the film we are using that we may have stifled our imagination a bit. When we say that the color quality of our light source must be correct, we mean, of course, that we must have this balance between light source and film if we are to record the colors in our composition faithfully.

But there are times when we may wish to create colors that do not appear in our composition. The most obvious introduction of color through use of colored light would be through giving a white background color by using background lights covered with colored cellophane, for instance. Go back to the diagram showing use of two 250 watt background lights. You merely cover these lights with colored cellophane and you have added that color to the background. In so doing you must remember that this cellophane covering will decrease the volume of light, how much depends somewhat upon the color used, and it is seldom advisable to use more than one thickness of the cellophane as two or more thicknesses added, with the ostensible idea of adding more color merely defeats its own purpose as the extra thicknesses will cut down the volume of light to such an extent that the resulting color will be so dark in value that even to hold it as you see it would require much more exposure than you would be giving the fully lighted subject. At any rate the idea has unlimited possibilities and will warrant some experimenting.

Another use of "added" color would be a blue back-lighting on figure, for instance, using the same back-lighting idea as shown in the diagram on the opposite page.

Still another, use a light blue cellophane over a side light, to give the shadow side of the subject a cool feel. Or you can reverse the process and add a weak warm cellophane to the side light and create an illusion of strong, warm highlights. In this case you should bring the side light in close enough to the subject to be sure of creating an effect of your principal light source coming from the side. You can make these compensations visually, but the safest procedure would be to check both front and side-lighting carefully with a light meter to be sure you are getting the proper balance between front and side light.

Do not attempt to add overall color to a composition by covering all light sources with colored cellophane, for instance, because the resulting color transparency will appear just as it will to the eye if you view your subject through such colored transparent material. The Kodachrome will hold the colors in your subject but it will look as though it has been given an added dye bath of a color corresponding to the color used over the light source. This is mentioned only as a caution against any attempt to bring partially worn out photofloods back to their original color quality by covering them with a light blue cellophane. Such color correction might be accomplished successfully if you had a Color Temperature Meter with which to measure the color quality of such covered lamps. Even then it is much better to correct with a filter than to attempt such correction at the light source. Such filter correction is uncertain unless used with the Meter. If your lamps are badly exhausted it is cheaper to buy new lamps than to waste film under conditions that thwart every possibility of a satisfactory Kodachrome result.

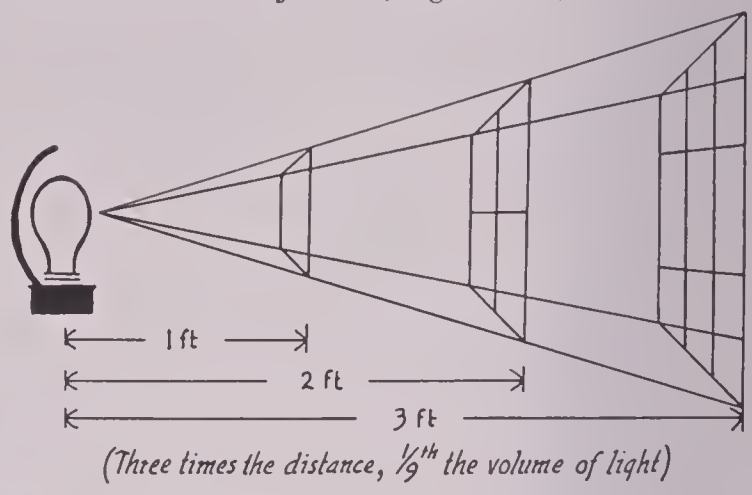
Determining Exposures

The diagrams and suggestions in this chapter have been given only to stimulate your own thinking and originality. Most diagrams for artificial light photography show such data as distance of lights from the subject; number and wattage of lights; exact angles for lights and camera and other such suggestions of definite formulas. The rigidity of these directions tends to suggest that one cannot, or should not, depart from the mathematics of the problem one iota.

I am not inferring that these tables will not produce desirable results, but I do feel that you will develop more flexibility in your thinking and will go farther in creating new and often better results through starting at the other end of the problem. That other end is the placement or arrangement of lights to create the effect you want and do that *first*, before you concern yourself too much about distances and whatnot. The only thing you must keep in mind is the necessity for plenty of light volume, which means that you cannot have all lights twice their effective distance from the subject. This effective distance is regulated, somewhat, by your subject. If you are photographing some object that will stay in a fixed position for an indefinite period, you can work with lights farther away and give the subject a longer exposure to compensate. If you are photographing flowers that tend to droop quickly under the impact of strong light, or if your subject is a person, you must shorten your exposure to the point that will accommodate the situation. In this latter case the shorter exposure needed decreases the "effective" distance at which you can place lights.

Those of you who do not have a light meter will be obliged to follow the regular tables given for the purpose, and in consequence your flexibility of action will be somewhat limited.

In all your calculations on placement of lights and determination of the proper distance of lights to subject, keep firmly in mind the first law of light, as illustrated by the diagram herewith. This law is that "The brightness of an object falls off in proportion to the square of the distance between light source and object," or to state it another way, "The illumination on an object varies inversely as the square of the distance from the light source to the object." (Figure 61.)



(Three times the distance, 1/9th the volume of light)

61 *A graph showing the ratio at which artificial light falls off as it travels from the light source.*

In practice this means that if you move a single front light back from a position three feet from your subject to a distance of six feet, (twice the distance) the subject is then getting only one-fourth as much light (not one-half) as when the light was at a distance of only three feet. If you should move the light back three times as far, or from three feet to nine feet, the subject would be getting only one-ninth as much light. Or reverse the process—when you move the light closer to the subject, as from six feet to three feet, you do not just double the light volume on the subject, you *quadruple* the light volume. It is rather important to remember this fact when you are using more than front light. It is both an advantage and a hazard when you are using a side light with a front light, for example, and it is another reason why the problem becomes much simplified when you use a light meter to check lights individually and in combination.

There is nothing difficult about producing good color results with artificial light. It is a technique all its own, that is true, but no more difficult to master than any other phase of photography, and in many respects less, as you have control over *all* factors that influence results.

Think through what you want to accomplish, then go to work. Your timidity and hesitancy will soon disappear, and you will have launched into a new and almost limitless phase of Kodachrome photography.

Exposure Table—Type A Kodachrome—Photoflood Lamps

For checking tables against Meter readings use Film Factor Weston 12 or GE 20

Although a Light Meter is not an absolute essential in artificial light color work, it is advisable as it is the only way you can definitely check the value range of your subject, and can then make corrections in light placement to even up the illumination. This is quite important when you are lighting the subject from several angles.

For 35 mm. and Bantam Film Size Cameras

Number and Size of Photofloods	Shutter Speed	f/2	f/2.8	f/3.5	f/4	f/4.5	f/5.6
Two No. 1 or	1 sec.	30 ft	21 ft	17 ft	15 ft	13 ft	10 ft
One No. 2 or	1/5	13 ft	9½ ft	7½ ft	6½ ft	6 ft	4¾ ft
One No. 2R	1/25	6 ft	4 ft	3¼ ft	3 ft		
	1/50	4 ft	2¾ ft				
Four No. 1 or	1 sec.	42 ft	31 ft	24 ft	21 ft	19 ft	15 ft
Two No. 2 or	1/5	19 ft	13 ft	11 ft	9½ ft	8½ ft	6½ ft
Two No. 2R or	1/25	8 ft	6 ft	4¾ ft	4 ft	3¾ ft	3 ft
One No. 4	1/50	5¼ ft	4 ft	2¾ ft			

The above table of Lamp-to-Subject distance presupposes that the lights are grouped or not widely separated, and that they are all focused on the main portion of your composition. Weaker side or fill-in lights can be used without affecting the exposure of front lighted portion of the composition.

The above table is for subjects that are average in color and value. For darker than average, use ½ f/ stop larger or move lights 20% closer to subject. If lighter than average, use ½ f/ stop smaller or move lights about 10% farther back from subject.

Movie Cameras—8 mm. and 16 mm. Kodachrome—Photoflood Lamps

For checking tables against Meter readings use Film Factor Weston 12 or GE 20

Number and Size of Photofloods	Shutter Speed	3 ft	4½ ft	5 ft	6½ ft	7 ft	9 ft	13 ft
Two No. 1 or	Normal	f/5.6	f/4	f/3.5	f/2.8	f/2.2	f/1.9	
One No. 2	½ Speed	f/8	f/6.3	f/5.6	f/3.5	f/3.2	f/2.8	
Four No. 1 or	Normal	f/7	f/5.6	f/5	f/4.5	f/3.5	f/2.8	f/1.9
Two No. 2	½ Speed	f/10	f/8	f/7	f/5	f/5.6	f/3.5	f/2.8

For darker than average subjects, use ½ f/ stop larger.
For lighter than average subjects, use ½ f/ stop smaller.
Calculations are based on use of Kodaflectors or equally efficient reflectors.

Exposure Table—Type B (Cut) Kodachrome—3200° Kelvin (GE) Lamps

For checking tables against Meter readings use Film Factor Weston 6 or GE 10

The following table is offered more as a guide as to number of lamps needed, and distance at which they should be placed, than it is as a guide to definite exposures. Use a Light Meter if possible, for it is your best assurance of determining the value range of your subject, and in balancing your illumination for best color results. The 3200 Kelvin Lamps recommended burn in any position. Other sizes and base styles are available in 1000, 1500, 2000 and 5000 watt capacity.

Number and Size of 3200 K Lamps	Shutter Speed	5 ft	7½ ft	10 ft	15 ft
Two 500 watt	1 sec.	f/11	f/8	f/4	f/3.5
A-25 3200 K	1/2	f/8	f/5.6	f/3.5	
	1/5	f/5	f/3.5		

These lamps must be used in efficient reflectors, preferably a matte finish.

Note: In all artificial light color work the results are affected by serious fluctuations in voltage in the electrical circuit. The voltage should not run lower than 105 nor higher than 120.

SPECIAL NOTE: 3200° Kelvin Lamps may be used with Type A Kodachrome IF a Harrison B ¼ filter is used. The principal advantage of this departure from Photoflood is the longer life of the 3200° Kelvin Lamp (about 50 hours compared to 6 hours for Photofloods) plus the additional advantage of the constant light quality.

PHOTOFLASH AS SOLE LIGHT SOURCE

It is very much a matter of personal preference as to whether photoflash or photoflood is the better light source for such color subjects as this one.

In favor of photoflood, the photographer has an opportunity to experiment with light placement, to better check the composition and make alterations under the light conditions being used for the exposure, and to observe the influence of light reflected from walls, ceilings and nearby objects.

Photoflash offers the advantage of more illumination, and an instantaneous exposure. In the case of children or pets, this often means the difference between getting the shot or capturing a "movie" on still film. Photoflash is less likely to disturb the subject than will the heat and glare of photofloods. It is often advisable to use photoflood to determine light placement, etc., and then make the exposure by flash.

As pointed out on previous pages this color plate emphasizes the effect of "color casts" on white or very light neutral colors. The casts on the white costume are from the colored walls. Although less detectable, this color cast also affects the true color of the yellow chair.

DATA: Exposed on 4x5 cut film Kodachrome, Daylight type; Illumination, two No. 3B (blue) Wabash Photoflood lamps, one high at left of camera, one low at the right. Camera, Speed Graphic; Lens, 7⅛ inch B. & L. Convertible Protar. The reproduction is four color process, letterpress, plates made from a Wash-Off Relief Color Print from the transparency.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KODACHROME AND PHOTOFLASH

LEST you suspect that any discussion of the use of Photoflash with Kodachrome must necessarily be a revamp of what has already been said about Photoflood as a light source, let me hasten to remind you that the only similarity between the two techniques is when they are both used as the *sole* light source.

With the exception of using a combination of *blue* photoflood with daylight, all uses of photoflood assume that it is the sole and only light source.

Photoflash is more flexible in use than is Photoflood. In the first place, you carry your own "light plant" with you with Photoflash. The use of Photoflood is limited, on location, by the distance to an accessible electrical circuit. You can use Photoflash anywhere you can hold a camera or set a tripod.

The four most obvious uses for Photoflash with Kodachrome are:

1. Synchronized flash, in sunlight, to fill in shadow areas in the same way one might use reflectors.
2. Synchronized flash, in sunlight, to furnish a light source nearly equal to that of the sun, using the flash to illuminate the back-lighted side of the subject, with the sunlight being used for highlights and accents.
3. Synchronized, or open and shut flash (bulb or time), for night shots indoors or out, with flash being the sole light source.
4. Synchronized, or open and shut flash (bulb or time), where you use existing illumination as supplmentary light, such as house lamps, etc.

As each of these four uses present distinctly different problems it will avoid confusion if we discuss each separately and without regard for techniques that may be common to all. Repetition of those common characteristics should only serve to emphasize them.

Flash in Sunlight —To Fill In Shadow Areas

In making such shots you must, of course, use daylight type Photoflash lamps (such as G. E. No. 21B or Wabash No. 2B or 3B), in order to maintain approximately the same color balance between the film, the flash and sunlight. (This applies even though you might be using artificial light type Kodachrome, converted to daylight use with a filter.)

As each subject is a different problem, it is not advisable to lay down any hard and fast rules as to whether (1) you should use a flash in the gun on the camera, or (2) have the flash on an extension cord running from the flash gun to a position away from the camera, for side-light, for instance, or still further (3) whether you should use one flash lamp at the camera and another on an extension cord at the same time. The character of the subject, the angle of sunlight to the subject, and other easily recognizable factors all influence the choice of the number of flash lamps to be used, and at what position they should be placed.

One illustration might serve as a basis for such analysis. We will assume your subject to be a close-up figure shot. If the sun is overhead such light will cast heavy eye, nose and chin shadows. We might go one step further and assume that the subject is wearing a hat, the brim of which casts a shadow across the forehead. If you are satisfied with a lower than eye-level camera angle, then a flash in the gun on the camera will open up all those distracting shadows. On the other

hand, let us assume that you want a higher than eye-level camera angle. Then it might be advisable to run an extension cord from the gun on the camera to a flash lamp set or held some three feet from the ground, at the proper angle to pour light into the shadows. That is one type of problem.

For a second illustration, we will assume the figure is turned so that in addition to the eye, nose and chin shadows we also have a large shadow area on the side of the face and body. Flash at the camera would open up these shadows to some extent, but a flash lamp, used as a side-light, and directed at these shadows from the side would do a more efficient job of even illumination.

A third problem, and perhaps the most common, is that of getting sufficient light into shadow areas when the camera to subject distance is more than the effective distance of the flash *at the diaphragm stop you want to use.* To state it more specifically, say the camera to subject distance is 15 feet and you want to use a sufficiently small lens stop to hold good depth of focus from the subject (on which you are focused), on through to a background that is another 10 or 15 feet behind the subject. (The shorter the focal length of the lens you are using the less serious this problem of holding sharpness for any depth beyond the point of focus, of course.)

In this case you are obliged to use a flash lamp closer to the subject than is the camera, if the flash is to be effective. And this means that the flash lamp must be on an extension cord, and moved to within half the distance of camera to subject, more or less depending upon what size flash lamp is employed, what diaphragm stop you are using, etc.

Perhaps we should clarify the suggestion that it is necessary to hold good depth in color shots. Out-of-focus backgrounds in black and white work are seldom objectionable and often desirable, but quite the contrary is true in color. In consequence our problem of flash with color calls for a more precise and exacting evaluation of some of the factors the black and white worker can usually disregard. An out-of-focus background in black and white merely serves as a tone or value against which your sharply focused subject stands forward. On out-of-focus backgrounds in color you have an uncertain conglomeration of color which the eye tries to make into recognizable shapes and identifiable objects. I think you will agree with that conclusion.

In using synchronized flash as a supplementary light source, disregard the flash in calculating exposure *if* you can place the flash anywhere you wish in relation to the subject, and independent of camera position if necessary. After you have determined the f/ stop you will use, then check your flash data to determine at what distance you must set the flash to get the desired effectiveness at the aperture you have selected.

For instance, let us suppose that you have decided to use stop f/11, and the flash lamp you propose to use will (according to flash exposure data) give the desired effectiveness when placed at a 9 foot distance from the subject, regardless of camera to subject distance. If the camera is farther than 9 feet from the subject, the flash must then be used on an extension cord, obviously.

Do not expect much effectiveness from a flash placed at 12, 15, or 18 feet from the subject when the flash data says 9 feet, for stop f/11. You will recall that light falls off inversely as the square of the distance, whether it is photoflash or photoflood, as illustrated in the preceding chapter.

If you cannot place the flash lamp closer than 12 feet (instead of the 9 feet the exposure data suggests) you must then use a larger f/ stop and a faster shutter speed, to compensate for the greater distance of the flash from the subject. If the distance of flash from the subject cannot be altered, you must start your exposure calculations with what the flash requires, and then use an f/ stop and shutter speed to fit that calculation. This procedure contradicts our previous statement that one bases his exposure on the sunlight reading of his composition and lets the flash, as supplementary light, take care of itself, insofar as its effect on the overall exposure goes. But there are exceptions to all general statements, including this one.

Before we get too involved, we should remember that there is only one factor in calculating a flash exposure by itself and independent of any other light that may be present. That one factor is f/ stop, for the flash has its own shutter speed, so to speak, inasmuch

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Synchronized flash used to fill in shadows on the foreground figure. One No. 21B photoflash lamp was used five feet from the figure, just outside the picture at the right. Lamp-to-Subject distance determined by the f/ stop used for the exposure. The lower illustration shows an identical exposure without the flash.

as the interval of light output is fixed. That is the length of time a flash "burns." Most flash lamps burn no more than 1/25 of a second, with peak light output lasting only about 1/50 of a second. So when we talk about gearing our exposure to the flash we mean we have to assume a predetermined flash shutter speed of about 1/50 of a second, and with that factor fixed then determine at what f/ stop we can expect any effectiveness from the flash.

Some explanation should be given as to why I have suggested, or at least inferred, that one should use such small f/ stops as f/11 or even smaller. One reason, and the one previously mentioned, is to insure holding good depth in one's color shot, on the assumption that you do not like out-of-focus backgrounds any better than do most other color enthusiasts. The other reason, and in practice you will find it a perfectly valid one, is that the smaller the f/ stop the slower the shutter speed, and with slower shutter speeds you are more likely to have efficient synchronization of shutter and the flash, as all you need be concerned about is that the flash fire sometime during the interval the shutter is open. Still further, there is a lag in extension cord flash, and size of wire and other factors enter into precise synchronization, all of which (within reasonable limits) is eliminated when you use a shutter speed of 1/25 of a second or slower.

After all this discussion of synchronized flash in sunlight, a perfectly natural question is, "Does Flash, as a supplementary light source, improve outdoor Kodachrome results?" The answer is a most emphatic "yes," on relatively close-up shots and if your composition includes any sizeable or distracting shadows. Obviously there is no need for flash on perfectly flat-lighted sunlit subjects. But such flat lighting is not always the most interesting, and two light sources give one an opportunity for controlling value range and rendition of color not possible with one light source. And in controlling the value range one controls the modeling of his subject to a very appreciable extent.

We use flash, in sunlight, with black and white to hold detail in the shadows. We use it in color not only to hold detail but to preserve color, and to bring the value range of the subject well within the effective limits of the Kodachrome film. It cannot be repeated

63 *Using Flash on Extension Cord. Such accessory equipment permits placing where it is most needed and closer to subject. Used here to throw light into some hard face shadows, caused by the strong side-lighting.*

too often that in all color work we must strive to shorten the scale of values of our composition; must bring the scale of values within shorter limits than is necessary for good black and white. It seems rather strange that synchronized flash should be so universally recognized as a most necessary adjunct of good black and white photography, when so little has been done to promote its use with color, where its usefulness is even more pronounced.

Perhaps we can add some weight to our argument for synchronized flash outdoors by showing a "before and after" example. The illustration (Figure 62, page 111) shows how much a GE No. 21B (one of the smallest lamps for outdoor use) blue photoflash lamp opened up the shadows on the girl's figure. There was no change in camera position nor distance, nor in exposure. The lamp, on an extension cord, was placed under the umbrella just outside the picture at the right, and the light was directed by a small reflector of the type used on flash guns. The flash lamp was about four feet from the figure. Camera was about nine feet from the foreground figure.

Although the man was four or five feet beyond the foreground figure the flash had some effect even at this extra distance, as evidenced by the shadow across his arm and body cast by the umbrella pole. There is nothing unusual in this shot in either its conception or execution. It is a most ordinary, snap-shotty type of picture but you do not need to see the Kodachrome transparencies to appreciate that in the one with the flash the shadows were eliminated and the figure had roundness and solidity. In the other, the figure had only a two plane modeling—one plane all light, and the other all dark.

Exposure on this shot was 1/10 of a second at f/16 on 4x5 Cut film Kodachrome when the film had a speed of Weston 5, instead of the present speed of 10. This exposure (f/ stop) was not enough for full effectiveness of the flash (it should have been f/11 or f/12.7) but the f/ stop used was purposely a little smaller than flash data called for in order to keep away from an overlighted, flashlight feel in the color result.

Extension Cord Flash

This use of photoflash is so flexible and offers so many opportunities for better Kodachrome results that it deserves a little more

consideration than we have given it in the preceding pages.

Perhaps I should add that extension cord flash is not limited to situations where the need for supplementary light is almost imperative. In fact one would be safe in asserting that 75% of all close-up Kodachrome subjects could be improved through use of a flash on an extension cord. You notice we do not say merely that 75% of such color shots would be improved by use of flash as a supplementary light source *regardless of position* of the flash. We might carry that assertion still further and say that the best results will be secured if the flash is always used on a cord rather than in the gun at the camera.

The reasons for this preference for flash that can be placed independently of the camera position should be obvious. First, when you use flash at the camera, as a supplementary light source, in sunlight, you are more likely to get a flat, flash-light appearance in your Kodachrome result. Second, cross-lighting helps model the subject. Third, when the flash can be placed anywhere you have more flexibility in choice of exposure.

The illustration at left (Figure 63) may seem to be one of those cases where the use of synchronized flash was a little superfluous. But remember you are not viewing the subject from the same angle as was the camera. As you will notice by the ground shadows the subject is posed in a low side-light, the sun being a little to the back of the camera, but not at such angle one could designate as "flat" light. The lighting is flat side-light. From the camera angle there were some very hard shadows on the side of the face and figure. To have made the shot without the aid of flash the face and figure would have been entirely too contrasty in the Kodachrome, and because of the strong contrast between light and shadow the shadows would have been colorless, or almost so.

To get light into these shadow areas, even though they were small in relation to those areas in full light, three GE No. 21B photolamps were used in shallow reflectors. The perspective of the reproduction foreshortens the apparent distance from camera to flash, and from flash to subject, but the flash was actually at about a 45 degree angle from the camera axis. If deeper reflectors had been used it would not have been necessary to use three photolamps, but the reflectors used were all that were immediately available.

64 *Outdoor shot with exposure based on the illumination afforded by the flash bulb only, with sunlight being used for accent.*

The problem illustrated is a very simple one, but it is also one that demonstrates rather conclusively that flash at the camera would have been of little if any value.

You may be interested in another device I have found most helpful in all such synchronized flash work. The flash gun on the camera is wired so that it can be fired by a short extension cord with push-button switch. This removes all possibility of camera movement when you are making slow exposures, gives one the opportunity to stand at a different level than camera position, or any one of a dozen other advantages helpful in practice.

Balancing Flash and Sunlight

You will not want to stop with the use of flash purely as a supplementary side or fill-in light, but will be eager to undertake balancing flash with sunlight in such problems as shown in the reproduction above. This illustrates

the second simple adaptation of flash technique, previously mentioned as "*Synchronized flash, in sunlight, to furnish a light source nearly equal to that of the sun, using the flash to illuminate the back-lighted side of the subject, the sunlight being utilized for highlights and accents.*"

In this problem (Figure 64) the sun was behind and a little to the left of the figures. Time, about 2 o'clock on a June afternoon. Visualize, if you will, that the figures were getting no light except on those planes turned toward the sun. Those planes are most evident on the man's figure—the side of his face, his right shoulder and the planes of the legs facing the sun. On the girl's figure the sun was catching the outline of her hair, a little of the side of the face, the outline of the shoulders and was hitting her hands and knees. If the shot had been made in that light we would not have had even a satisfactory black and white result as the contrast between light and dark was too great to hold both extremes.

To have over-lighted the shadow areas would have produced a flat result much the same as though the figures were facing directly into a low sun. The object was to utilize the sun for strong modeling and accents, and by so doing produce a Kodachrome result that would look like one thinks his eyes see such a light effect. Above all, it was important to hold the feeling of strong sunlight, which could be accomplished by slightly under-lighting the shadow side of the figures. for the sake of all the contrast the latitude of the Kodachrome film would permit.

Exposure calculations were determined as follows: Meter readings were made of the areas in full sunlight—the highlighted areas of the final result. The back-lighted portions (most of the composition, in fact) were disregarded in these meter readings. A Wabash No. 3B photoflash lamp was used near the camera, at the same low angle. The distance the flash should be placed was determined by using the flash manufacturer's table for exposure when flash is employed as the *sole* light source. This calculation disregarded for the moment, the meter readings of the sunlit areas. Whatever sunlight was being reflected into the back-lighted areas of the figures was disregarded because the effective light from the flash would "smother" this weak light.

The indicated f/stop for the flash at six feet from the figures was f/11. The meter readings of the sunlit areas called for a shutter speed of 1/25 of a second if stop f/11 was to be used. Theoretically, such an exposure should have balanced the amount of illumination of the flash with that of the sun. But as we stated before, we wanted "contrast," and the best way to get it in this instance was to slightly overexpose the sunlight portions of the subject, and underexpose the flash-lighted portions. By opening up a half stop (about half way between f/11 and f/8) we were sure of overexposing the lightest areas, and by moving the flash back from six feet to nine feet we were equally sure of underexposing the flash-lighted areas. (In this instance, f/8 would give us the same flash exposure at nine feet as f/11 at six feet. Since we used a half stop smaller than f/8 in the exposure, the flash portion of the picture was underexposed one-half stop.)

But, you may ask, why all this seeming complexity? Why not take the shot in flat-lighted sunlight and be done with it? True, you could take such a shot in typical flat light, but you would have lost the strong modeling and the feeling of strong sunlight produced by the contrast. Further, few people can face a low sun without squinting or making a wry face.

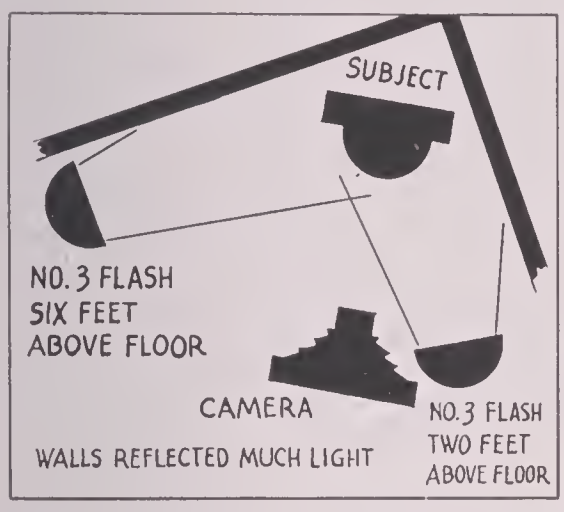
The two examples cited of the use of synchronized flash in sunlight are by no means rigid formulas for such use, but are presented as suggested starting points from which you can adapt the principles involved to color problems you encounter.

Flash as Sole Light Source

In such use of flash with Kodachrome one can very generally follow the same formulas as for work done with photofloods as a light source, with some exceptions. In the majority of color problems in which we use artificial light as a sole light source we can use either photoflash or photoflood, with equally good results. For the beginner in artificial light work, photoflood offers some advantages over photoflash in that one can experiment with placement and angle of lights, he can check each move with meter readings, and he has the satisfaction of seeing his subject, before he makes an exposure, about as he will see

65

Photoflash used as the sole light source, with lamps in reflectors as indicated in the diagram below. This is almost the identical lighting arrangement used in making the shot shown in the Color Plate on page 107.



66 *Diagram of the lighting arrangement used in making the picture shown at the right.*

it in the final Kodachrome result. This disadvantage of photoflash. can be somewhat overcome if one makes his lighting arrangement with photofloods in the reflectors, and then replaces the photofloods with photoflash lamps (after pulling the plugs in the house light circuit), and then fires the flash.

On the other side of the argument, photoflash has the advantage of providing (or can provide) a greater volume of light, and since the flash exposure is, of necessity, short, you can stop movement or guard against the possibility of movement. In portraiture, flash assures "open," more natural eyes.

In placing photoflash lamps for proper illumination, one can follow the rules for good lighting with photofloods. That applies to angle of lights only, for there is no rule of relationship as to comparative distance of lights to subject, when using photoflash in a photoflood lighting arrangement. Distance of lights to subjects is a matter of exposure calculation, based upon dependable exposure tables furnished by the photoflash lamp manufacturer.

The illustration shown on this page (Figure 65) shows the use of two front lights, neither of which was placed far enough from the camera axis to be called a side light. The diagram at the left (Figure 66) shows the position of the camera and lights in relation to each other and to the subject.

Two Wabash No. 3 flash lamps were used, one at two feet from the floor, at the right of the camera, and the other at camera height, and to the left of the camera, as you will notice. The light at the right was more directly in line with the camera, but at a low angle to fill in eye and chin shadows that might be cast by the other light and by a certain amount of light reflected down from the ceiling.

The exposure was made open and shut, the shutter set on bulb and held open while the

flash was fired by a push-button switch wired to the battery box. As this was what would be designated as a "lighter than average" subject, the f/ stop used was one-half stop smaller than that called for by the lamp manufacturer's data for two flash at the distance lamps were set. We arrived at this deduction of "lighter than average" because there were no dark colors in the composition that needed any special compensation; the figures were posed in the corner of a room that had light colored walls and ceiling, and oil painted walls at that, which meant that these surfaces would reflect a maximum amount of light on the subject, as well as "kicking" the light around with some resulting diffusion.

The apparatus used for this shot was of the home-made variety and especially adaptable to indoor work because of its capacity. The outfit will permit the use of as many as eight outlets and twice that number of ordinary flash lamps, if one should ever wish to use such an abundance of light. The apparatus is described and illustrated later in this chapter.

In using photoflash indoors, the same care must be exercised in placement of lights as one would use in photoflood work. And the same reflected unwanted color casts must be guarded against. In placing your subject in a room be sure that all reflected light will enhance your color result, which means that the safest reflecting surfaces would be white or nearly white walls. When you are lighting your subject with photofloods you have an opportunity to survey and appraise the effect of these reflected lights in arranging your composition and your lighting. It is a little more difficult to foresee some of these effects when using flash, so take a second look at all surroundings before you fire the flash.

It should be mentioned that one can use either regular or daylight flash, indoors, with the proper film, and with equally good results although there is a slight difference in color quality. For those Kodachrome enthusiasts whose principal shooting is outdoors, it is a great convenience to be able to use daylight film indoors with daylight type photoflash lamps.

Follow rules for good lighting and a dependable table for exposures and you will have no difficulty in producing brilliant, colorful Kodachromes indoors, with photoflash as sole light source.

Flash and Supplementary Light

What we mean by using some existing illumination as a supplementary light source can best be explained by describing an actual problem involving such use in combination with photoflash.

The reproduction on the opposite page, from a Kodachrome shot made in Lehman Caves National Monument, Nevada, shows this use (Figure 67). Photoflash was used, of course, as the principal light source, but the pictorial and color result were both very much dependent upon use of the Cave lighting as supplementary light.

This shot was made with open and shut shutter exposure, set on "Time," with the flash fired by a battery box similar to that described on a following page. The exposure was *based* on the flash data, as to diaphragm stop and distance of lights to subject. This matter of distance was more of a problem than usual, as the formations were very open and the surfaces in the foreground were small in relation to the total area of the composition. It was obvious that one could not expect much reflected light assistance, although the irregularity of the surface formations did break up and diffuse the light somewhat. There was the second problem of getting light into and onto areas beyond the immediate foreground.

The final exposure deduction evaluated this subject as a night shot outdoors, where there are no surfaces to gather and reflect the light, and in which cases it is always advisable to use the next larger f/ stop than for same distance of light to subject indoors. Obviously this exposure would tend to overexpose the immediate foreground but one could afford to take that chance in order to give better exposure to the surfaces beyond the immediate foreground. The flash lamps were placed about 12 feet back from the figures and those formations in the same plane. Going back to the law which states that "light diminishes in intensity inversely as the square of the distance," we instantly calculate that surfaces 24 feet from the flash would need *four* times the exposure of those 12 feet from the lights. Surfaces 36 feet from the lights would need *nine* times the exposure. And some of the surfaces

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A flash exposure combined with the indirect lighting in the cave. Foreground was lighted by flash only; the surfaces beyond 25 feet got practically all their exposure from the lights in the cave. To register these surfaces required a three minute exposure.

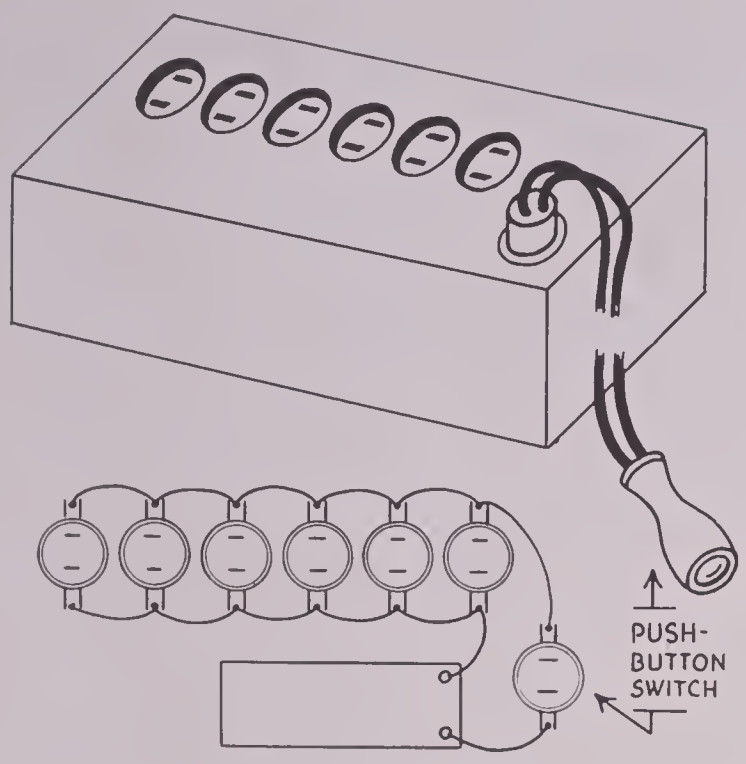
shown in that shot were more than 36 feet from the flash lamps.

With no light except that from the flash all surfaces beyond 18 to 20 feet would have gone as black shadows, unless, of course, a sufficient number of extra flash had been used to permit spotting them throughout the area of the composition and at a distance from each step-back to provide approximately even illumination. To do that in this instance would have required no less than six photoflash lamps.

The alternative was to make use of the available Cave lighting, as a supplementary light source. This lighting was very weak and indirect, but sufficient to register if given a long exposure. Obviously the models could not hold motionless for the several minutes necessary to register any appreciable effect from the Cave lights.

The shot was made with two No. 75 (GE) photoflash lamps, on type B Kodachrome, with a 2A filter. The reflectors were wider angle than one would usually employ for close-up shots, to give better coverage. One flash was placed to the right of the camera, about 12 feet from the models. The other flash lamp was some 25 feet in front and to the left of the camera, hidden behind one of the formations. This light was so placed as to give some cross lighting as well as to carry into certain areas of the middle distance the other flash would not reach.

After the flash was made (shutter still open), the lens was covered while the models moved out of range of the camera, and then the exposure was continued for three minutes, to register the Cave lighting. Fortunately none of this Cave light fell on any of the foreground formations, and the three minute exposure registered the distant areas and formations which the two flash lamps did not and could not reach. If this secondary exposure had not been made all areas and surfaces beyond the effective carrying power of the flash would appear as black holes in the composition. As the result turned out, you will notice that some of the background got more exposure from the Cave lights (at three minutes) than did the foreground from the flash. Although the black and white reproduction gives you no idea of the color rendition in the Kodachrome, it does show very clearly just what effect both the flash and the Cave light had in producing the result. The



68 *Multiple outlet battery box for simultaneous firing of up to six flash, on open and shut exposures.*

foreground formations have texture and modeling and they have none of the flat, flash look; the middle distance and background formations also have sufficient modeling and texture, and there are no objectionable shadows cast by foreground formations onto the ones behind them.

This problem is distinctly an individual one that had to be analyzed in terms of the conditions encountered. Perhaps it is not indicative of a common use of flash and supplementary light, but as every problem is different and must be appraised for what it is, you need only concern yourself with the same simple steps any such lighting problems require.

One adaptation of this flash and secondary light combination is in the use of house lights such as reading lamps, fireplace light, and so on. In such instances it is assumed that the secondary, or supplementary light is of low intensity—a 60 or 75 watt bulb in a table lamp, for example—and that this secondary light is placed where the flash has not already given the area more exposure than the secondary light can register. In most such uses it is desirable to keep such secondary lights outside the picture for unless the bulb itself is hidden by a rather opaque shade you will register the lamp itself too strongly in relation to the areas the light from such a lamp is covering.

Many other adaptations of this flash and supplementary or secondary light use offer opportunties for a variety of new and pleasant Kodachrome results.

Multiple Outlet Battery Box

Those of you who do not have a flash gun and who do not care to invest in one for an occasional indoor shot with flash, will be especially interested in this device. This inexpensive battery box can be made by anyone who is handy with tools and who can follow a simple wiring diagram.

The battery box illustrated (Figure 68) has six regular outlet plugs, the same as is used in outlet boxes for floor lamps. These are wired in parallel, with the circuit broken by one plug into which the push-button switch cord is plugged. To be sure of ample current if and when as many as eight No. 75 photoflash lamps might be fired at one time, the power source should be a 45 volt radio battery. If you expect to use less than eight No. 75's at maximum, or prefer to use smaller lamps, a 22½ volt battery is sufficient.

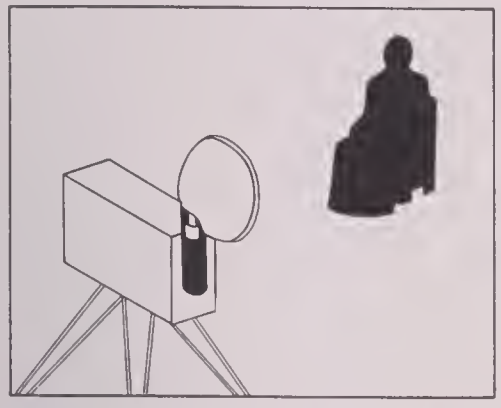
With a battery as current source, this box can be used anywhere you can make open and shut flash exposures. If you do not care for such flexibility, and expect to confine its use to indoor photography where you will always have an electrical circuit to plug into, you can dispense with the battery and fire the flash from the house current. If you want to make a dual purpose outlet box you can wire for both the battery and for house current use by interposing a switch so that you cut out the battery when box is plugged into house circuit or switched over to the battery when you depend upon it as source of current.

Since this paraphernalia can be used only on open and shut flash exposures, we do not have to be concerned with lag due to kind or length of wire used in the extensions.

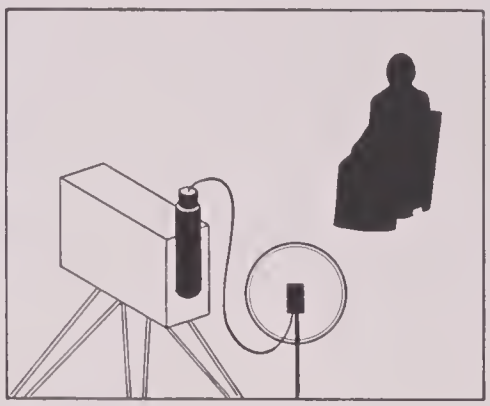
A Few Suggestions

In summarizing our considerations of this subject of Kodachrome and Photoflash, we should segregate the problems encountered into two general categories—(1) synchronized flash in sunlight, and (2) flash as the sole or principal light source.

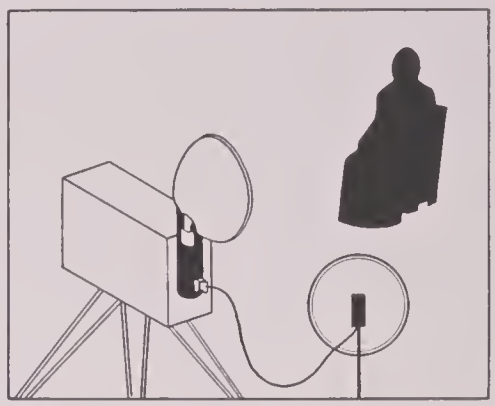
SOME SUGGESTED LIGHT PLACEMENTS FOR SYNCHRONIZED FLASH



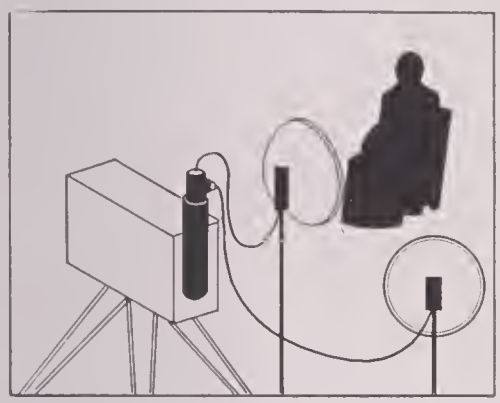
69 *Flash at camera, to fill in shadows from overhead sun*



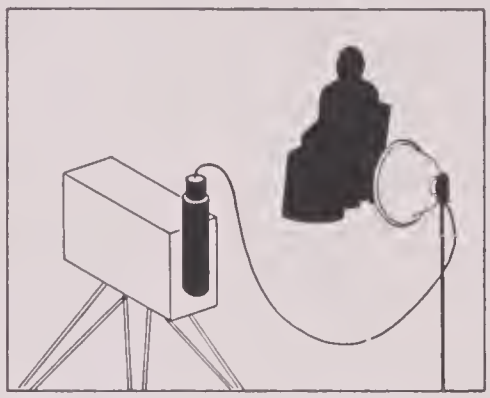
70 *Flash on extension cord, for more varied light placement*



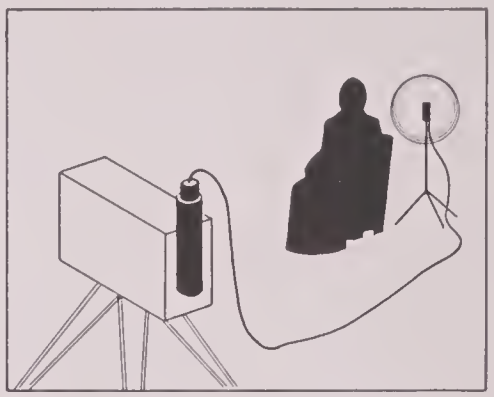
71 *Flash at camera and one on extension cord, for more coverage.*



72 *Two flash on extension cord, for more choice of light placement*



73 *Flash on extension cord, used as a side, fill in light*



74 *Flash on extension cord, to light background, or back-light subject*

The basic and apparent purpose of synchronized flash in sunlight is to illuminate shadow areas so they will be well within the exposure latitude of the Kodaehrome film. If and when we bring the darker areas within the latitude of the film, we then base our exposure on the sunlit portions of the eomposition, rather than upon a eompromise between the lightest and darkest areas. If the flash is used properly and in sufficient volume, not only will it assist in getting a proper exposure of those areas covered by the flash, but you will more properly expose the fully sunlit areas beeause your exposure is based on them.

When one eonsiders the comparatively short latitude of Kodaehrome film, this use of synehronized flash is imperative in a large pereentage of closeup outdoor color shots *if* one wants the best possible results.

The seeond general use of flash, as a sole or prineipal light souree, hardly requires any elaboration. Whether you use photoflood or photoflash indoors is largely a matter of personal preference except in certain eases where photoflash is more desirable beeause it provides suffieient light volume for a short exposure. In outdoor shots at night or indoors when photofloods eannot be used (as in the Cave shot) there is no choiee but photoflash.

While on this subject of indoor flash work I suggest that pleasing effects ean oftcn be seeurcd by using one flash lamp (when two or more are being used) in a home lighting fixture. If a flash lamp is placed in a table lamp, for instanee, you must remember that the effective volume of light is greatly dissipated or scattered, as it is not being directed by a reflector which forces the light to go in one direction. However, this use of house fixtures adds greatly to the feeling of "authentieity" and naturalness in light effeet.

One eould go on ad infinitum on this subjeet of photoflash, but the purpose of any sueh discussion should be to suggest ideas and basie procedures that stimulate your interest and imagination, and that give you the urge to create and develop your own techniques. It is learned best in the doing.

Observe these simple suggestions in your photoflash work:

1. Be sure your batteries are fresh.
2. Use only efficient reflectors.
3. Clean reflector surfaces before using.
4. Use the appropriate size flash lamp.
5. Use a lens shade, the deeper the better.
6. Do not overexpose indoor flash shots.
7. Take care that reflectors are properly "aimed" at the areas you want the light to cover.
8. Avoid too much flat lighting. Use two or more flash lamps on night shots when you can—one as principal light source (imagine it is the sun) and the other lamp as a side light, to fill in shadow areas.
9. In night flash shots outdoors, use one stop larger than for indoor shots (light is dissipated outdoors; is reflected back indoors).
10. In synchronized flash work use shutter speeds of 1/25 of a second slower, and with camera on tripod. This recommendation applies only to color work. (There are exceptions, if you want to attempt fast action shots, but Kodachrome's speed is too slow for much flexibility in such use, without special equipment).
11. Check all wires and contacts to be sure the flash will fire when you press the button. If your shot requires large flash lamps or two or more of any size, it is advisable to fire a test flash with an inexpensive "peanut" lamp to be sure equipment is working properly.
12. On indoor shots make effective use of walls and ceiling to reflect and diffuse the light but *avoid* unwanted color casts that might be reflected back onto your subject.
13. Until you have developed better formulas for your equipment, base your exposures on dependable exposure tables—those furnished by the photoflash lamp manufacturer.
14. Always use the blue, "daylight" type photoflash lamp in daylight or with daylight type Kodachrome indoors.

Table for Lamp-to-Subject Distance for Synchronized Flash, used as Fill-in Light, in Sunlight

If two flash lamps are used at separate positions, base calculation on lamp nearest subject

DAYLIGHT TYPE KODACHROME

SHUTTER SPEED	Flash Lamp	f/12.7	f/11	f/8	f/5.6	f/4.5	f/3.5
1/25 or slower—for 1/100 use 1 f/ stop larger or reduce lamp distance ⅓—for 1/200, 2 f/ stops larger or reduce lamp distance ½	2 No. 21B	5 ft	6 ft	9 ft	12 ft	16 ft	20 ft
	1 No. 2B	4 ft	5 ft	8 ft	10 ft	14 ft	18 ft
	1 No. 3B	6 ft	7 ft	11 ft	15 ft	20 ft	25 ft
	NOTE: No. 21B is a GE Lamp. No. 2B and 3B are Wabash Lamps.						

The above table (worked out for my own equipment), as well as all others for such use, can only suggest and recommend. Type of reflectors, the contrast range of the subject, the angle at which flash is placed—all these and many other factors influence results.

Indoor Photoflash Table for Lamp-to-Subject Distance—The Flash as Sole Light Source

If two or more flash lamps are used, base exposure calculations on lamp used as principal light source

Artificial Light Type Kodachrome—Shutter Set on "Time" or "Bulb"

TYPE "A" KODACHROME (35 mm. and Bantam)

Flash Lamp	at 6 ft	at 9 ft	at 12 ft	at 18 ft
No. 11 (GE)	f/16	f/11	f/8	f/6.3
No. 50 (Wabash)	f/12.7	f/9	f/6.3	f/5
No. 3 (Wabash)	f/20	f/14	f/10	f/8

TYPE "B" KODACHROME (With 2A or CC15 filter)

Flash Lamp	at 6 ft	at 9 ft	at 12 ft	at 18 ft
No. 22 (GE)	f/20	f/12.7	f/9	f/6.3
No. 75 (GE)	f/25	f/18	f/12.7	f/9
No. 3 (Wabash)	f/12.7	f/9	f/7	f/4.5

Daylight Type Kodachrome—Indoors—With Daylight (Blue) Flash

35 MM. AND BANTAM SIZE KODACHROME

Flash Lamp	at 6 ft	at 9 ft	at 12 ft	at 20 ft
No. 2B (Wabash)	f/10	f/7	f/5	f/3.2
No. 3B (Wabash)	f/14	f/10	f/7	f/4.5

CUT FILM KODACHROME

Flash Lamp	at 6 ft	at 9 ft	at 12 ft	at 20 ft
No. 2B (Wabash)	f/11	f/8	f/5.6	f/3.5
No. 3B (Wabash)	f/16	f/11	f/8	f/4.5

Lamps must be used in efficient reflectors. The above distances and f/ stops are for "average" subjects. If subject is darker than average, open up ½ stop; if lighter than average, close down ½ stop. (For more detailed information as to other available photoflash lamps and their exposure data, check the lamp manufacturer's latest data sheet.)

CHAPTER 9

REFLECTORS AND DIFFUSERS

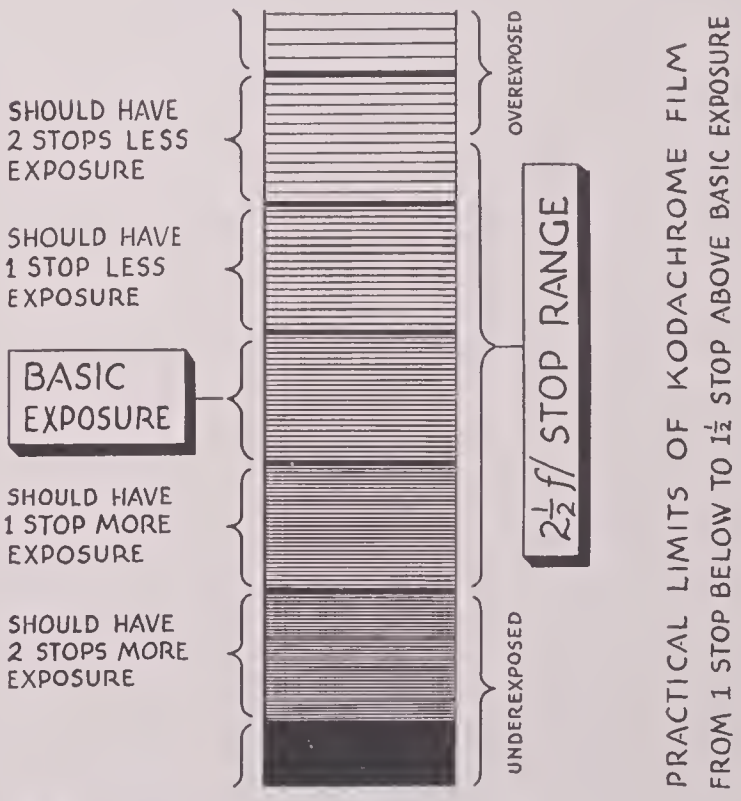
AN EVER present problem in color photography, whether in Kodachrome or any other color medium, is that of excessive value contrast in the color subject when the subject is illuminated only by one light source, as by the sun, or a front flash or photoflood light indoors.

This value contrast is accentuated, in effect, in the Kodachrome result because the film does not have sufficient latitude to record, faithfully, the extremes of light and dark in the same composition, at any exposure that does justice to the main portion of the picture. This inability to hold detail and color in the highlights and shadows gives the Kodachrome a hard, contrasty appearance that is most displeasing. If you will forget, for a moment, all about color and will analyze the Kodachrome purely from the standpoint of black and white standards, you will find that many of your color shots are not too good as color transparencies, and in terms of black and white tone value rendition they are still worse.

This comparison will emphasize the necessity for shorter scale lighting on your Kodachrome subjects, if you want to get better than average color results. It will serve to prove that one must adjust the lighting of his color subjects to the latitude or "capacity" of the Kodachrome film, for the film has no ability to make compensations for value extremes in your subjects.

In the chapter on "Outdoor Exposure Calculations" we suggested that a good practical limit for Kodachrome exposure latitude is two and one-half (2½) f/ stops. By that we mean the darkest darks in your composition should not call for more than 2½ stops more exposure than your meter indicates should be a correct exposure for the lightest lights. In other words, if the black and white value or brightness range of your subject is more than 2½ stops, (a scale of 1-6) either the lightest or darkest values, or both, will be beyond the latitude of the Kodachrome film. (Figure 75.)

You may ask, "Does it matter if shadow areas go black?" If you are at all critical it matters very considerably. There is a decided difference in overall color quality between the effect of a black object in your composition and a shadow area that goes black. True, they are both "black" in the Kodachrome. But in the case of the black object there will likely be some tone change to give at least a suggestion of form (unless the object is two-dimensional), if nothing more than a highlight. Even such meager tone variation gives the



75 *Graphic illustration of the efficient f/ stop latitude of Kodachrome film.*

object some color interest, but one can hardly say that a black shadow area can ever appear as anything more than a distracting displeasing "void." When such a shadow area is surrounded by or associated with color in the other areas of the composition, we keep trying to see color and detail in those shadow areas, for our brain tells us that there is color buried somewhere in that mass of black.

If we get better color results when the values of our compositions are kept within a 2½ stop range, how can we easily and most effectively control our lighting to create the needed shorter scale of values?

Obviously we cannot "compress" both the light and dark extremes of the composition, to bring them into a value range closer to the "middle" values of the composition. Just as obviously we cannot "compress" the lightest values *alone*, for any device that would decrease those values would lower all the values of the composition.

But we can raise the value of the dark areas without disturbing the other, lighter values, and in so doing bring the extremes of light and dark closer together, and within the latitude limits of the Kodachrome film.

Using Reflectors

It is understood, of course, that all the preceding discussion has to do with close-up compositions, the limit of distance from camera to subject being not more than the limit of effectiveness of any device we may use to add light to shadow areas. The exception would be when we might use a reflector to light a foreground object in an expansive scene.

We have already covered one phase of this use of "supplementary" light in the chapter on "Photoflash"—synchronized flash in sunlight. That is one way to raise the value level of dark or shadow areas, and it has many advantages to recommend its use. Its portability and flexibility in use are two very distinct ones. But flash also has disadvantages. One is the cost of synchronizing equipment. Another is the cost of photoflash lamps. A third is that one cannot see beforehand just what effect the flash will have on the final result. There is no chance for meter readings, or experimenting with a variety of light placements.

Efficient reflectors are, for the average amateur, a much preferred device for creating supplementary light. True, reflectors haven't the portability of flash equipment, but if most of your color shooting is done around your own home, this is no serious handicap. In fact it is less trouble to set up a reflector than to get into action with flash equipment.

Reflectors offer the opportunity to (1) experiment with placement for best light effect and (2) to check such placement with your light meter to reassure yourself that the reflector is raising the darker or shadow area values sufficiently to be well within the limits of the exposure you propose to use.

There is nothing mysterious about the use of a reflector. You simply place it in such position that it catches the direct rays from your light source, and at the same time reflects this gathered light into the areas you want lighter in value.

You follow the general rules for placement that we have previously discussed in connection with photoflood and photoflash when they are used as a supplementary light source. And somewhat the same general rules apply in regard to distance of supplementary light to subject. The closer the reflector is to the subject the more light it will pour into the shadow area; the farther away it is the less effect it will have, naturally. The type of reflecting surface used also greatly influences the effectiveness of any supplementary light source.

Reflectors in Sunlight

Any efficient reflector will produce the greatest volume of reflected light, in full sunlight, when the reflector is set at or nearly at a right angle to the sun. There is a serious dissipation of reflected light when the reflector is used obliquely to the sun's rays. But care should be taken not to place the reflector too far around on the shadow side. In general the reflector should not be at a greater angle than 75° from the axis of the camera.

As surprising as it may seem a reflector will be effective even when the sun is all but obscured by high fog or slight overcast. We are accustomed to consider "shadows" as something cast in direct, full sunlight, and to think that there are no shadows in diffused light.

76 *Showing the use of a reflector to fill in shadow area on face and figure, to simulate the effect of light reflected from the ground. As a long focal length lens was being used, the picture framed only the girl and the horse's head.*

However, if the diffused light is created by fog or overcast, there is a shadow side to every three dimensional object in your composition. While it is true that diffused light shortens the value scale of any composition it does not create equal illumination on all sides of the objects in your subject.

I mention this only because most of us have not developed a sufficiently keen perception for subtle or close-together values.

77 *Using a reflector close-up. This aluminum reflector returns a light volume, at close range, equal to full sunlight.*

Another reason for using reflectors in sunlight, entirely aside from the ostensible purpose of raising the value of the shadow areas, is to improve the color quality on the shadow side. The shadow side of any subject, is of course, opposite the source of light, and in consequence this shadow side is being affected by blue sky reflection (if the sky is clear), and by a preponderance of diffused blue light if the sky is overcast.

One common mistake is to put the reflector too low and too close in on a figure with the result that the reflected light gives a "foot-light" effect on the face and figure. This is pleasing or otherwise, depending upon the effect you wish. But it is advisable to guard against such errors if you desire a feeling of "naturalness." To get such feeling you should add only a sufficient amount of light to hold detail and color in the shadow areas, for you certainly want roundness and modeling for strength.

Keep in mind that there are two basic uses of supplementary light. We can employ it (1) to create effects, one of them being the "foot-light" feel just mentioned, or (2) we use such a light source for the sole purpose of getting light into those areas not reached by our principal light source. This last use is, of course, the one that concerns us most.

Before we forget about the possibility of special effects with reflectors, it might be well to enumerate a few simple adaptations of the idea. The "foot-light" effect is one. A variation

(Continued on page 127)

MT. BAKER ACROSS BAKER LAKE, WASHINGTON

As is obvious, this scene taxed the limit of Kodachrome's latitude. The value or brightness range is extremely long, from the atmospherically diffused snow on the mountain to the dark value, light absorbent foliage in the foreground trees, most of which were not in full sunlight.

In arriving at an exposure calculation, meter readings were made of all foreground areas and the water, with the meter shielded from sky influence. It was impossible to make readings of the distant areas, but a reading was made of the sky above the mountain, for as the sky was a darker value than the white snow, such sky reading was an assurance that the snow would tend to be overexposed even at an exposure based on a sky reading.

Exposure was based on a reading of the water in the foreground, with the knowledge that the dark trees would be underexposed in any case except by an exposure that would be correct for them alone. Any more exposure than was used would have washed out the sky and the mountain. Fortunately, the mountain was sufficiently side-lighted to give it some form and surface texture.

A Kodachrome filter was used to add a little "warmth" to this excessively "cool" scene. In fact, I generally employ such filter correction on subjects in which large areas of sky and water set the color mood, because Kodachrome has a tendency to accentuate blues in such expansive landscape scenes.

DATA: Exposed on 4x5 cut film Kodachrome; Camera, Speed Graphic; Lens, 5¼ inch Zeiss Tessar; Filter, Eastman CC13. The reproduction is 200 line deep etch four color offset lithography, plates made from the transparency.

is to use a color reflector, or stretch a large piece of light-colored cellophane across the reflector so that the reflected light adds color to the areas it strikes. Suppose you want to emphasize the warm reflected light from a dry sand beach. A light straw colored cellophane over the reflector will produce an excessively warm glow on the planes of the subject upon which the reflector is focused. Your own imagination will suggest many other ideas for the unusual and pleasing in special effects with reflectors.

All such experiments are easily performed and the results just as easily controlled, for you can study and alter the setup until you are completely satisfied, and you can check and recheck light readings with your meter, and *know* beforehand what the final result is going to be.

Getting back to the more general use of reflectors, Figures 76 and 77 show the device employed at about the two extremes of distance of reflector to subject. In Figure 76 at the top of the page the reflector was used at considerable distance because the shadow side of the face and figure was already partially lighted by light reflected from the ground, under a hot Arizona sun. In the other use illustrated, (Figure 77) the reflector was used very close to the subject because of the strong side light and equally strong shadow area. In addition there was no appreciable amount of light being reflected into the shadow area by any surrounding surface.

There is no need to elaborate further on suggested uses of reflectors in sunlight. No tables could be devised for distances or angles because every reflecting surface is either more or less efficient than what might be called standard, and you need nothing more than a light meter and a little judgment in order to use any good reflector effectively, and with excellent color results.

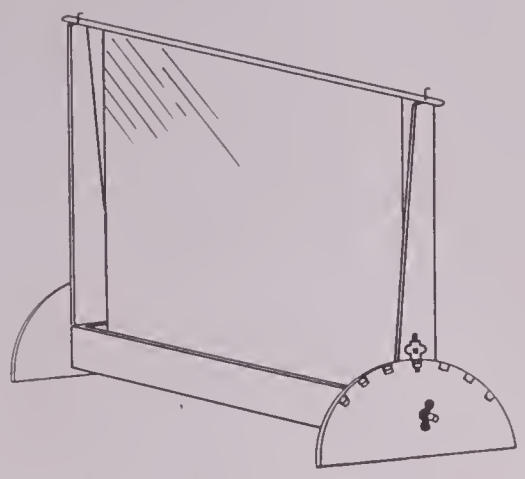
Reflectors and Artificial Light

Because we are in the habit of associating reflectors with outdoor color work we are apt to lose sight of their adaptability for indoor use. In the chapters on "Photoflood" and "Photoflash" we touched upon the use of walls or other interior surfaces as a source of some reflected light. While it is true that such

78 *Using a reflector with a single photoflood lamp, to open up shadow areas. Reflector set to catch direct light from the photoflood.*

surfaces do kick-back and diffuse a considerable volume of light, they are seldom adequate when we are using a front or nearly front single light source indoors. For one thing a wall is usually too far removed from your subject. You do not want to squeeze the subject into a corner just to get fuller use of light reflected from a wall, and for another, it is impossible to turn the wall to a better angle, and often undesirable to attempt to turn the subject to accommodate the angle of the wall.

If you are using a single artificial light source and this single source is creating a displeasing shadow area on the "off" side, you can quickly remedy the difficulty by setting a reflector at the proper angle to the light and subject. (Figure 78.) Get the reflector as close to the subject as possible and still keep it out of the picture. Sometimes such placement of the reflector kicks light back into the lens but this can be overcome by standing a floor screen or some other opaque "mask" between the camera and the reflector so that there is no possibility of any of the reflector's light hitting the camera lens. If you have the reflector out of the picture this screen can also be kept out of the view of the camera, of course.



79

A sketch of the roll-up reflector made from a window shade. Details in text.

Personally I would not recommend the use of a reflector indoors when you are using flash as a sole light source, principally because you have no way of accurately predetermining where and how seriously this shadow problem may be. And most difficult of all, unless you are an expert at figuring angles, is the placement of a reflector so that it will both catch the flash and reflect that gathered light onto the subject.

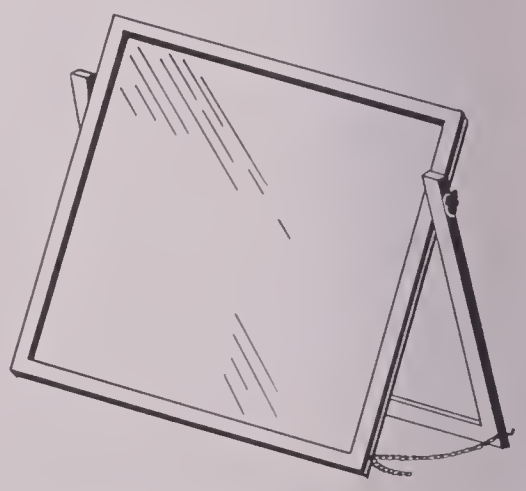
So much for the use of reflectors. This rather sketchy outline of suggestions is presented primarily to assist you in watching for those things that one should avoid in the use of any supplementary light.

Those of you interested in employing reflectors in your Kodachrome work probably have your own ideas as to type of reflector to use, and there are many on the market that are highly efficient. You can buy flat reflectors that reflect quite a spread, or you can buy "reflector spotlights" that concentrate the light very much as do parabolic reflectors for artificial lights. Or perhaps you would like to make your own, which any one can do if he can saw a board or drive a nail. Two rather efficient homemade ones are shown on this page, and they both can be made in short order and with a minimum of expense and material. (Figures 79 and 80.)

The first, a roll-up type, answers the problem of portability. The reflecting surface is a 40-inch white window shade of heavy cloth, one side of which was given a heavy coat of aluminum paint. By coating one side with aluminum or silver you have the choice of two surfaces. The shade roller is mounted in a 4-inch square box of a length to accommodate the roller. The lid is two 2-inch strips, one hinged at one end of the box, the other at the opposite end, and these strips serve as supports for the drawn shade. The shade is held drawn by attaching to the wood stick in the shade a flat metal strip at either end, which extends about 2 inches beyond the wood stick ends. There is a ¼-inch hole in the metal strips that slip over an "L" shaped screw in the ends of the boxtop strips. The tension of the shade roller spring keeps the shade taut and keeps the end fastenings from coming free.

The reflector is always vertical when the box is set on floor or ground unless some means is provided for holding it at any angle desired. The gadget illustrated has supporting wood end pieces, with the top cut in an arc, using as center a hole 3 inches from the bottom of the end pieces. To support the box between these end pieces there is a ¼-inch bolt inserted through the box ends, from the inside, and the end pieces are held firm by a wing nut on this bolt. Then to provide adjustment for any angle, there is a series of metal loops evenly spaced and flush with the arc top of the end pieces, and a sliding bolt (small door bolt with knob handle) is attached to the boxtop side supports. You merely swing the reflector back into the angle you wish and drop the bolt into one of the metal loops.

The other reflector illustrated is a simple wood frame of ½x1-inch material, 40″x40″, to which is nailed a sheet of aluminum. Then for rigidity a second frame of the same ½x1-inch material is nailed on the back of the metal sheet, giving the reflector a 1x1-inch



80

A rigid reflector — a sheet of aluminum in a wood frame. A heavy card covered with foil is equally efficient.

81

Side sunlight, with neither diffusing screen nor reflector

82

Same light angle, but with the light softened with a diffusing screen

83

Same light angle, showing effect of both the screen and reflector

frame with the appearance of the metal being inset in the frame. To support the frame a "U" shaped frame of 1x1-inch wood is attached with wing nut bolts about two-thirds of the way up the sides of the main frame. This can be used as an easel back, to adjust the reflector to any angle. To keep the easel and frame from doing a "split" attach a small chain to the center of the frame and a small headless nail in the center of the easel bottom support allows feeding out any length of chain to accommodate the angle you wish.

You will find either of these reflectors an indispensable aid once you start using one or the other as an adjunct to your Kodachrome technique.

Creating Diffused Light

We have several times referred to the desirability of "diffused" light for close-up color shots, especially those of people. We have mentioned that thin fog creates an ideal light for portrait studies. But we have not advanced the suggestion that you can create a diffused light condition, and with very little effort. Even if the effort needed was considerable, the results would more than justify any reasonable expenditure of time and money.

Any diffusing device softens the hardness of direct, strong light. It also lowers the value of the lightest areas without appreciably lowering the values of the darker areas. In fact a diffusing device operates in reverse to that of a reflector. The principal difference between a diffuser and a reflector is that the diffuser scatters the light and in so doing softens the hard edges of shadow areas. A reflector does soften the shadows, but it cannot reduce the harsh effect of direct, strong light, nor subdue extreme highlights.

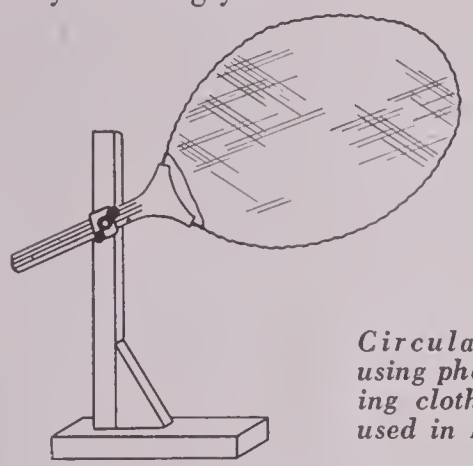
Before we discuss the construction of devices for creating diffused light let us take a look at the results that can be secured with a diffusing screen, and with a diffusing screen used in combination with a reflector. Figures show (1) a side-lighted head study, in full sunlight, without use of diffuser or reflector (Figure 81); (2) the same study with the direct sunlight softened by a diffusing screen, but with no reflected light added to the shadow side (Figure 82); and (3) the same study again with both the diffusing screen and the reflector employed to bring the range of values

as close together as possible without destroying roundness and modeling. (Figure 83.)

Fortunately this is one experimcnt that can be demonstrated in a black and white reproduction more effectively than in color, for we are primarily concerned, for the moment, with a study of the control of light intensities or subject tone values. If tone values are kept within narrow limits and if the exposure is correctly made, good color quality inevitably follows.

Study these three illustrations carefully, not to discover any technical excellence, for none is intended, but for minute comparison of the effect of these light control devices on every area and plane of the study.

If your forte is portrait or figure studies may I strongly recommend that you build or buy some paraphernalia for creating diffused sunlight conditions and thrill to a new experience in your Kodachromes.



84

Circular diffusing screen using photographer's diffusing cloth. Similar to that used in Figures 82 and 83.

Two Simple Diffusing Screens

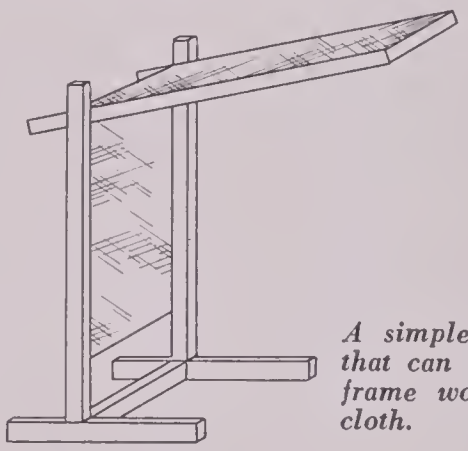
We have all seen the screens the portrait photographer uses to soften the harshness of his lights. We are talking about diffusing the light and not diffusing the image on the film.

You can buy such screens, or you can buy the cloth and make a framework more suitable to your needs, perhaps. Herewith are shown two types of diffusing screens, either of which most anyone can construct.

The first shown (Figure 84) is a circular heavy wire frame to which has been sewed a wide piece of this diffusing cloth. A wood standard may be used if it is heavily weighted at the bottom. Figure 82 shows an inexpensive metal stand made to hold a diffusing screen, an opaque blockout screen or a light on an extension arm. You can buy a similar stand at any well stocked photographic supply house. If you make the entire structure you will be ingenious enough to work out your own ideas for adjustment of screen height and angle.

The second type of diffusing device (Figure 85) is a little more pretentious and is only needed if you prefer to include full figure or other sizeable subjects in your composition.

This framework is patterned after the design of a baseball backstop, and if you wish to cover the back as well as the top with diffusing cloth you will have still further control over light conditions as this sizeable device will block and diffuse all direct light. With the circular screen sometimes the strong light passing around it falls on surfaces that reflect light back on the subject that is unwanted and equally undesirable.



85

A simple diffusing screen that can be made of light frame work and diffusing cloth.

These two suggestions for diffusing screens are offered as a starter for designs of your own, and perhaps better ones at that.

The point of this chapter will have been missed if we have not registered the desirability and importance of short scale light conditions for superior color results. Although such light conditions are especially preferred for portrait studies because they help the rendition of subtle flesh tones, the idea of diffused light is applicable to any color problem wherein you want the most faithful registration of all colors. In planning any color composition to be photographed under diffused light, bear in mind the same rule we have repeated so many times—keep the composition in "key," high, low or middle, but in any event do not include extreme contrasts in value in the same composition. Neither diffused nor any other kind of light condition can provide a sufficiently even illumination so that both extremes of light and dark can be captured with fidelity in Kodachrome.

CHAPTER 10

LANDSCAPE PROBLEMS IN KODACHROME

THE old saw that "Everybody loves a lover" might be paraphrased with the even more truthful statement that "Everybody loves a landscape picture." Landscape pictures have universal appeal and they speak a universally understood language.

When we go on a vacation or travel tour we feel a compelling urge to take home a pictorial record of those sights that impressed us when we are on the scene. We want those pictures to refresh our memories and to recall certain aspects of our original impressions that are easily forgotten without some visual reminder. We also want those pictures to help us share our enjoyment of the trip with our friends, and we know that words alone are sadly inadequate in conveying any mental picture of even the simplest scene. A picture does the job, for we all get more accurate and more lasting impressions through our eyes than we do through our ears.

Photographs you make always give you more satisfaction than any picture you can buy. And surely you get greater pleasure from taking good pictures, than you do from pictures that have no interest in composition and less to recommend them from the standpoint of execution and technical skill.

Now that you can capture, for your everlasting enjoyment, all the thrill of the color of a scene as well as its form, landscape photography has really come into its own as a medium for the millions. But with this medium of Kodachrome your results are either very good or rather bad. No longer can you fall back on the old black and white explanation that "This shot didn't turn out very well, but if it was a little more distinct you could see thus and so here and there." A good Kodachrome needs no verbal translation. A bad one is not even an "impression" of the subject.

With Kodachrome our opportunities are multiplied tremendously, but so are the necessities for care and thought in handling the medium. From my observations in contact with amateurs "on the scene" and all over the country I get the impression that too many of them have been sufficiently successful in their black and white work, to satisfy their uncritical standards, without exercising much care and less judgment. This "success" has been achieved with so little effort that it has bred an attitude of nonchalance which they carry into their color work. Perhaps they have been lucky. If the quality of their negatives has been erratic to the extreme these workers console themselves with the knowledge that they can compensate for poor negative quality through manipulation in printing. Such an attitude prompts a careless approach to the simple problem of negative exposure.

If every black and white worker had been taught from the beginning that he must print every one of his negatives on the same grade of paper, with identical print exposure and development, he would have fixed in his mind the rigid limits within which he must work if he is going to produce Kodachrome pictures of a quality of which the film is capable.

If you are shooting Kodachrome, when you click the shutter you are all done—done as far as making any alteration in the Kodachrome transparency is concerned. In Kodachrome work you must do your thinking *before* you press the button. Real thinking in black and white work too often starts only *after* the developing, fixing and drying of the negative.

This necessity for "before the exposure" thought and planning in Kodachrome photography is excellent discipline. If every beginner in photography started on color instead of black and white, seriously and with the

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Boulder Dam. A difficult subject under a clear sky and a bright desert sun. This shot made just after a rain, under a faint overcast sky. Such conditions gave the subject much more color saturation than it normally appears to have.

necessary discipline of mind and action for good color results, when he did turn to black and white he would produce his picture on the film in the camera. We would see less of darkroom tricks practiced in an attempt to make good prints from bad negatives.

What is a proper approach to this subject of "Landscape Problems in Kodachrome?" We might generalize by the hour and still only arrive at a set of hypothetical solutions for a set of hypothetical problems.

If I can be of any assistance in helping you analyze and appraise at least some of the varied conditions and problems encountered in landscape photography in Kodachrome, I can do it best by relating some of my own experiences in this field of color. Although black and white reproductions are a little short of being fully satisfying, they will serve as a "diagram" of the problem. Even though color is missing, these illustrations do convey the value range of the subject, the angle of light, and in some cases a suggestion of the character of the light.

Boulder Dam

While it is true that this subject (Figure 86) has certain characteristics peculiar to itself alone, the problem of recording the scene in Kodachrome involves many considerations common to all distant landscape subjects that are comprised principally of hard, highly reflective surfaces.

Let us imagine for the moment that we are on the scene and that we are analyzing the subject in terms of (1) overall value (whether it is lighter or darker than average), (2) value contrast, (3) kind of color, (4) angle of light, (5) quality of the light, and (6) the factors on which to base an exposure.

Overall Value. This is one case where one must distinguish between value and color. The rock walls of the canyon seem to be dark in color. They are dark red, dirty brown and related colors, and the distance is purple-blue. The water is extremely dark blue. Most of us are accustomed to think of such colors as being "dark," and we forgot that they may be light in value and still be the same *kind* of color.

But these surfaces are all highly reflective, and if compared in value with timbered hills at the same distance, these rock walls are much higher in value. This overall higher value would call for ½ to ⅔ smaller f/ stop

than would be given an average subject. And it should be mentioned that the angle of the camera was about that of the sun's rays, because of the elevation at which the shot was made. At such an angle the area up to the Dam was being seen in about the flatest possible light. And that means maximum reflected light, and would indicate the use of about ⅓ smaller stop, for that factor alone.

Value Contrast. You can see from the reproduction that there was a minimum of modeling on the formations. From the angle at which the shot was made one is obliged to work in either relatively flat light or a strong side light, for the character of the formations is such that the light effect changes quickly from a flat-light condition to one of full shadow on one side of the canyon, either morning or evening. When one or the other side of the canyon walls is in full shadow the scene is too contrasty. The shadow wall becomes a "hole" in the composition, and the opposite wall appears burned out, with a loss of texture in both walls.

In this scene and others like it, we have to depend upon color contrast rather than value contrast. And fortunately we have such contrast between the Dam and the canyon, the water and the distant mountains, and between the mountains and the sky. And in this instance this division of areas makes an interesting pattern.

Kind of Color. The color of all areas is slightly more intense than one usually finds in such an expanse. And the fact that each color area is a rather large mass helps give a feeling of more color than is actually present.

Quality of Light. The atmosphere was relatively clear, but with a more than average moisture content, which softened the light somewhat, and added some intensity to the color of the rock. Wet or moist rock always has more color than dry rock, as you know.

Exposure. A rather accurate meter reading was possible because the distant sky was overcast, and did not adversely affect a reading of the balance of the composition as a clear sky often does. A little study of the scene indicated that the most dramatic color effect could be secured through slight underexposure. If one overexposed the area up to the Dam that area would appear weak in both color and value — would be washed out. The distant mountains were somewhat darker in value than the foreground but slight underexposure would do them no serious damage. Certainly better to sacrifice the distance for the sake of the closer areas, if any sacrifice is necessary.

87 *Taos Indian Pueblo. A composition with extremes of light and dark slightly beyoud the efficient latitude of the film.*

Another reason for deliberately working toward underexposure was that we all seem to have a tendency to overexpose light value expansive landscapes.

The exposure used as 1/10 at f/22 on 4x5 Cut Kodachrome (rating Weston 10). Translated for 35 mm. and Movie, this would give a basic exposure of 1/50 at f/9 on 35 mm. and at f/11 on Movie Kodachrome, at 1/30 second shutter speed.

Filter. To add some color saturation to the rock formations a Harrison Coralite C½ filter was used.

Taos Pueblo

This subject is shown because it has one characteristic not encountered in the usual landscape scene. (Figure 87.) The difference is that a fair percentage of the composition is the pueblo roof top, which lies in a hori-

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San Xavier Mission, Tucson, Arizona. A scene with extreme contrast that presented the problem of holding detail in the back-lighted wall without losing the fully lighted, white towers. The result secured was possible because the wall in shadow was partially illuminated by light reflected from a clear north sky, and from the ground.

zontal plane and at nearly right angles to the overhead sun. In such a situation the value contrast is high, for this flat plane reflects much more light than would a vertical wall against which the sun's rays fell obliquely.

In making the exposure three factors were considered: (1) the necessity for holding some color in this horizontal plane; (2) the advisability of holding detail and some color in the foreground shadow areas; and (3) the desire to darken the sky below normal, to provide color contrast with the adobe and to hold as much detail as possible in the clouds.

The compromise exposure decided upon was ⅔ stop smaller than for an average subject. This exposure did darken the sky and as you see, held rather good cloud detail. The foreground shadow areas held no color but did hold detail and they have a feeling of luminosity due to the reflected light from the roof surfaces. The roof areas held color, but of lighter value than the eye "thought" it saw this area. There is no feeling that these areas are washed out in spite of the fact that they were ½ to 1 full stop overexposed.

The exposure used, translated for the three films, was (basically) 1/50 at f/8 for 35 mm.; 1/25 at f/12.7 for cut film; and f/10 for Movie.

San Xavier Mission

There are times when we are all tempted to press the latitude of Kodachrome to the limit of its ability. And such attempts are quite all right if we know what results to expect.

A glance at the subject above (Figure 88) indicates it is in that category, because of its extreme contrast range. But, fortunately, the back-lighted area is not a dead shadow because of the light reflected into it from the bare, dry adobe earth foreground. If this foreground plane had been a grass lawn or other equally light absorbent surface, it would not have reflected any appreciable amount of light into the back-lighted wall. Under those circumstances and unless an exposure was made for the wall alone, this wall would have registered in the Kodachrome as a silhouette, devoid of both color and detail.

This subject is shown primarily to emphasize that there are two kinds of back-lighted conditions. Ones that are dead shadows except for some sky reflection, and others that are made somewhat luminous through the influence of light reflected from surrounding surfaces.

Exposure for a subject under the conditions

89 *Exposures for cloud effects alone should be based on meter readings of the sky. Let the foreground go as will.*

90 *Excellent subtle color results can be secured under weak, greatly diffused light conditions, as in this canyon.*

of this one should favor the sunlit portions of the composition — not the lightest lights, but the general area in sunshine. The back-lighted areas will be underexposed in any case unless the exposure is made for such areas only. A part of the effect of such a shot is the dramatic contrast between light and shade. The problem is to hold some color and detail in the back-lighted surfaces. The exposure did that, although the color on the wall was a cool blue cast from the sky.

The exposure used was the same as for an average subject. If we had been exposing for the sunlit areas only the exposure should have been ½ to ⅔ stop smaller. Such an exposure favored the light areas more than the dark ones, for an exposure for them alone would have called for about 1½ larger stop than for an average subject.

Clouds Over the Desert

Expansive cloud-filled skies often make dramatic Kodachrome shots. (Figure 89.) When clouds are a part of a landscape composition our attention is so centered on the balance of the scene that we give little thought to what exposure we should use if we reversed the process and concentrated on the clouds and let the landscape come as would.

If you enjoy clouds particularly, you have noticed they have a lot of color. There are blue clouds, gray ones, purple-blues, and over the great expanses of the Southwest the sky is frequently filled with pink-bottomed gigantic white clouds that are very dramatic.

It is difficult to underexpose clouds in full sunshine (we are not considering overcasts and such), so use 1 to 2 stops smaller diaphragm opening than you would for an average landscape in the same light, at the same angle. Or follow meter readings, which will serve well except when pointed directly toward the sun. In shooting back-lighted clouds you will have to use some judgment as some such clouds are dark and dramatic, others light and airy.

Echo Canyon

Color intensity is reduced as the volume of incident light is decreased, but that does not

91

Mt. Moran across Jackson Lake, Wyoming. A type of composition in which there is both good color and value separation even in flat light.

mean that there is no color in or under weak light, and quite often interesting color effects at that. You will grasp some idea of the character of the light in which this shot was made when I tell you that it was about 1/5 that of normal sunlight volume in the open. (Fig. 90.)

The scene is in the bottom of a narrow canyon whose rock walls are smooth and highly reflective, which greatly diffused such light as came into the canyon from the light overcast sky.

The short value range of this subject is an ideal situation for color rendition in Kodachrome. Of course the color would have been more intense if the volume of light had been greater. But on the other hand, direct, strong sunlight would create extremes in contrast that could not be held in Kodachrome.

Exposure was based on a Weston reading of 50. Light readings ran from 25 to 80 Weston. Translated for the three films, the exposure would be 1/25 at f/4.5 on 35 mm.; 1/10 at f/8 on cut film; and at f/4 for movie film at 1/30 second, or f/5.6 at half speed.

Mt. Moran

We have mentioned several times in these pages that flat light produces the most brilliant color, or the greatest color saturation, with the exception of transmitted light through translucent substances, of course. Sometimes color contrasts provide all the separation necessary between planes and areas. The above subject (Figure 91) is an excellent example of the kind of composition where flat light is preferred. There is good color *and* value contrast even though the scene is made up, primarily, of related rather than contrasting colors—blues, greens and the blue-gray of the mountains.

The dark green trees in the foreground against the grayer tone of the distance give a pleasant feeling of depth to the picture, still more pronounced when you view the Kodachrome. Other adjacent areas have either color or value contrast to give sufficient separation.

One excuse for taking this scene in side light might be when the mountains were completely blanketed in snow, and a side light could provide modeling to give form to the mountains.

The exposure was based on a Weston reading of 320, a little on the underexposed side, to hold detail in the mountains. This calls for a basic exposure of 1/50 at f/8 on 35 mm.; 1/25 at f/12.7 on cut film; and f/10 on movie

Kodachrome. The shot was actually made at 1/5 second, stop f/29, on cut film.

As a general rule, Kodachromes of such scenes as the one we are describing—subjects made up of blues and greens—have an excessively blue cast. We have mentioned before that Kodachrome "likes" blue haze, and on the slightest pretext will seemingly disregard its duty to all other colors in the composition while it concentrates on registering this haze with a vengeance.

That is just one of the problems of Kodachrome landscape shooting. A weak, warm correction filter will often overcome most or all of this blue cast, but such filters should be used with some discretion. There was no need for a filter on this shot because it was made rather early in the morning, when the light is "warmer" than in the middle of the day. Besides, the atmosphere is clearer in most mountain country early in the day and before the sun starts to pull moisture into the air.

If you do use a correction filter to counteract this blue cast tendency do not expect the filter to penetrate the haze and record any more detail than your eye sees. Should you wish to use filters for the purpose mentioned I suggest the Harrison Coralite C½ or Eastman's CC13 or CC15. Filters stronger than these are likely to produce a cast of the filter color in the Kodachrome, which in many cases is more objectionable than the blue cast you are trying to eliminate. You need not make any exposure compensation for the three filters listed. The Eastman filters have no factor, and the factor for the Harrison is so small that it can safely be disregarded.

Wheat Field

As a contrast to the Mt. Moran shot few subjects could better illustrate the type of thing that requires any kind of light but flat light (Figure 92). Here is color against its own color—wheat shocks against a background of wheat stubble. One could hardly find less color contrast. While it is true that there is plenty of color contrast between the total area of the wheat field (viewed as a mass) against the trees and green hills, that does not solve the problem of holding form in the wheat field.

The necessity for strong side light on this

92 *Many light-colored subjects such as this require side or modeling light to give strength.*

scene seems too obvious to need mention. There might be some difference of opinion as to a choice between side- and back-light, but in back-light the hills would be in full shadow and the sky would be burned out because we would be shooting at the source of the light.

Since the foreground shadow areas are such a relatively small portion of the composition and since the stronger they are the more strength they add, they were disregarded in making exposure calculations.

Printed reproductions do not convey much of an idea of the volume of the incident light under which the shot was made. Probably your first thought is that this wheat field should be considered as a much lighter than average subject. It should be, and under a brilliant sun and a cloudless sky the subject would call for at least 1 full stop less exposure than if the foreground field was green, growing wheat instead of the brilliant straw color. But this scene was photographed about one-half hour before sundown (when the light is losing its intensity), and the volume of light was *further* reduced by a slight haze over the sun.

There is one aspect of this Wheat Field composition that might be mentioned in passing. It is the extreme difference in light reflective quality between the wheat straw and the green grass on the hills. It is partly a matter of surface texture, as we discussed in an early chapter. The point that should be made is that although there is excellent color

93 *A type of color subject that demands at least modified black and white lighting. Formless in flat light.*

contrast between the yellow of the straw and the green of the grass, that contrast is greatly accentuated because the straw surface texture is highly reflective and the texture of the grass (in the aggregate and not in terms of individual blades) is highly light absorbent. If you can imagine the straw as green in color, there would still be a considerable contrast in value between the wheat field and the hills.

I am merely trying to emphasize again that we must not presuppose that color alone is the determining factor in making an area seem light or dark. It is a mistake to assume that all yellows are light and that all greens are dark, for instance, and a still greater mistake to develop any kind of exposure formula based on any such assumption. It is the black and white value of an area that determines exposure, which is another way of saying how much light is being reflected back to the camera lens from such area.

The texture of an object or surface often has more to do with this matter of value than does the color of the thing.

Exposure data on this shot means nothing unless you recall that it was made in a weak light, or should we say, weaker than normal. The fact that it is a light value subject (the exposure used favored the wheat field) taken in weak light further complicates any attempt to compare this exposure with some of your own experiences.

The exposure was made on cut Kodachrome, ½ second at stop f/32. That is equivalent to 1/50 at f/5.6 on 35 mm., or at f/7 on movie film. If the straw had been green grass, for instance, the exposures should have been 1 stop larger, in the same light, or f/22, f/4 and f/5 respectively.

Ranchos de Taos Mission

If the foregoing illustration did not sufficiently sell you on the advisability (if you feel "necessity" is too emphatic) of using side light on certain types of subjects, this old Mission shot may add weight to the argument.

Here we have a situation that in some respects is more extreme than that encountered in the wheat field shot. There is absolutely no color contrast between anything in this composition except that of the sky and building. (Figure 93.) The building and the surrounding walls "grow" out of the ground, and they are the same substance and texture because the building and walls are made of the same adobe earth as the ground upon which they sit.

Even though this illustration is merely a color snapshot, it does prove rather conclusively that side-lighting is imperative if we are to preserve any semblance of form or change of planes. This type of subject has one advantage over the wheat field in that light reflected from the ground helps greatly in keeping down value contrast, as well as helping to hold color and detail in the shadow areas. And we might mention that this ability to hold detail in luminous shadows is not just because the value of the area has been raised through reflected light, but because the reflected light is in itself a light source and it casts texture shadows within the main shadow, subtle though they may be.

This shot was made in bright sunshine. The flat-lighted surfaces gave a meter reading of Weston 800, the shadow side 250 (high because of strong reflected light). The exposure was based on Weston 500, which would give basic exposures of 1/50 at f/10 for 35 mm.; 1/50 at f/11 for cut film; and at f/12.7 for movie Kodachrome.

Shooting in the Woods

These two illustrations are reproductions of some test shots, made to determine the best light condition for color shooting in one of groves of the giant Sequoias, in the Sierra

94 *Light in heavy timber, under a bright sun, is excessively contrasty, and no exposure will hold good color in both extremes of light and dark.*

95 *Under a fog light or an overcast that eliminates shadows, good color can be held in closeup objects. A color correction filter will balance the color quality of the light.*

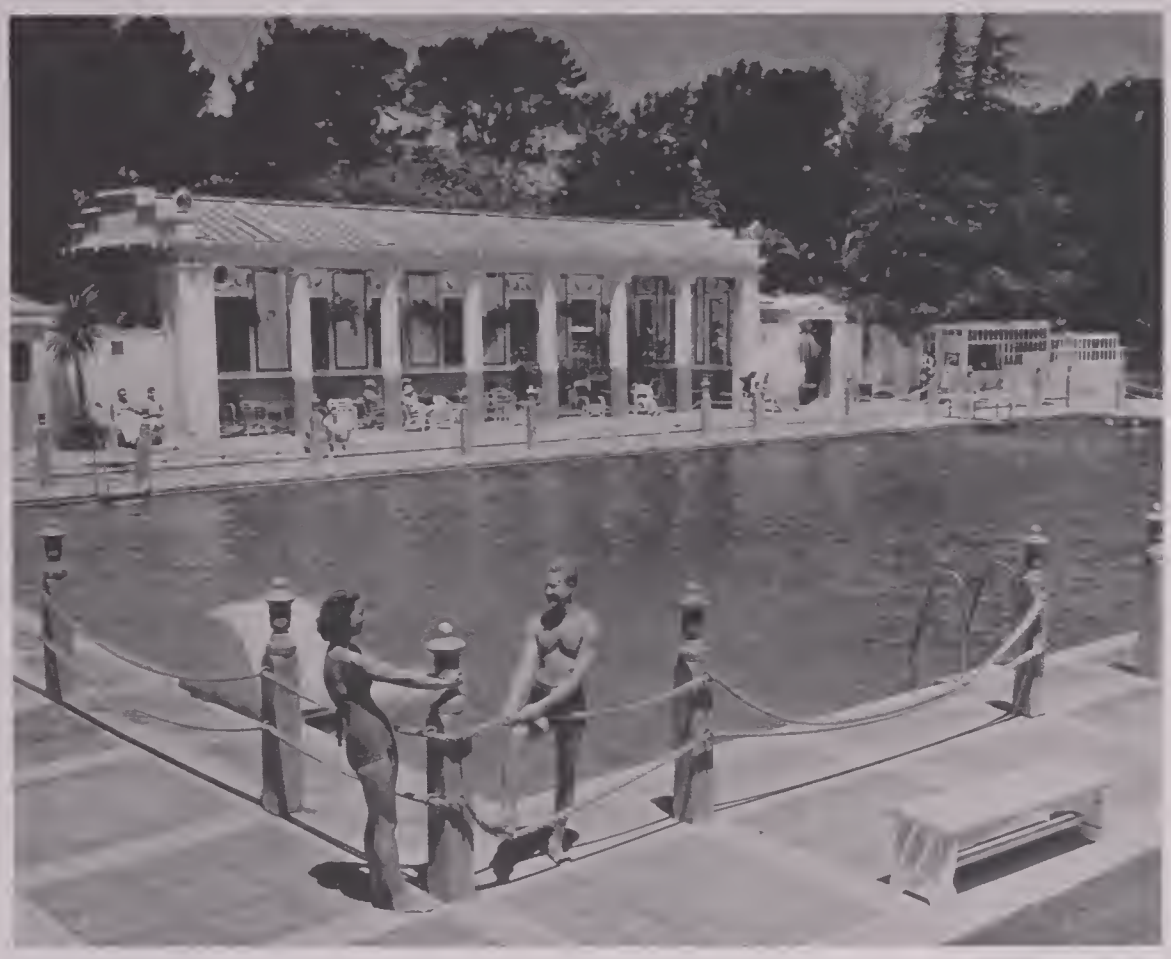
Nevada Mountains. These two are from several made under varying conditions. The illustration at the left (Figure 94) is the most extreme in contrast, and was shot in bright sunshine during the middle of the day. Unfortunately the black and white does not sufficiently express the total failure of the Kodachrome to hold detail or color in either the light or dark areas.

As you can imagine, the tree trunks are practically black, and the green foliage in the light is all but colorless—completely burned out. As is obvious from the reproduction, each area is either all light or all dark, and there are few in between values. There isn't much that can be said about such a condition except that it is one of those situations where one should never waste Kodachrome film, especially since a good black and white negative will produce a much more satisfying picture. The one exception might be a closeup shot of a figure against one of the tree trunks that seemed to be in modified diffused light. An exposure made for that local area could be quite satisfactory although the colors would not be as intense as you expect.

The reproduction on the right (Figure 95) shows a light condition at the other extreme. This shot was made in fog light, the fog so low it was dragging the tree tops. In this soft diffused light the Kodachrome recorded excellent detail and bark texture, and with the assistance of a CC15 filter gave full saturation and faithful rendition to the tree trunk color, which is about that of new saddle leather. The filter overcame the fog light blue cast in the red of the trees but it wasn't strong enough to prevent the green foliage from being more blue-green than it normally appears in direct sunlight.

There would be no point in giving exposure data on these two shots in the woods for no two conditions would be the same, and the only safe procedure would be to follow carefully made meter readings of all important areas in the composition.

It might be mentioned here that the use of a Wratten No. 1 filter is sometimes recom-



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Roman Plunge, Del Monte, California. This scene is in full, flat light. When there is good color separation between the principal areas, flat light is preferable as it produces the most brilliant color.

mended for overcast light conditions, and a Wratten 2A for extreme conditions. It is claimed that they add a "feeling of sunlight" to the seene. My experience with them has been rather unsatisfactory as they give the Kodachrome a cast of the filter color, which the C½ and CC13 or CC15 filters do not do. After some experimentation you may develop a preference for the Wratten filters, for they do add something to the Kodachrome result.

The Swimming Pool

This composition (Figure 96) has one characteristic in common with the Taos Pueblo picture we discussed a few pages back. That one thing is that a considerable portion of the total area of the composition is in a horizontal plane, and at right angles to the almost directly overhead sun.

In this pool shot the horizontal plane is a more reflective surface than that in the Taos illustration, and since this area occupies better than half the total area of the composition, since it is the foreground, it must be given first consideration in determining exposure.

There is nothing unusual about this problem of good exposure of water, especially if you check light conditions with a meter. But one should not fall into a habit of assuming that all water in bright sunshine calls for the same exposure. It depends upon the depth of the water, the color and texture of the walls and bottom of the pool (or the banks and bottom of a little creek, for that matter), the angle at which light is hitting the water, *whether the water was rough or still,* and to what extent surrounding objects or surfaces are being reflected in the water.

While we are talking about water we might explode a common fallacy. Water itself is not necessary blue or green or white. I have heard numberless expressions of disappointment in Kodachrome shots of little lakes that lie at the foot of a cliff or mountain, because the water did not register blue. It has taken much unnecessary explaining to point out that the "brown" water of the lake is the reflection of the cliff or mountain, and still the fact was not freely accepted as a fact. Blue water is blue because it reflects the sky; gray water is gray under a heavy overcast sky because the sky is gray. And the white water of a rapids is white because it is broken into so many facets that it reflects only the incident light.

If you will examine the structure across the pool, in the above illustration, you will ob-

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Columbia River Gorge. More strength and greater color saturation is secured in such expansive scenes just after a rain when surfaces are damp and the atmosphere is washed clean.

serve that the light under the roof is a mixture of diffused and reflected light, very much the same in character as we created in the demonstration in the preceding chapter, with the combination of a diffusing screen and a reflector.

In this instance the direct sunlight is diffused by a rough texture glass roof, and is reflected by the tile floor in front of the building. No use was made of this excellent light condition in this shot except that it made possible a better rendition of color and detail within the structure. If the roof had been opaque the interior walls would have registered a solid black except for whatever reflected light was cast on the lower portion of the walls.

I mention this light condition again only to suggest that you be on the alert for every opportunity to utilize reflected and/or diffused light in any part of a composition in outdoor work, whenever and wherever you find it.

The exposure for this swimming pool shot was based entirely on a meter reading of the water and foreground area surrounding the pool. This average reading was Weston 500, and the exposure based on this gave faithful color and value rendition for all the composition except the trees, which were underexposed about 1½ stops. But while this underexposure lost the true color of the trees it lowered their value and made the rest of the composition seem more brilliant and more sunny by comparison. Basic exposures for Weston 500 would be 1/50 at f/10 for 35 mm.; 1/10 at f/25 for cut film; and f/12.7 for movie Kodachrome.

Columbia River

This subject is a good example of those expansive scenes that depend for successful results in Kodachrome more upon light and atmospheric conditions than upon your own technical ability. (Figure 97.) In other words the most expert of color photographers cannot produce a good Kodachrome of such subjects when conditions are unfavorable, and they are likely to be unfavorable more of the time than otherwise.

By way of explanation, and as we have mentioned before, excess moisture in the air creates a "screen" or film of haze that Kodachrome will not penetrate. The result is the Kodachrome "blue haze" you have objected to in some of your shots. There is really no solution to the problem except the use of one

(Continued on page 145)

THE GRAND CANYON

Probably no subject has been considered by so many people as being photographically impossible as has this one. I have never set up my camera at the Grand Canyon without being advised by one to a half dozen well-intentioned admonishers that I was wasting my film. The advice is both right and wrong. There are days when atmospheric haze defies all attempts at penetration except with infrared film and filters.

There are, however, conditions that are just as favorable as the others are disastrous. This is one type of subject that depends upon ideal atmospheric conditions for best results in both good definition and faithful rendition of color. More often one can secure dramatic color effects of the Canyon, but they are just that, and at the sacrifice of definition and true local color.

The shot illustrated here was made about 7:30 a. m., after a two-day downpour of rain. At 6 o'clock the clouds shown on the horizon were down in the Canyon. As the sun warmed the upper air these clouds lifted en masse and the exposure was made just as they reached the level of the far rim, some thirteen miles distant. The early morning sun added some red to the Canyon color, but not an excessive amount, and with no more effect of intense color than the formations appear to have under the ideal conditions of damp surfaces and unusually clear, clean air.

DATA: Exposed on 4x5 cut film Kodachrome; Camera, Speed Graphic; Lens, 5¼ inch Zeiss Tessar. The reproduction is 200 line deep etch, four color offset lithography, plates made direct from the transparency.

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Garden of the Gods, Colorado. A typical light-colored subject that requires some side-lighting for foreground strength. Reflected light in the shadow areas made them luminous and preserved the color in those shadows.

of the warm correction filters to counteract the blue cast, but as we have stated before, the filter will not appreciably cut through the haze and register distant detail.

This shot was made on one of those very favorable days and the Kodachrome did hold the distance as well as one could expect, as you will realize when you are told that the distant horizon is some eighteen to twenty miles away. Even though the atmosphere was especially clear for this territory, the shot was made through a Harrison Coralite C½ filter, to offset such blue haze as was present, and it is always with us in more or less degree, in any outdoor expanse such as this subject illustrates.

Some use was made of cloud shadows, to strengthen and to give separation to some of the river bank cliffs. I might add the admonition that these effects are worth waiting for, and the serious color worker will be glad to wait for the proper shift of light and shadow, for best effects.

The exposure was made on cut Kodachrome at 1/10 at f/20 with C½ filter. Translated for 35 mm. this would be 1/50 at f/8 or at f/10 for movie. No exposure compensation was made for the filter.

Garden of the Gods

Again we present the suggestion, and some supporting evidence, that it is unwise to blindly follow a "flat-light technique." This subject (Figure 98) has excellent color separation, in that the immediate foreground rock is very light in color; the vertical rock formations are strong reddish-brown; and the distance is purple-blue against a sky of clean white and vivid blue, as Colorado skies can be.

But straight flat light would have resulted in a "back-drop" effect and the vertical rocks would have had no texture or solidity. Color separation alone, as effective as it was in this instance, is not enough. We also need some modeling and the side-light used was perfectly safe, for such shadows as there were on the rocks at the left were extremely luminous, due to reflected light, and there was no loss of color in these shadows. It was only lower in value, but was still good, clean color.

This subject presents an entirely different problem in the choice between flat and side-light than that found in either the Swimming Pool or Columbia River shots. Flat light was used on the Swimming Pool because color separation was sufficient, plus the fact that there was no foreground form or texture that

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Laguna Beach. A low sun, slightly to one side, created foreground shadows that defined planes and gave this area some value contrast that helped pull it forward from the flat-lighted, low-contrast distance.

could be improved by side light. In the Columbia River shot there is a little side-lighting, but one would classify this as incidental. And flat light does penetrate the haze more than right angle side-light and, of course, much more than does back-light, even though the sun is only slightly in front of the camera.

The basic exposure for this Garden of the Gods shot was 1/50 at f/9 for 35 mm.; 1/5 at f/32 for cut film; and at f/11 for movie. This slightly overexposed the white foreground, and slightly underexposed the rock formation on the left.

Laguna Beach

Ordinarily it may be advisable to confine the time of your color shooting to the middle hours of the day, but there are exceptions to any such rule. The subject illustrated (Figure 99) demanded a low sun for best effect with the elements that are the theme of the composition.

The intense color of the composition is in the umbrellas. Their intensity is increased by the sun's rays hitting them at about the same angle as the line from camera to the umbrellas. Also, it was important to get as much light into the underside of the umbrellas as possible. And most important, the figures at the table must be kept in full light, which could not be done with an overhead sun. Reflectors or flash would not serve adequately as they would be too far removed from the figures when they were kept outside the picture, which of course they would have to be.

Sometimes long shadows are objectionable, but in this case they give direction to the plane which is the patio floor, and add a feeling of strength and solidity that would otherwise be lacking. Since these shadows do not fall across nor destroy any important detail their presence does not detract from the final result, either in color or composition. Further the strong contrast in the foreground helps separate the foreground area from the distant spotting of buildings. From a purely pictorial standpoint I would prefer bare hills for the background rather than as is, but such things are not always within one's control.

This shot was made about 4 o'clock, under a September sun. Exposure was based on a "compromise" Weston reading of 320. No filter was used, of course, because they are seldom advisable on closeup shots in full sun, and certainly one would not use one of the warm ones as the light would tend to be warmer at 4 o'clock than at noon, but still

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Mt. Rainier, Washington. Another instance in which the principal areas have good color contrast, which permitted the use of flat light. Not all this color separation in areas is apparent in the black and white reproduction.

not sufficiently on the "reddish" side to warrant the use of a cool correction filter.

Mt. Rainier

This type of subject is proof again that no general rule fits all situations. (Figure 100.) Ordinarily side lighting will add a feeling of depth and distance to such scenes, and just as usually the side lighting will add interest to the forms in the composition. But this subject, as reproduced, is one of those exceptions wherein flat light produces the best result.

If you can visualize the color, as I attempt to translate it, we can prove our point, I am sure. The foreground bush against which the figure is placed is brilliant fall foliage color. The water reflects the deep blue of a clear sky. The little hill beyond the water is the greenish brown of autumn grass. The row of trees just beyond is very dark warm green, and the mountain ridge is a rich blue purple. The white mountain top is silhouetted against a strong blue sky. The only element in the composition that could be improved with side lighting is the snow-capped mountain, but it is such a small element in the composition that it is just as effective in the flat light. The distant mountain is about fifteen miles airline.

However, one is faced with a different situation when photographing this mountain from near its base, as I have done many times, for then one is close enough to hold texture in the glaciers and snow covered promontories if side light is used. In flat light, close up, the mountain looks too much like a white card cutout. And, too, haze is not a factor when one is working close.

Ordinarily I would suggest the use of one of the weak warm correction filters on Kodachrome shots made at this altitude and higher. The foreground in this picture is at about 5,500 feet elevation; the dark mountain range is 8,000 to 9,000 feet, and Mt. Rainier is over 14,000. But several factors argued against the use of any filter. First, the atmosphere was exceptionally clear, and there was no visible evidence of an objectionable amount of blue haze. Second, the immediate foreground was all warm in color—yellows, reds and browns—and the warm correction filters tend to degrade the purity of such colors when photographed close-up. Third, none of the other color areas in the composition could be improved in color quality through the use of a filter, and there was the possibility that such a filter might darken an already dark blue sky. Remember that skies appear a darker and more intense blue at high altitudes and in

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Fisherman's Wharf, San Francisco. A happy combination of brilliant color and highly reflective surfaces, all in the same general "key" or value range. A type of short scale composition ideal for Kodachrome or any other color medium.

addition we are here shooting into the sky much above a "normal" horizon.

The actual exposure used was 1/5 at f/29, on cut film Kodachrome, based on a "compromise" Weston reading of 320. This is the equivalent to 1/50 at f/8 on 35 mm. or at f/10 on movie Kodachrome. This exposure sacrificed some detail in the snow-capped mountain, but it proved a good compromise for all other areas in the composition except the dark green foliage of the foreground tree, which would have required about 1½ larger stop for good color. Since the principal function of this foliage was to give mass and value contrast with an already dark sky, it would not have been advisable to expose for this tree foliage to the detriment of everything else in the picture, and more particularly to the sacrifice of the rich fall color in the foreground and to a further "wash out" of the snow-capped mountain.

Fisherman's Wharf

Seldom are we so fortunate as to find an outdoor composition of short value range, with still enough color and value contrast to provide interest and good color. An expanse of desert sand may be a short range composition but not necessarily a good color subject.

The above reproduction (Figure 101) of this famous old fishing-boat harbor in San Francisco lacks the sparkle and color of the Kodachrome transparency from which it was made, but it should convey the fact that the whole composition is surcharged with light. Bathed in brilliant overhead sunlight, every surface and plane picks up and reflects this strong light onto surrounding surfaces and objects—into and onto surfaces turned away from the source of the light. In fact this reflected light, multiplied and amplified by the excellent reflective quality of a hundred surfaces, reaches every spot in the composition except the deep shadows of cabin interiors.

And what is equally important, this composition is all in one "key"—high key—which makes the problem of exposure and faithful rendition of all colors and values extremely simple. We have mentioned before that because of the short latitude of Kodachrome film we always get true fidelity in all colors in a composition when all colors are within a certain limited value range, or key, it matters little whether the key be high or low.

Water shots are, as a general thing, excellent subjects for Kodachrome if full use is made of the reflective quality of the water.

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Zion Canyon Nat'l Park, Utah. An example of the use of cloud shadows to define shapes and to separate planes. Without such shadows this scene is two-dimensional in flat light.

There can be exceptions, of course, but they are rather rare.

There is little point in giving any specific exposure data on such a subject because one does not have to arrive at a carefully calculated "compromise," inasmuch as there are no extremes in value. The composition is, obviously, a "lighter than average" subject and calls for about ⅔ stop less exposure than one would give an "average" subject under the same light conditions.

Zion Canyon

By way of preliminary, if you will study the reproduction of this shot for a moment you grasp the immensity of the area included in the picture. The winding road, wide enough for three cars abreast, will help establish size and distance. (Figure 102.)

The four definite planes in the composition, separated and made distinguishable by the cloud shadows are rock formations of a common color. In flat light this expanse is as flat as a sheet of paper. Side light does not improve the situation as it only casts a shadow from the left, leaving all the rest of the area as flat as if it were painted on canvas, without modeling or atmospheric step-backs.

Perhaps I am over-enthusiastic about my luck in catching this scene with benefit of cloud shadows, for I have spent many hours, on successive trips, in waiting for some light condition that would do justice to the subject. But I cannot impress too strongly the advisability of making use of cloud shadows whenever and wherever they help add form or strength to a landscape composition. There are instances when small, spotty cloud shadows may only confuse the feeling of the true form of the surfaces upon which they fall, but more often than not they will enhance the quality of a distant landscape.

It should be explained that promiscuous use of such shadows is not the way to get effective results. In this subject it is not the fact that cloud shadows were used but how they were used. The result wanted was approximately that secured—to silhouette the formation on the right against the one on which the shadow is falling, and then to catch the next large formation in light against the distant 3,000 foot high rock wall in shadow. The heavy shadows at the left were unwanted, but beyond our control. Does one get these effects without time and effort? Hardly. In spite of the fact that clouds were skirting

103

Chili Peppers, Rio Grande Valley. An instance in which better local color is preserved in shadows than in direct light, since the shadows were made luminous through the influence of light reflected from the ground.

across the sky under the driving of a high wind, a wait of almost two hours was necessary to catch a condition that fitted the forms of the composition. Merely to have had shadows cast at random over the formations would not have separated the planes, but would have simply added confusion to the forms and a spottiness to the composition. So much for this type of use of cloud shadows.

A more common use is to employ them to strengthen distant flat-lighted landscape scenes, especially to strengthen the value of a distant horizon. A cloud shadow keeps the horizon from blending into the sky.

I mention this matter of cloud shadow use partly because I have run onto Kodachrome enthusiasts who have the misconception that cloud shadows will create "black spots" in a composition. They will not unless they fall on an already dark value area that would go almost black in full light. A cloud shadow has luminosity and those in the distance will have a decidedly blue color, the extent of the purity of the blue depends upon the color of the surface upon which it falls.

At the next opportunity try utilizing cloud shadows, judiciously of course, and see if they do not add an interesting quality to your Kodachrome results.

The exposure for this Zion Canyon shot disregarded the shadows for there would be no point in sacrificing the true color of the rock formations in light in order to hold a little more detail in the shadow areas. The exposure was based on a meter reading of the rock wall at the right.

Chili Peppers

The problem on this subject was to find an angle that would produce the most effective color brilliance and color contrast. (Figure 103.) If you have ever seen the upper Rio Grande Valley, in northern New Mexico in October, you will never forget the brilliant intensity of freshly picked red chili peppers draped in profusion over roof edges, on fences, or on specially built drying racks.

Although flat light usually creates the impression of greatest color intensity, this instance is one case where flat light seemed to destroy this intensity because the myriad highlights on each string of peppers had the effect of diluting the color, besides destroying the feeling of a mass of color because of all the little pin-points of light.

The strings of peppers on the pole rack in front of the house are, in effect, back-lighted, but in reality this shadow side is given life

and glow by light reflected back from the ground with the result that the intensity of their red color is greater than when viewed in flat light. This color quality of the peppers dictated the angle at which they were photographed, but some consideration was also given the direction of light on the adobe house, and the amount of side light used gave form but not dead shadows, as these shadows were also made luminous by reflected light.

It may not be amiss to repeat that bare ground, beach sands and such highly reflective surfaces can be profitably used in lighting shadow areas in many landscape compositions. Make full use of reflected light whenever it is available.

Meter readings are unbelievably high on a subject of this type, under a brilliant Southwest country sun. This exposure was based on a "compromise" reading of Weston 400 (to hold faithful color in the peppers) although the lightest areas of the adobe house gave a light reading of 800. But this slight burning out of the left end of the house was somewhat offset by silhouetting the outline of the building against the distant tree.

104 *Shooting into the sun can produce dramatic effects, but at the sacrifice of true local color rendition.*

Shooting Into the Sun

You may recall that we discussed this problem in the chapter on "Sunlight Characteristics." This Canyon subject is an excellent example of the difficulty of holding any detail or definition, much less true color, when shooting toward the source of light. (Figure 104.) This shot was made directly into the South at about noon, so the effect can not be attributed to a low sun. The only concession that can be made to this low sun feeling is that the shot was made about the middle of October. But I have tried this same shot in late June when the sun is more directly overhead, with but slight improvement in color results.

This illustration is not offered as a contention that such shots should not be made. But one must understand what to expect. The local color of the rock walls runs from pinkish red to brownish red, but in the Kodachrome all surfaces are blue, the value and the intensity of the blue varying with the angle at which the light hit each plane. This overall blue is a combination of sky reflection and atmospheric haze, with the haze getting the upper hand as distance is increased to the point where it all but blocks out any semblance of form in the far distance.

Whether you are satisfied with the color result you get on such shots depends entirely upon your point of view. If you let your brain tell you the rock is red and should be registered as red, then you will be disappointed if not disgusted. If you let your trained eye see the scene as it is, and will be pleased with a faithful rendition of the effect as it is, you will get a thrill out of such results. If a landscape painter produced the scene as he saw it you would commend his ability to capture an effect. Why, then, must we try to make color photography reverse all rules of true light conditions and produce a result that would be "unnatural," to say the least.

This example, like most of those in these pages, is presented to help you see and analyze conditions as they are, and to see beauty and drama in unusual and unorthodox color subjects.

Exposure of distant landscapes, into the sun, is a guess at best. Close-up subjects, back-

lighted, can be judged more accurately or definitely determined through meter readings. The exposure for this Canyon shot was based on Weston 160. This compromise was about half way between a meter reading of the shadow side of the figures and that of the light area of the trail, but favoring the back-lighted area of the figures slightly.

For the figures alone 1 stop larger should have been used, but that would have badly overexposed the light foreground and somewhat overexposed the distance. On the other hand, the foreground in full light should have had about 1½ smaller stop, for faithful rendering of texture and local color, but that exposure would have badly underexposed the distance.

A little experience with close-up back-lighted subjects will sharpen your perceptions for the problems more distant landscapes present. If there are figures in the composition, decide whether your picture is of the figures, or the landscape, or a compromise. Sometimes a silhouette figure, if it does not occupy too much of the composition, will add a feeling of depth in a back-lighted landscape. In arriving at a compromise on this shot the figures were considered as of equal importance to the scene as a whole.

A Little Summary of Landscape Problems

The specific landscape problems presented in the preceding pages are offered as suggested "signposts" — things to look for in shooting Kodachrome of this expansive world about us. And it is really a picture world when you commence to see it through knowing eyes.

Because of the limitations of black and white reproduction it has not been possible to include landscape subjects that depend upon dramatic color effect for their appeal. Many such subjects are most uninteresting in normal light.

It is my observation that most color workers are deterred from photographing landscapes under dramatic light conditions because their introduction to Kodachrome was accompanied with the admonition to work in full, flat sunlight, preferably if not exclusively. This is, no doubt, the best beginning for the beginner in color. It is easier to calculate exposure for flat-lighted subjects, and flat light will give a color result that seems most satisfactory to the untrained eye.

But after you have made a dozen or so exposures on Kodachrome you are no longer a "beginner" *if* you have studied carefully all major factors of each problem *before* you made the exposure, and have just as painstakingly and critically examined the color results of your efforts. From there on every new experience should add to your expanding ability as a color worker.

Above all do not become static. Try new problems and new approaches. You will learn through doing, just as surely as does the artist in acquiring a mastery of his medium.

All of which is a premise for the suggestion that you accept every opportunity to record in Kodachrome the unusual and dramatic light condition in landscape work. Do not be afraid of early and late light (an hour or so after sunrise or before sunset). Do not worry too much about strong modeling or heavy shadows in landscape scenes as long as they do not occupy more than 20% or 25% of the total area of your composition, *and* as long as you can use a light angle that will eliminate bad dead shadows in the foreground.

Get strength in your landscapes. Get good color in the foreground—it will make the whole composition seem more colorful. Follow good rules of composition in framing your pictures. Remember that color is no substitute for good composition. Decide what is most important in the scene and arrive at a compromise exposure that will favor that area.

To develop a workable composite formula for better landscape photography in Kodachrome keep in mind the principles we discussed in the chapters on "Color Composition," "Value Characteristics of Color," "Sunlight Characteristics" and "Outdoor Exposure Calculations."

All these aspects have some bearing on your approach to every Landscape Problem in Color. They are not difficult to understand, and not involved in practice. The more judiciously you incorporate and combine your knowledge of these principles the better will be your results.

PORTRAITS, COSTUME STUDIES, STILL LIFE

PERHAPS I should warn you at the outset that this chapter goes into much detail on the subject of portraiture, but I can quiet your fears, if any, by assuring you that one need not employ every step outlined in these pages in order to secure satisfactory and altogether pleasing color results. Since the subject is so ramified it seems advisable to cover it rather thoroughly and then leave it to the discretion of the individual worker as to how completely he cares to follow the numerous suggestions given here.

It is rather difficult to define a composite of what constitutes a portrait. To the beginner in color, any close-up head and shoulder shot may express, to him, his idea of a portrait, although the resulting picture may be no more than a color snapshot. And that is quite all right. We all must make a beginning, and more power to any Kodachrome worker who aspires to a studied practice of this interesting phase of color photography.

The other extreme is the black and white professional photographer who is proficient in all the aspects of posing, lighting and make-up, and who has also the ability to capture that spark of life and personality in his sitter that makes the result a real portrait and not just an anatomical record shot.

Portraiture with a camera, in either monochrome or color, challenges the best skill of the finest photographer. Especially so if we contemplate the problem with the thoroughness of the portrait painter, for in the fine arts there is no higher rank than a recognized standing as an accomplished portrait painter.

The painter, for all his skill and insight, possesses one great advantage over the camera portraitist in that he can be selective—he can alter, subdue, amplify, leave out or add to, due to the flexibility of his medium. The portrait photographer must make all, or almost all of his compensations in the subject or composition in front of his camera *before* he clicks a shutter, rather than on the film, as the painter does on his canvas. We refer to color portraiture, of course. No retouching or alterations can be made successfully on a Kodachrome transparency, and only within strict limits on the separation negatives for a color print.

Before we leave this last thought—if you contemplate making color prints from Kodachrome portrait shots, bear in mind that when you retouch one of the three separation negatives the other two must be retouched in the same area in order to maintain color balance. For instance, if you touch out a flesh blemish on the negative for the red printer only, the spot will show up green in the color print for there is blue and yellow as well as red in every area no matter how red the blemish may appear in the Kodachrome. This admonition may seem out of order here, but its statement now will make more obvious the necessity for some of the suggestions which will be offered later.

For those of you seriously interested in doing fine color portraits may I suggest that you first study all the color reproductions (and originals when you can) of portraits by famous portrait painters. Because the old masters and some of the painters of the last century were "pioneers" in technique, rather than copyists, I prefer their works for study to those of the "modern" moderns. Look for the works of such men as Sir Joshua Reynolds, *Frans Hals*, Raphael, *Velazquez*, Gainsborough, Van Dyck, Titian, *Holbein*, Rubens, Hogarth, Rembrandt, Durer, Raeburn and *Whistler*.

Study their lighting, backgrounds, their handling of color areas and color intensities.

105

"Pope Innocent X," by Velasquez. One of the fine portraits by this notable Old Master. An interesting study in both strength of composition and simplicity of lighting. Refer to the text for a discussion of this portrait's fine color arrangement and harmony.

There is something to be learned from all these things in spite of the fact that these painters incorporated many subtleties that cannot be duplicated with the camera, and some that are undesirable even if possible.

The first characteristic common to so many of the best painted portraits is simplicity. A second most noticeable characteristic is the use of grayed or low value color even in those paintings that seem so colorful. There is a certain restraint and feeling of dignity that is lacking in too much of the color photography of figure and portrait studies of the present day. We are still a little "barbaric" in our conception of what is good color in color photography.

What is a portrait? That depends greatly upon our individual conception. But certainly a real portrait is more than the mere recording of the subject on a Kodachrome film, through proper exposure. A portrait that deserves the name is a fine technical record in which there is that touch of fleeting animation or personality or spark of life, or whatever you wish to call it. That you will get good color rendition must be taken for granted, in the broader view of the problem, and you will get good rendition if you follow known rules of lighting and exposure. But it is the capture of that something that lives which results in what can be dignified by the name portrait.

I venture the opinion that most portrait studies are started "hind-end-to." Most color workers are so mired down in the mechanics of the medium and so concerned with the problems of color selection and color harmony that they forget that they have set out to produce a picture of a face and head of a real live flesh and blood person that thinks, talks, laughs and has emotions. After all, these myriad problems of getting ready to take the portrait shot are, or should be, subordinate to the main theme. The color composition should build up and enhance the theme of our picture rather than merely be a colorful setting into which we "insert" the subject.

106

"Erasmus," by Holbein the Younger. This portrait employs a technique quite different from that used in Figure 105. It is a flat-lighted, decorative composition akin to much Oriental art. The same treatment can create an interesting portrait in color photography.

The Casual Portrait

Perhaps "portrait" is a rather forbidding word for those spontaneous color shots of family and friends that are more or less spur of the moment ideas. But regardless of how casual your approach you are never satisfied with casual results.

How then to get the results you want without too much effort? You cannot get something for nothing in color photography, but neither is it necessary to make the procedure too involved in this matter of the casual portrait.

If you are going to make the color shot in sunlight, by all means use a supplementary light. A reflector, even though it is no more than a large white card, is a necessity for good face modeling. Or you can use synchronized flash for this supplementary light, if you prefer. But in any event do not depend upon the sun alone, for you will either be obliged to flat-light the face or be plagued with hard, colorless shadows. One is as bad as the other.

With provision made for a supplementary light, pick a setting and background for the figure. Simplicity should be the keynote. The background can be lighter or darker than the flesh tones, but when possible use a lighter one for dark hair and a darker one for light hair. The simplest of backgrounds is a wall. One in full sunlight can be used for light background; a wall in shadow (with the figure in sunlight) can serve for a dark one.

If the only available background is green foliage, which at best is never too satisfactory, use an area that is as simple in form and as flat in light or shade as you can find. Broken up areas of light and shadow in foliage detract from the outline of face and figure. Some simplification of a foliage background can often be secured by placing the figure far enough in front so as to throw the foliage out of focus. Ordinarily out of focus areas in color are to be avoided, but the procedure is not objectionable (for a figure background) when the area is all of the same color.

A seated figure will be more relaxed and is more likely to assume a natural pose. Unless there is some reason why the full figure must be included in the picture, you will simplify the composition by framing to include little of the figure below the hands, or still further and include only enough of the body below the shoulders to give a good basc to the composition.

Color in the background? Yes, but it should be subordinate to the figure. The right color, of weaker intensity than the color of the costume, if the costume is at all colorful, will step the background back into its proper plane. If the costume is a pastel color, a background of weak intensity but lower value will add strength to the composition and pleasantly silhouette the figure. In any event, the hue or kind of color used in the background should not detract from the quality of the flesh and must not clash with the color of the costume. Any pastel shade is relatively safe, although some are more plcasing with flesh colors than others. A list of suggested colors appears on a later pagc. Blue, sky blue, is the most all-around satisfactory background color of those stronger than pastels. It is a good near complement to flesh color, and we are accustomed to seeing things against the sky so we accept this combination even when the "sky" color is too strong or too dark.

Why not use the sky itself? You can, but too often you are forced to a camera angle that is displeasing, or to a light angle that is inadequate. There is no better background than the sky for the casual shot, but do not use it if it gets you into other difficulties. If all you want is a "snapshot" you can disregard most all rules in capturing the dramatics of a windblown figure in a flaming red jacket silhouetted against the deep blue of a north sky. That is one kind of color shot, and one that cannot be ignored. But for the moment we are concerned with studies that are a little less "snap-shotty."

Getting back to our seated figure before an appropriate background, the next step is to place the figure in proper relation to the angle of the sun's rays. Do not use straight front light, but front and a little to one side. If the shot is being made betwcen the hours of 9 and 3, the sun is sufficiently overhead to cast eye, nose, lip and chin shadows. Select a head position that gives the modeling indicated by the sketch on page 165, (Figure 111). Alter the head angle until you have the front face fully lighted (except for the feature shadows), and then determine your camera position.

With camera position set, light up the shadow side of the face and as much of the figure as possible, with the reflector. You can judge contrast between the front face and side shadow visually, and can add or reduce the amount of effective reflected light by placing the reflector closer or farther from the subject.

The strength or amount of reflected light used is dctermined by the effect you want. If the subject is a child or an adult with delicate flesh tones, light the shadows until they all but disappear. If the subject has a rugged face and if you want to emphasize its strength, use less light on the shadow side. But do not decrease the amount of reflected light too much (it should not in any case be more than one f/ stop darker than the front face), for the shadow side will register darker than it appears visually, unless the exposure is made for the shadow side alone. And such exposure would tend to burn out the delicate flesh tones of the fully lighted front face. There are variations that will give a "stunt" light effect, but they are only stunts.

With the "mechanics" of the task complete, watch for or coax some spark of animation in the subject, click the shutter and your "casual" portrait study is on film.

The same steps, from background to lighting arrangement, can be followed in artificial light work. Set the principal light to represent the sun, and the second light to serve the same function as the reflector.

Do not get the impression that the simple and rather "casual" procedure just outlined will produce salon color pictures or ones that will offer serious competition to an old master portrait. But the results, whether in Kodachrome or the new Kodacolor, will be a decided improvement over the usual "snapshot" figure or portrait color shot.

If you want to improve light quality one step further, use a diffusing screen to soften the harsh sunlight, as described in the chapter on "Reflectors and Diffusers."

Base exposures, indoors and out, on meter

readings on the fully lighted front face. If no meter is used outdoors, use ½ smaller f/ stop than for an average subject in full sunlight, or ½ larger f/ than for an average subject if the diffusing screen is used. Indoors, follow regular exposure tables for photofloods, in determining distance of lights to subject, shutter speed and f/ stop, with necessary compensations for lighter or darker than average subjects.

After you have successfully mastered this rather elementary technique you will want to progress to a more serious and more thorough study of the problem of carefully planned and expertly executed color portraits.

Study Old Master Portraits

Before we delve into the subject of serious portrait studies it will be advisable to return for a moment to the original suggestion that the Old Masters can teach us much that can be incorporated in portraiture in the medium of color photography.

Since color has come to photography it will be well if we cross over into the fascinating company of the World of Art and surround ourselves with as much knowledge of art and painting as can have specific application in the things we propose to do photographically. With an appreciation and understanding of the fine arts the color photographer will be much better fortified to produce something worthwhile.

It will pay you to buy several inexpensive color reproductions of Old Master portraits, to serve as a ready reference for composition, for color arrangement, for placement of head and figure, for the pattern of the subject against the background, for the use of hands, and for lighting.

The first element for study should be the placement of the head. In the portraits sans elaborate settings one finds the head placed well above the center of the area of the composition. One might say that this is a rule so universally recognized that we seldom think of doing otherwise.

A second characteristic of the fine old portraits is that even in studies of the head alone the artist always included a sufficient amount of the body to give generous support to the head.

In your study of the Old Masters you will

107 *This sketch emphasizes the mass and directional line employed in "The Lady with a Fan," by Velasquez.*

also find that when more of the figure is used the pose of the hands, the arms, the lines of the costume, and the arrangement of color in mass and value are all skillfully employed to lead the eye into the focal point of the composition—the face.

"The Lady with a Fan" By Velasquez

One of the finest examples of a masterly handling of all elements to support and express a personality is "The Lady with a Fan" by Velasquez. The accompanying sketch (Figure 107) illustrates how all lines of the composition lead the eye around, back and toward the face. The simplicity of well placed mass is expressed by the black dress and mantilla, painted in those Velasquez blacks "that ripple and glisten like a shadowed stream flowing under overhanging boughs." The white gloves, delicately modeled in blues, add a value contrast to the black costume and a color complement to the delicate warm glow

108 *"Mrs. Seymour," by Copley, a work by one of America's earliest portrait painters. See text for a discussion of this subject.*

of the flesh tones. A further and more intense spot of this complementary blue is found in the bow below the rosary.

Perhaps this description over-simplifies the study, but I only want to impress upon you that the real artist, regardless of his medium, does not need to "shout" color in order to achieve a colorful result.

"Pope Innocent X" by Velazquez

The same sound fundamentals of good composition are found in the two portraits which appear on earlier pages in this chapter. In the portrait "Pope Innocent X," by Velazquez (Figure 105) we find the strength of a pyramidal composition. The firm, broad base of the costume supports the pyramidal shaped cape, which in turn supports the strongly but delicately modeled head. The directional lines of the arms and the chair frame very positively direct the attention toward the head.

In color the composition is equally well planned. This is a red picture, with suggestive hints of purple and crimson in cap, cape, face and background curtain, with the background area interestingly broken by the gold chair. There is orderly variety in the masses of red, with the lowest value and the weakest intensity being used in the background. The second group of orderly arrangement of masses is found in the whites of the surplice, sleeves, collar and the letter held in the left hand. But with all the seeming importance of color and mass in costume and surroundings the head still remains the dominant point of interest, further accentuated by the cunning, comprehensive glance of the eyes.

"Erasmus" by Holbein

In the Holbein portrait "Erasmus" (Figure 106) the excellent placement of the figure is immediately compelling. The simplicity of the unbroken mass of the figure is balanced and relieved by a background broken in pattern by a small design in a color related to that of the field.

There is interesting variety in mass between the coat and the cap. The same feeling of variety is maintained between face and hands and even though the hands seem to compete with the face for attention the pencil very tactfully directs one's eyes back to the head.

"Mrs. Seymour" by Copley

To bring our study down to that of early American art the reproduction of the portrait "Mrs. Seymour" by Copley (Figure 108) illustrates an interesting placement of the figure and a good sense of lighting. But there is something lacking, and a little closer inspection reveals that this disturbing element is the rigidity of the pose and the too obvious intent to engage the hands in some activity. The lady is conscious of her duty as a model, and you are conscious of her effort. It detracts from the feeling of naturalness and ease so well exemplified in the Velazquez and Holbein portraits.

Whistler's "Portrait of My Mother"

Bringing our study about two generations nearer the present day than the time of Copley, we find an American whose best work ranks as great art. This man was Whistler, whose "Portrait of My Mother" is known to

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This famous portrait is shown here in sketch form in order to emphasize the elements of mass and tone values that give strength and dignity to this fine composition.

every school child and most adults wherever art is a part of the life of the people.

Whistler's art has been described as "The perfection of delicacy, both in line and color. Apparently very sketchy, it is in reality the maximum of effect with the minimum of effort. It has the pictorial charm of mystery and suggestiveness, and the technical effect of light, air and space."

An analytical examination of the sketch of this portrait (Figure 109) emphasizes the orderly arrangement of this composition—order in the areas or masses—order in the values—and order with variety.

Examine first the order of values and masses. In the light values we find the largest area in the picture on the wall; the next in size is the combined mass of head and cap; then the hands, handkerchief and lace cuffs as a unit; the fragment of the picture at the right; and last, the small light pattern in the curtain. These areas are the lightest values.

The next step lower in the value scale is the wall area; the third step down is the floor; the fourth distinctive value step is the curtain; and the last is that of the dress and horizontal panel at the juncture of the wall and the floor.

We can find still another order—that of the structural strength of the composition, which is achieved through arrangement of the dark value areas. The dominant mass is the figure and baseboard. Second is the curtain. Third in importance is the hair, partly because of what and where it is in relation to the theme of the picture. The fourth and last in importance is in the fine line of the dark picture frames.

The color scheme of this portrait is simplicity itself and a tribute to the effectiveness of restraint in variety of color, in color intensity, and in massing of color. The wall color is a light value, weak intensity green-yellow, with a floor color of same hue but slightly different in both value and intensity. This background of a near complement to the pale flesh tones gives the face and hands a warmth and subtle glow beyond what their color would reflect in less favorable association. The only other color in the composition is the faintest touch of coolness in the whites and blacks, an expression of the influence of subdued light on these surfaces.

The more you study this fine portrait the more you realize that this order and variety

(Continued on page 163)

CREATING COLOR COMPOSITIONS IN STILL LIFE

There is no better exercise for developing a sense of color composition than through experimentation with Still Life studies in Kodachrome. One can give full play to his creative instincts, in kind and arrangement of color, for he has control of all factors that go into or that affect the composition.

This color composition is based on the employment of two principal colors that are, in their pure state, complementary. The scheme is built around Yellow-Red (Orange) and Blue, its complement. As the Yellow-Red used is the more intense of the two colors, a larger area of the Blue (which is less intense) must be used to approach a color balance. The light value of the print on the wall—since its color is a near neutral—only affects the *value* of the composition and not its color balance. The dark table top, although less neutral, does not appreciably add to the amount of warm color in the composition.

The Yellow-Green foliage in full light is a minor introduction of a third color but one that is distantly related to the Yellow-Red, since both contain Yellow.

In creating such color compositions it must be remembered that only colors in the same value key will be reproduced faithfully. If one color is light and another is dark, an exposure that is correct for the light color will reproduce the dark color darker than its local color. The light one will appear lighter if the exposure is based on the dark one. In the illustration herewith the Blue background recorded a darker Blue than its local color because the exposure was calculated to hold as much detail in the flowers as possible, without too much loss in the darker areas.

DATA: Exposed on 4x5 cut film Kodachrome, Daylight type; Illumination, Daylight (blue) Photoflood; Camera, Speed Graphic; Lens, 11⅜ inch B. & L. Convertible Protar. The reproduction is four color process, letterpress, plates made direct from the transparency.

in areas and values is no accident of time or place. Everything is evidence of deliberate planning and masterful execution. There is nothing extraneous in this composition and nothing could be removed without disturbing the fine balance.

The pose of the figure, the dignity and simplicity of the entire picture express the calm, orderly habits of a life that is almost over.

But Robert Henri, the painter, interprets this great work of art in terms that the portrait photographer should remember and apply to his studies of the personalities of his sitters. Henri says "About the portrait Whistler painted of his mother I have always had a great feeling of beauty. She is old. But there is something in her face and gesture that tells of the integrity of her life. There is nothing wabbly about her face as there is in the faces of those whose integrity has been uncertain. A wonderful record of woman's beauty would have been lost to the world if her son had seen fit to look for any other beauty than that which was present. There she sits, and in her poise one reads the history of a splendid personality. She is at once so gentle, so experienced, and so womanly strong. She may have had other beauty in her youth, but it could not have surpassed this, which charms and fills us with reverence."

As you study the works of the Old Masters you will be increasingly impressed with their conservative and restrained use of intense color. It will sometime dawn on you that even the most colorful of these fine old paintings are, after all, very much subdued in key and intensity, in comparison with what most color photograpers seem to think necessary to register the result as a color picture.

This ability to create the illusion of color with but little color is the touch of the master. Anybody can concoct a "colored" picture through the simple means of associating splashes of intense, pure colors in something they designate as a composition.

In Ruskin's "The Stones of Venice" he explains that the finer an eye for color a painter has (and we might include color photographers), the less does he require to gratify it intensely; that less, however, must be extremely good, as the finest notes of a great singer, which are so near to silence.

If you are seriously interested in undertaking color portraiture as an *art*, you can do no better than experiment with compositions of your own based on some of the best old masters. Try to duplicate the lighting, the color harmony, and the subtleties that make them everlastingly pleasing. Do this experimental copying just as art students make copies of paintings. Having to mix the colors and match the values gives the student a valuable understanding of how the master used them to achieve his results.

The Serious Portrait Study

By "serious" portrait studies we mean those that will be as carefully planned and as painstakingly executed, in your medium of color photography, as the serious approach of the artist in painting a portrait. The final form of your effort should be a full color print, rather than merely a color transparency. A fine color print expresses to most of us the most satisfying ultimate of our efforts on such subjects as a picture of a human being.

If you will pardon a little digression for a moment we might consider one aspect of the mechanics of this medium of color photography. Portrait work can be done with a "one-shot" camera, but it is presumed that few of you own, or desire to own such expensive equipment. Besides, Kodachrome is a more flexible medium in many respects. Once you have captured the portrait in Kodachrome, separation negatives (for color print making) can be made at your leisure (or you can have them made at any later date). Further, such separation negatives can be made and remade until you are completely satisfied. When separation negatives are made in the camera (in a "one-shot") they cannot be remade, in case of failure in the laboratory later, without repeating all the effort of the original arrangement of the setting, etc. Such retaking is expensive, and is often impossible.

Personally I like the idea of having the Kodachrome transparency as a color guide in making color prints. When one makes prints from "one-shot" negatives he has no further guide as to color than a gray scale, and his memory. So much for this aspect of the undertaking. The argument as to which produces the better final quality is debatable, for too much depends upon the skill of the photographer. No single type of equipment or process has any monopoly on quality in such a

personal medium of expression as photography.

The portrait phase of color photography has, as yet, made but little progress because most color workers have just commenced to get the "feel" of this medium of Kodachrome. And too, experience and ability in black and white portraiture is not quite enough, for one cannot merely add color to black and white technique and produce a fine color portrait. A new element must be introduced, and for want of a better word we shall call this new element "Art." Art in color selection, color arrangement, color harmony, color composition, and a new appreciation for the effect of light.

Every element should help express the personality of the subject. The placement of the figure, the color of costume and background, the lighting and the value key of the whole composition should be planned to enhance the mood and character of the sitter.

In our brief investigation of the few Old Master portraits described on previous pages we should have learned that the painters of those portraits did not set out to merely paint a picture but to achieve the infinitely more difficult result of recording a personality.

The color photographer may produce excellent color pictures but still not produce a portrait. But if a good color portrait is a finely executed color picture *plus* that spark of personality that makes a picture a portrait, then the photographer has an obvious and immense advantage over the painter. The photographer can catch, in a split second, that fugitive and fleeting something that expresses personality. The painter must retain in memory what the camera shutter captures and locks up in the film.

But both photographer and painter must know *when* the sitter registers that momentary expression that they feel best portrays the spirit and character of their subject.

In planning and executing a color portrait the following progressive steps will help order your thinking, and in practice they will be found a good basic formula, amended to fit your own mental processes and your mechanical facilities and equipment.

1. Analyze the character and temperament of the sitter. Art students are continually reminded that ten minutes of inquisitive study of the model is worth more than hours of haphazard work. It would seem to be an equally good rule for the portrait photographer.

2. Decide upon the pose. Determine how much of the figure can or should be used. Study what turn of the head will best express the sitter's personality, and how this can be enhanced by use of the arms and hands.

3. Next should come the selection of the costume. Its color, line and form should be in keeping with the atmosphere you want to create, and should by all means become an integral part of the spirit of the portrait, and not something that offers competition to the face.

4. The background is dictated by flesh, hair and costume colors. Unobtrusive though it may be, the background must not be slighted in the planning of the composition as a unit.

5. With the foregoing decided upon you have all the elements for a portrait composition, but you do not have a composition until these elements have been associated in some orderly arrangement. That arrangement should support the mood of the sitter as successfully as is evidenced by such outstanding examples as Whistler's portrait of his mother. But composition in color photography is more than the arrangement of areas or masses. Equally important is the selection and arrangement of color, and an orderly variety in the intensity and value of the colors used.

6. Now comes the problem of lighting. For the present discussion we will concern ourselves only with fundamental lighting—natural lighting for a natural effect. The matter of restraint in lighting seems as difficult for most color photographers as that of exercising restraint in a too lavish use of color.

There are only two reasons for giving any thought to lighting. The first is to have sufficient light present to get an exposure that will properly record the entire composition on film. The second use of light is to help express the character and temperament of the sitter. Any use of light that goes beyond these simple applications only tends to call attention to the use of superfluous light, with an unnatural result.

7. Now we come to that subtle something that makes a color picture a portrait—expression. When we use the term expression we conjure up a whole galaxy of visualizations, from calm repose to an expressive smile. You are the judge of what this fleeting something is to be, determined by your study of the sitter and what mood best expresses what differentiates this human being from all other human beings. One clue to animated expression can be taken from our experience in photographing action. No doubt you have discovered long since that action is best expressed at the moment of start or finish of an action. A rather trite example is that of a jumping horse. If you catch him in mid air he appears to be hanging in a state of suspended animation. If you catch him at the start of the leap or upon impact in landing the illusion of movement seems to be more complete. This is often so in catching a smile or other animated expression. Get it just as it starts to break rather than after it has reached full expression. Try this in your next portrait shot and see if you do not agree.

Simple Lighting

At the risk of being called old fashioned I urge you to make your early experiments in Kodachrome portraiture with simple lighting, the kind of lighting you will find was sufficient for most of the world's greatest portrait painters.

There are two such basic lighting arrangements. The first is modeling light; the second is flat light.

Let us consider the first type first, and it is as simple as this. Visualize lighting an egg from *above* and in *front* (assuming that the side toward you may be called "front"), with a single light source, and at such angle that the highlight on the egg will correspond in position to the upper crown of a human forehead.

If the light is in a vertical plane that coincides with a line from the center of your face to the center of the egg you have a head-on flat light, and soft shadows on each side of the egg as its surface turns away to the egg's outline.

Now move the light 45 degrees to the left of the original head-on position (without changing your angle of view), and the left

Figure 110. An egg suggests the general form of the human head.

Figure 111. Illustrating "Near-shadow" lighting, for portrait photography in color.

Figure 112. An example of "Far-shadow" lighting, a lighting popular with portrait painters.

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"Stuart Smith, Esq."
Julian Smith, F.R.P.S.

side of the egg becomes relatively flat-lighted, with the shadow at the left outline all but disappearing. But the shadow on the right side has been extended over more of the right surface of the egg. At the same time the highlight has moved to the left of center. We will call this "near-shadow" lighting, for reasons we will explain later.

If the light is moved to the right a similar distance the right side of the egg becomes flat-lighted and the left side is now the shadow side. We will call this "far-shadow" lighting.

Our terms "far- and near-shadow" are clarified when we apply these light angle variations to a human head, in three-quarter position, as shown in Figures 111 and 112. The terms "far" and "near" now mean that the shadow is either on the subject's side nearest you (and the camera), or on the far side.

Turn back to the reproductions of the portraits of "Pope Innocent X" (Figure 105) and "Mrs. Seymour" (Figure 108) and notice that both are done in "near-shadow" lighting. Just as many portraits are painted in "far-shadow" lighting, however. If one can say there is any rule to govern choice between these two light angles it is that "near-shadow" lighting offers more opportunity to emphasize bone structure and pronounced facial planes, as illustrated in Figure 113, "Stuart Smith, Esq." by Julian Smith. This lighting very obviously added more emphasis to the cheek bone, temple and frontal bone than would have 'far-shadow" lighting. (More than one light source was used, as is obvious, but the general effect is of a single light source, for primary facial modeling.)

If the subject is a child or young lady "far-shadow" lighting will leave a larger unbroken area of fully lighted flesh color nearest the camera.

So far we have concerned ourselves only with a single light source, overhead, in front, and to either right or left. Without diagramming light placement you can visualize that the "far-shadow" light calls for the main light near the camera position, but above. "Near-shadow" lighting calls for the principal light in a position 60 to 90 degrees to the camera axis.

So much for the principal light source, and may I suggest that your supplementary lights be sufficiently subordinated so that the finished result will appear to have been secured through the use of a single light source.

The second type of general lighting hardly needs more than mention because it is "flat," flat-light, so flat as to be practically shadowless on all but the background, and if there is sufficient color and value separation, even the background shadow should be eliminated. In photography this calls for the light source or sources at or near camera position and reasonably close to camera height.

If you will permit a reference to the Old Masters again, study the portraits "Erasmus" by Holbein (Figure 106) and Whistler's "Mother" (Figure 109). These were both done in flat light, but a flat light that is nicely diffused. A more modern exponent of flat light is Bernard Boutet de Monvel, whose portraits are some of the finest of this technique.

But keep this one thing in mind. When the best painters use flat light more attention is given to pattern and decorative composition. Some of them even show influence of oriental art which is primarily decorative and two-dimensional.

Yes, you can use full flat light but if you do, work out the pattern of your composition with great care, and then be sure that you have soft, even illumination fully covering the entire composition.

There has been so much involved and

"stunt" lighting recommended in recent years that the inference is that one is not up-to-date, and certainly not original, if he follows more conventional and orthodox methods. There will be time enough to try stunt and trick lighting after one has learned to produce superior results through more fundamental procedures.

Short Scale Lighting

Just a word about supplementary lights. In color work such lights are more than advisable—their use is imperative. In portrait work exposures should be based on the fully lighted areas of the flesh tones. No "compromise" exposures, between light and dark areas, will record flesh tones with fidelity. No flesh shadows should call for more than one full f/ stop more exposure than do the fully lighted areas. In fact such lighting will give you rather strong shadow effects, although there will be good color in such shadows. This means a very short scale in your lighting, which requires very careful light balance and placement.

If you desire to reproduce costume colors rather faithfully, the darkest areas on the costume should give a meter reading within one and one-half f/ stops of the fully lighted flesh readings. For such colorful results use costume colors that are fairly light in value, to keep them in key with the flesh tones.

Perhaps you want to use rich, dark colors in costume and background. Since the exposure is to be based on the flesh tones, every darker than flesh value will be still darker in the Kodachrome result, for all such colors and areas will be underexposed, to what extent depends upon the percentage of incident light each color reflects. The only rule that can be advanced that will cover every situation is that you must use a color that is somewhat more intense and somewhat lighter in value than you want that color to appear in the final result. A few experiments will help you judge about how much darker a variety of colors will record in Kodachrome.

Or if you are doing a Whistler's "Mother" type of thing, forget about holding faithful color in the dark colors, but give those areas sufficient light to show form and some detail.

In lighting backgrounds remember that you can control their value with light. For instance, if you have a blue background that is too light in value and perhaps too intense in color, underlighting it will lower its value and in effect will reduce its intensity. Or you may want to reverse the procedure and overlight it to raise its value. Do not have background too close to sitter, and be sure that neither the background nor other surrounding surfaces reflect unwanted color casts back onto the subject.

The foregoing suggestions are by no means arbitrary rules. You will make more progress and will produce better results through working out your own solutions. I do strongly advise that you buy several little art books showing reproductions of good painted portraits. There are many such books on the market for 50c to 75c each, and they will be worth their weight in gold. They will teach you more of the fundamentals of posing and lighting, for color portraiture, than the "formulas" of a dozen photographic experts.

Use of Arms and Hands

In the five reproductions of painted portraits (shown on previous pages in this chapter) hands are used to good advantage, and in all of them the hands were given something to do, even though a little too obviously in the portrait of "Mrs. Seymour."

The two portraits (Figures 114 and 115) by Julian Smith show admirable use of hands.

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"Professor Fraser"
Julian Smith, F.R.P.S.

"The Master Plays"
Julian Smith, F.R.P.S.

In the portrait of "Professor Fraser" the use of a stick of blackboard chalk adds a deft touch that unobtrusively classifies the subject's profession. The hands and arms in the portrait "The Master Plays" are not only excellent directional lines, but they help create the mood of the sitter. The upper hand leads the eye directly into the face. The lower hand adds a light area spot to an otherwise overlarge expanse of dark. Although the violin bow may seem to carry the eye out of the bottom of the picture, the more dominant action of the bow is to direct the eye into the sweep of the left arm, and through that back to the face again.

In planning portrait studies remember that many hints as to the character, profession, hobbies, etc., of the sitter can be subtly suggested through effective use of the hands. Give them something to do, but be careful that the "doing" does not call too much attention to its action.

Modifying Facial Faults

Facial faults (variations from the ideal) may often be modified by one or more of the following: The pose, lighting, make-up, hairdress, costume, and sometimes with accessories.

To list a few more common faults, we find (1) receding chin and forehead, (2) eyes too close set, (3) long thin nose, (4) small or deep-set eyes, (5) thin lips, (6) too full lips, (7) too thin lashes and eyebrows, (8) excessively high forehead, (9) low forehead, (10) prominent cheek bones, (11) overly large, broad nose, (12) big ears, (13) forward jutting jaw, (14) discoloration under the eyes, (15) double chin, (16) excessively round face, and (17) excessively thin face.

The suggestions that follow apply to a lady sitter unless otherwise specifically stated.

1. *Receding chin and/or forehead.* For receding chin alone, use approximately front view, and lighter color make-up on the chin than on the balance of the face. Also try tilting the head back slightly or lower the camera angle. If both chin and forehead recede, keep close to the same straight front view, and use slightly lighter make-up on both chin and forehead. Be sure the *color* of the make-up is the same, only lighter in value.

2. *Eyes too close set.* Usually go with narrow, pinched nose. Can be best modified with make-up. Use mascara on the lashes at the outer corners of the eyes and keep eye shadow and rouge away from the nose. Widen the apparent width of the nose with slightly lighter make-up on bridge and carry this tone down over the sides of the bridge.

3. *Long thin nose.* Try foreshortening with the pose of the head. Keep eye shadow, eye brow pencil and rouge away from the nose.

4. *Small or deep-set eyes.* Arch the eyebrows a trifle lower than usual. Use mascara only on the *tips* of the lashes. Do not use too much eye shadow, nor a dark shade.

5. *Thin, tight lips.* Bring make-up slightly over the natural edges of the lips, with slightly darker make-up on the lower lip (it will match in the result because it gets more light than upper lip). Try to get an expression with the lips slightly parted—an expression as though about to speak or smile—but do not show teeth unless you want such a smile.

6. *Too full lips.* Keep make-up well inside the natural outlines of the lips. A lighter color lipstick keeps lips from being too prominent. Often smiling lips look less full.

7. *Too thin lashes and brows.* Easily corrected with make-up but must not be overdone. Exaggeration can completely change character.

8. *Excessively high forehead.* If a woman, arrangement of the hair is often sufficient. Or if the make-up next to the hair at top of forehead is a little darker it will shorten the forehead. Or you can use a foreshortened pose or lower camera angle, or keep highlights low on the forehead.

9. *Low forehead.* Keep hair back off forehead and arranged higher to give length to the head. Have highlight run into the hair, above hair line. Darken the upper temple areas to narrow the forehead.

10. *Prominent cheek bones.* If a man you might use "far-shadow" lighting and do not have too much value contrast between face and background. If a woman, keep highlights off cheek bones, and use little or no rouge. "Far-shadow" lighting on a three-quarter pose, against a background that softens the far outlines of the face will help.

11. *Overly large, broad nose.* Sometimes a slightly off front-face pose helps, but do not turn or tilt head in any way that will emphasize the nostrils. Use a darker make-up on the sides of the nose and around the nostrils, with a lighter shade down the top of the nose.

12. *Big ears.* If a man, choose a background close in value to that of the flesh tones. If a woman, hairdress can be arranged to correct this fault.

13. *Forward jutting jaw.* Darker make-up on the chin than on balance of face. Higher camera angle, or tilt head forward and down.

14. *Discoloration under the eyes.* Expert make-up can bring flesh tones and this discoloration closer together in value by darkening the flesh slightly and deftly lightening the discolored areas. Strong top and front light falling more directly on these areas will make them appear lighter than cheek planes.

15. *Double chin.* Have model sit erect, then lean forward slightly. Camera position should be slightly above the level of the head. See that lighting does not cast shadows that outline these voluptuous chins.

16. *Excessively round face.* Hair should be well off forehead. Eyebrows should be arched slightly with make-up. Rouge should cover outer area of cheeks in triangular shape, reaching in to about the center of the eye, and then rather straight down to jaw line. Use darker make-up base on the outside of the face, lighter in the central area. Make-up mouth as wide as possible but do not add fullness to lips. Use any pose but a full front face. "Near-shadow" lighting will further narrow the face.

17. *Excessively thin face.* A soft arrangement of the hair at sides of head, and lower on top of head. Use full front, or near front face pose. A face of this type can be widened with rather flat light. If the hair is light, a light value background is advisable. Costume neck line should be round or curving—no V-neck or straight lines down from the head.

Materials for Color Make-up

Since no retouching can be done successfully on a Kodachrome transparency and only a limited amount is advisable on separation negatives, make-up for color work is both imperative and exacting. "Panchromatic" make-up cannot be used for Kodachrome.

Special make-up for color work is available from several manufacturers. All of it is to be used sparingly, but when properly applied its use will not be detected in the Kodachrome transparency.

The following materials should be in your make-up kit. (1) Foundation, (2) Face Powder, (3) Powder Brush, (4) Lip Rouge, (5) Brush for Lip Rouge, (6) Rouge, (7) Eye Shadow, (8) Eyebrow Pencil, (9) Liner, (10) Brush for Liner, (11) Towels, (12) Face Tissue, (13) Cold Cream.

Make-up for Women

MAX FACTOR

Complexion	*Blonde*	*Sun Tan*	*Brunette*
Foundation	Pan-Cake Cream No. 1 or 2	Pan-Cake Tan 1 or Natural 2	Pan-Cake Natural 1 or 2
Powder	Olive No. 1	Sun Tan	Olive No. 1
Eye Shadow	Light Grey	Grey	Brown
Lip Rouge	Tru-color Light Red	Tru-color Med. Red	Tru-color Med. Red
Eyebrow Pencil	Light Brown	Brown or Black	Brown or Black
Eyelash Make-up	Brown	Brown or Black	Brown or Black
Cheek Rouge	Light Red	Tru-color Dark Red	Tru-color Dark Red

Max Factor's Pan-Cakes are in dry cake form, and are best applied with a moist sponge in a thin, even coat. This manufacturer has recently introduced a new make-up known as the "T-D-Gray" series. The colors are scientific duplications of natural skin-tones, subdued to fit the limitations of the color camera. This new make-up is in liquid form; the thinnest mineral oil which will hold the necessary pigments in suspension. It forms a microscopically thin, but none the less effective, coating which partakes of the natural transparency of the skin.

MINER, INC.

Complexion	*Fair*	*Brunette*	*Suntan*
Foundation	K-22	K-23	K-25
Powder	K-22	K-23	K-25
Eye Shadow	Foto No. 1	Foto No. 2	Foto No. 2
Lip Rouge	K-Light	K-Medium	K-Dark
Eyebrow Pencil	Brown	Brown	Brown
Cheek Rouge	Medium	Medium	Medium

Miner, Inc., foundations are of the grease-paint type. Make-up kits as a complete unit are supplied by this manufacturer through photographic dealers.

RUBENSTEIN'S PHOTOCHROME

Foundation, Photochrome No. 1; *Powder,* Light; *Eye Shadow,* Light Brown; *Lip Rouge,* Medium Red; *Eyebrow Pencil,* Brown; *Cheek Rouge,* Medium.

The Rubenstein foundation comes in liquid form. It is easily applied, dries evenly, and produces a fine skin texture.

Make-up for Men

MAX FACTOR

Foundation, Pan-Cake Tan No. 1; *Powder,* Sun Tan; *Eyebrow Pencil,* Brown or Black.

MINER, INC.

Foundation, (blonde) K-23, (brunette) K-24; *Powder,* (blonde) K-23, (brunette) K-24; *Eyebrow Pencil,* Brown.

RUBENSTEIN'S PHOTOCHROME

Foundation, Photochrome No. 2; *Powder,* Medium; *Eyebrow Pencil,* Brown.

Elizabeth Arden's Screen-Stage Make-up, especially the "N" Technicolor Series, is quite popular. It is easy to apply and produces very satisfactory results.

Remember that make-up must not create a "mask." Its purpose in color work is to enhance the natural beauty of the subject and to present a smooth, even coloration that matches the natural skin color. Make a few experimental shots before you attempt many serious portrait studies. There is a fine balance in this matter of make-up that can only be learned by a little trial and error unless you have had instruction in make-up for color.

Color Composition

The ideal situation exists when the photographer can control the selection and arrangement of all colors—provided he knows what he is about.

A portrait color composition should be conceived and created in the order of importance of the elements and the areas they occupy, and generally in the following sequence:

1. *Costume*
   —should harmonize with the sitter's complexion type, and should be appropriate to the mood to be expressed
2. *Background*
   —subordinated in both color and value to the rest of the composition unless the background itself is a part of the story
3. *Incidentals*
   —include no extraneous objects, but objects that support the theme of the picture may often be used as effective spots of color accents

I might give you a hundred color combinations and you in turn could make a hundred variations of them, but only a few color suggestions are being listed. They are presented as a starter for your own thinking rather than as definite recommendations for use as is.

The two basic fundamentals upon which to build your color scheme are (1) a costume that enhances the beauty and personality of the sitter, and (2) follow the rule of "twice the area, one-half the intensity" or "one-half the area, twice the intensity" and so on, in planning the color for each area in your composition. (See discussion of "Values and Intensities" in chapter 3.)

In the list of color suggestions which follows we are obliged to use color names common to industry rather than the more exact and scientific designations of the Munsell System, for the Munsell terms would mean little to you unless you had the charts by which you could definitely identify each color in its proper intensity and value.

We have headed up the color listing with the suggestions "Largest Area," "Second Largest," etc. By "Largest Area" we mean just that, and not necessarily the background. If the costume occupies a larger area than the background, then first color listed is suggestion for the costume, and second one for the background.

Again may I repeat, these are not hard and fast rules for color selection, they are merely suggestions. How well you adapt them or any others depends as much upon your understanding of intensities and values as upon the hue or color used.

BRILLIANT COLOR COMBINATIONS

Largest Area	*Second Largest*	*Small Accents*
Dark Green	Gold	Spectral Red
Gold	Blue	Vermilion
Blue	Turquoise	Scarlet Red

SOFTER COLOR COMBINATIONS

Delft Blue	Amethyst Purple	
Gold	Amethyst Purple	
Rich Dark Brown	Apricot	Blue
Chestnut Brown	Cream	Bottle Green
Beaver Brown	Sapphire Blue	
Beige	Peacock Blue	
Sage Green	Bottle Green	Gold
Buff	Soft Blue	Rose
Honey Color	Emerald Green	

GRAYED COLOR COMBINATIONS

Gray Blue	Silver	Pink
Pearl Gray	Dark Cardinal	
Silver	Sage Green	Ashes of Roses
Beige	Heliotrope	
Cream	Brown	Gold

My final suggestion is that you plan portrait compositions around the head and figure (costume) as a unit, and that all directional lines and color values tend toward drawing the attention to and not away from the head.

Do not burn up the colors with too much intense light and light that is too flat, unless your objective is a decorative composition, as previously discussed. While it is true that color separation partially eliminates the need for the amount of value contrast, or modeling, required in black and white work, remember that color *alone* does not express form. Modeling must still be done in light and shade, an axiom too obvious to need more than mention.

Above all, put a feeling of art in your portrait compositions. Do not follow the techniques of the advertising photographer who is obliged to deal with colors that catch the eye, in competition with everything else that is attempting to capture the reader's attention. A portrait is subjected to no such competition, and is a thing to be viewed for itself and itself alone.

116

"Dick Swiveller"
Julian Smith, F.R.P.S.

Costume and Character Studies

This phase of color photography offers unlimited possibilities for imaginative and unusual treatment—a free play for your creative ability.

Visualize if you will the color possibilities in the two studies Figures 116 and 117. In character studies along the line of the first study you can base your composition, color and lighting on sound portrait principles and then add a little exaggeration in all elements. That is, you can use more contrasty lighting, more intense colors, and greater contrasts in color and value. Such studies can border on the dignified or they can be "caricatures." It is a fascinating adventure any way you approach it, and one that gives full scope to your dramatic instincts.

The second illustration (Figure 117) needs no interpretation. You can "see" this subject in color, and so vividly that you subconsciously reach for your camera to get a color shot of the subject before he gets away.

A more modified costume study is that of the three dancing girls shown in one of the color plates in this book.

117

"Entr' Acte"
Julian Smith, F.R.P.S.

For those of you with a creative urge nothing will bring more enjoyment nor offer more opportunity for an exercise of your abilities than costume and character studies in Kodachrome.

118 *A Still Life study based on a related color scheme made up of yellows and reds, with a small accent of a near complement, the green in the flower foliage. The experiment also tested the color effect secured by photographing the principal colors through the transparent, color-tinted glassware.*

Still Life Studies

There is no better way to study and experiment with Kodachrome photography than through the creation of still life compositions.

In still life work you have control over *all* elements of the problem. You can plan, alter, try and check your composition as leisurely and thoughtfully as you wish. You are not continually conscious that the model is getting tired or that the sun is at the wrong angle, or any one of a dozen other distractions that interfere with doing the best work.

This brief discussion of still life photography, in color, has been included in this chapter because there is a kinship between the subject and portraiture. One approaches the problem in somewhat the same way albeit still life has few of the limitations common to portrait studies.

I have no desire to so much as suggest what type of still life you try your hand at. I only want to remind you that the problem will be simplified if you have a clear mental picture of your objective before you start. Perhaps you are going to create something from the standpoint of pure composition, and you will use color to help express that. Or you will work out a finely balanced color scheme, and the choice of objects and their placement will be determined by their part in expressing the color scheme. Or you may attempt the reproduction of some object's color, texture and form, in which case everything else will only serve as a setting for that object.

Going back to painting again, you will pick up many helpful ideas from good still life art, especially when you view them analytically, to determine what the artist's objective was. Do not view such paintings merely as pictures but as an artist's effort to master some problem.

I cannot emphasize too strongly some experimentation with still life studies, if for no other reason than to learn something of color composition, the reflective power of various colors in various intensities and values, and above all, to learn how these variations are recorded in Kodachrome.

Kodachrome is your medium, study it as an artist studies the effect of his colors. He paints with pigments and a brush—you paint with colored light and exposures.

CHAPTER 12

PHOTOGRAPHING FLOWERS AND GARDENS

SO MANY Kodachrome enthusiasts are interested in flower photography that the subject seems to deserve this separate chapter. Even though you may not be especially interested in this field of photographic subject matter, may I urge that you indulge in a little study of flowers, not as botanical specimens but as examples of exceptionally stimulating color arrangements. Become at least casually aequainted with what nature has done in creating a limitless number of color compositions, for within the world of growing, flowering plants you will find every conceivable variation of every color in the spectrum.

Simplicity seems to be nature's color keynote. We are accustomed to think of flowers as a kaleidoscopic display of every hue in the whole gamut of color. In the aggregate this may appear to be true. But when viewed as individual specimens the color scheme of any one flower is quite simple. A pansy or other multi-colored flower may seem to be an exception, but it is not color rampant in the sense that many color photographers apparently feel is necessary to create a color picture.

But while nature has been sparing in the number of color hues usually associated, she has shown us that infinite variety can be secured through numberless slight variations in intensities and values of the two or three hues associated. And this association of many variations of a limited number of hues is always a safe basis for color harmony.

Has it ever occurred to you what phenomena gives color to growing plants, flowers and trees? It is an intricate subject, but perhaps we can grasp a better appreciation of the exhilirating beauty of the flower world if we explore the elementary aspects of this phenomenon.

Three groups of color-producing matter seem to be responsible for the color in growing plant life—in flowers, fruits, vegetables and trees. It will facilitate your grasp of the relationship of the colors within each of these groups if you will recall the colors of the three dye layers in a Kodachrome transparency. You remember that these three colors are Yellow, Magenta (red-purple) and Blue-Green. These three colors are, as we shall see, the more or less dominate ones in the three groups of colors found in nature.

If you will refer to the Color Wheel we will divide it into three segments. Each segment will represent, roughly, the colors produced by one of the color-producing groups before mentioned and which will be described later. But for the moment let us define the three segments on the Color Wheel. One will include all colors from Red on one side to Blue on the other. We will call this Segment No. 1. Segment No. 2 includes Blue-Green, Green and Green-Yellow. Segment No. 3 is Yellow and Yellow-Red.

In plant life the color group included in Segment No. 1 is known as the anthocyans, a word which means "flower-blues." In a free state the anthocyans are purple, but in the broad coverage the group also includes the adjacent colors of red-purple and red on the one side and purple-blue and blue on the other. This color-producing matter, or pigment, is in solution in the cell sap, and certain chemical actions seem to determine whether these anthocyan pigments appear as blues or reds. Certain acid conditions cause the "basic" purple to swing toward the blues, and an alkali condition tends to create reds.

In the second group, represented by Segment No. 2 we find the greens and the adjacent intermediate colors of blue-green and green-yellow. This color-producing matter is

known as chlorophyl, which means "leaf-green."

The third and most limited group is Segment No. 3, the yellows and yellow-reds, and all their variations. This group is known as xanthein colors, which means yellow. While this group may be limited in extent of color hues, it is found profusely in fruits and all kinds of flowering plants.

It is an interesting fact that while the anthocyan pigments are in solution and flow freely in the sap, the chlorophyl and xanthein pigments are a part of the plant tissue.

From the standpoint of color balance it is more than significant that the anthocyan pigments, or flower colors, are roughly complementary to the chlorophyls, or foliage colors. There are many flowering plants whose basic color scheme is as simple as this: A red-purple blossom, green leaves, and a yellow accent in the stamens. In such simplicity the two complementary colors dominate in color mass, while the third color is subordinated in area if not in intensity.

Another characteristic is that where an anthocyan color predominates, the chlorophyl is not present at all or tends to disappear. On the other hand, where chlorophyl appears there is little or no evidence or anthocyanins. When a flower loses one of the chief factors which produce this anthocyan color matter, but retains the others, the resulting deficiency produces an albino, or white flower.

There are cases where both anthocyanins and chlorophyl are present in the same part of the plant. The result is much the same as if you mixed any two complementary or near complementary colors. They tend to destroy each other, and in so doing produce a gray. This "annihilation" of color through the admixture of complementary colors is called "achromatism." We see evidence of this action in some tree leaves which are brilliant leaf green on the top side, to the sun, but a rather grayed green underneath. You have noticed this grayed effect when a strong wind turns the under sides of the leaves toward you.

We see the transition of color through the replacing of one color-producing property by another as a fruit or flower develops. For instance, chlorophyl predominates in flower buds and in unripe fruit but as the blossom or fruit matures this chlorophyl gives way to the anthocyan or xanthein pigments. We often find more subtle transitions present at the same time in such instances as a green leaf whose stem color delicately blends from the green of the leaf into the red-purple of the stem where it grows out of the vine or bush, as in certain species of roses. Nature has further seen to it that color harmony is maintained by altering the green of flower foliage to a better balance with the blossom color. This difference is especially apparent in such flowers as the iris, where we find foliage of one kind of green associated with the yellow iris and quite a different kind of green leaf with the purple iris.

In our study of flowers we find all of the "types" of color compositions we have discussed in the preceding pages. There are such simple two-color combinations as the dandelion, with its extremely intense yellow flower contrasted with a green foliage of less intensity and lower value. Then there are three-color combinations—the leaf green of the tulip foliage contrasted with the brilliant mass of color that is the blossom, with an accent of a third color in the throat of the flower. These and others like them are contrasting color schemes.

In an equally extensive variety we find related color combinations, like the foliage and flower of a blue delphinium, or the sky-blue morning-glory. Regardless of whether a flower's color scheme is a contrasting or related one, you will usually find that third and fourth colors are but a mixture, in some proportion, of the foliage and blossom colors. (Color accents such as stamens, pistils, etc., excepted.) This relationship of colors, in any color arrangement, established through creating "new" colors by admixture of the principal ones in a composition is one of the secrets of color harmony, whether in nature or in a costume.

Another characteristic that has a definite bearing upon the color quality of flowers is that of surface texture. Different textures of the same color have a different color quality due to the variations in power of surface reflection. We discussed that aspect of color early in the book.

Some flower petals are dull and light absorbent, a property of surface texture rather than of the color itself. Hard, shiny or waxy sur-

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In garden shots in which there is little color separation between areas, some side-lighting will define the areas and strengthen the composition.

faced flowers seem to reflect the greatest intensity of color. A good example of a dull, velvety texture is a purple petunia; a begonia represents a type of surface that is "hard" and highly reflective.

So much for this phase of our study of flowers. It may seem that this little side exploration has slight connection with flower photography in color. But in a broader sense, any effort that helps you become better acquainted with your photographie subject establishes a sympathetie understanding that not only increases the further enjoyment of your association with the subject but also results in finer photographic results. In short, the more you "see" in a subject the more you are likely to get out of it, photographically. And this is especially true in color work.

Photographing Flowers in Sunlight

Flowers are excellent subjects for color photography for several reasons. Your interest may be prompted by your love for flowers, or by your desire to faithfully record some floral display that has given you especial enjoyment, or you may look upon them only as sources of fascinating color schemes.

Whatever your interest, flower photography in color offers more angles of approach than almost any other type of subject. You can make studies of individual specimens, or of arrangements, or of large expanses of massed color. But what is most important—you have an unusual opportunity to utilize more variety in light angles because you are working with a translucent or semi-translucent substance.

What other type of color subject offers such flexibility of technique? When you side- or back-light any opaque object that object partially blocks out the source of light, with consequent loss in color brilliance in the Kodachrome result. When you photograph most flower subjects in side- or back-light, you are using *transmitted* light, with a resulting increase in the intensity of all color through which the light is transmitted. In such light your lens sees the flowers in the same kind of light that gives brilliance to a Kodachrome transparency—that of light coming through the color substance. The comparison stops short, of course, because a flower is not as completely transparent as is a Kodachrome transparency. But the principal involved is the same.

Which brings us to the question as to how to get maximum color intensity in our Kodachrome shots of flowers.

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Black and white reproduction of the Color Plate on page 179. Backlighting was used to increase the color intensity of the flowers through transmitted light.

Flowers or Gardens at a Distance

The garden scene shown in Figure 119 depends for interest more upon form and pattern than upon brilliant splashes of flower color. The overall color is various kinds and shades of green, with very little massing of flower color except in the border at the right. The only question here is to determine the angle of light that will make the most of the formal pattern of the garden without degrading the overall clean, sunshiny color of the scene.

We have just suggested, by inference at least, that strong side- or back-lighting is preferable for flower shots. But it depends upon the character of the subject. For a garden shot this scene is rather expansive. If it had been photographed in flat light, the forms would have "run together" for there is little strong color separation in the scene. When color contrasts are absent, value separation is imperative.

If back-light had been used the shadow areas on the hedges, for instance, would have been larger than the areas in full light. The result would have been a "blackish" effect across which cut bands of green. This would have destroyed the general color quality of everything in the scene except the border of flowers at the right, and you will agree that this area is decidedly secondary to the main theme of the picture, which is, obviously, the formal garden as a unit.

As you can see from the reproduction, the light angle used was about a 25% side-light. This gave soft modeling to the hedges and trees, and the side-light angle was so slight that there are no dead shadows and no loss of color in the shadow areas at any point except right at the ground line, which is not objectionable.

There is nothing unusual about this problem nor the result. It is presented only as a suggestion that there is one best light angle for every color problem.

Using Transmitted Light

It is unfortunate that text and color illustration cannot always appear together, but if you will refer to the color plate of the flower border, garden wall and young lady, you will notice that an entirely different light angle was employed from that used in Figure 119.

We might analyze this color shot briefly. The largest flower color mass is the white one in the foreground. If you have tried photographing white flowers you know that it is practically impossible to hold any detail in

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An excellent example of the use of transmitted light on close-up flower shots. Note that the tulip blossoms are back-lighted, a lighting technique that greatly intensifies the local color of such transparent subjects as these flowers.

them under flat light. If you attempt to hold detail through extremely short exposure the modeling will appear quite bluish; a result of sky reflection.

It was rather necessary to use these white flowers in the foreground of this composition because most of the other color areas were predominantly green and low in value. Cover the white flowers in the reproduction and the composition lacks the value contrast it should have to ereate a feeling of sunshine. Also, the white flowers seem to add color intensity to all other colors in the composition.

The shadows on the figure and the garden wall give a elue as to the angle of light. The sun was high and to the right, about in line with the direction suggested by the stepping stones. The sun being high, flooded the composition with good top light. And by being in front and a little to the right, the angle of light produced soft modeling on the white flowers, and there was a sufficient amount of light transmitted through the flowers directly in front of the figure and in those being held by the young lady to greatly intensify their color over what would have been true in flat light.

A reflector was used to keep the shadow side of the figure from going too dark and colorless. The reflector was small so its light did not appreciably affect anything but the figure.

Even though the pansy border was not getting as much "transmitted" light as the taller flowers, their color brilliance was enhanced by what little back-lighting they did get.

If this garden shot had been a flower border of masses of brilliant flowers like the tall yellow ones against the wall, I would recommend an even more direct back-lighting of the flowers, for maximum color saturation. In doing so we would sacrifice some brilliance in the foliage, for more of it would be in shadow and most flower foliage transmits but little if any light. Also, in stronger back-lighting the wall and bushes beyond would be unpleasantly dark in value. But the suggestion for stronger back-lighting applies *only* to the problem of getting the greatest color saturation in the flower blossoms. I mention this in connection with this shot only for a comparison with some light angle you may want to use when the blossoms of flowers may occupy all or practically all of your composition.

Camera Angles

The color composition we have been talking about includes so many elements besides the relatively small area occupied by the flowers that this subject is hardly a fair suggestion for camera angles. But before we discuss other angles it may not be amiss to state what determined camera angle in this composition. The factors that were considered in this case were (1) the desire to "look into" the blossoms as much as possible without losing the benefit of

(Continued on page 181)

PHOTOGRAPHING GARDENS IN COLOR

In the pages immediately preceding, the desirability of back- or partial back-lighting of flower studies done in Kodachrome has been stressed repeatedly, but not too emphatically. Flowers are one of the few color subjects in which the colors are intensified by back-lighting. That is unless the particular flower is opaque, and will not transmit light freely.

You know how much more brilliant the color of a Kodachrome transparency is than a full color paper print made from the transparency. Transmitted light creates the brilliance in the transparency's color. The print must be viewed by reflected light—flat light.

This same law applies to any colored transparent or semi-transparent material.

The garden illustration shown here does not contain a riot of color, but the colors in the flower border, and in those held by the model, are more intense in color than they would have been in flat light. Much intensity of color is lost in reproduction, you appreciate. Further, the foreground white blossoms would have been "washed out" in flat light.

The position of the sun is indicated by the lighting on the model. The shadow side of the figure was lighted with a portable reflector, similar to the roll-up type described in Chapter 9.

DATA: Exposed on 8x10 cut film Kodachrome; Camera, Eastman View; Lens, 12 inch Anastigmat. The reproduction is four color process, letterpress, plates made direct from the transparency.

transmitted light, and (2) the desire to make as much out of the sweep of the foreground directional lines as possible.

Going back to the supposition that this might have been a closely planted border of massed flowers, and without regard to any other part of the composition, I would suggest a slightly lower camera angle, to see the blossoms as a mass of color and to avoid too many "holes" in the flower masses like the almost objectionable openness of the second group of white flowers.

The reproduction of the tulip border shows a good, low angle for massing color. This was especially true in this case as the shorter stemmed flowers were all one color and the taller ones all another color. If the camera angle had looked down into such a border the color result would have been a confusion of conglomerate color. If on the other hand this had been a bed of low-growing, closely-massed flowers a sharp downward camera angle would hold the effect of color mass better than would a low angle, of course.

The kind of flower, the character of the planting, and the impression you are trying to create all influence choice of camera angle, and you will have little difficulty in determining the one best angle after a little study of each problem.

Close-up Studies of Flowers

Again our technique must be adapted to the problem. If you are photographing an isolated group of blossoms such as three or four spikes of iris, by all means use a side and back-light angle. By that we mean have the sun in front of the camera, but somewhat to the side at whatever angle gives the greatest color intensity. If you are using a ground glass focusing camera you can easily detect the angle of fullest use of transmitted light by studying the image on the ground glass. If you are using any other type of camera I suggest that you roll a piece of cardboard into a sharp angle cone, and study the blossoms at camera distance through this cone. You will be able to see the flowers with a more critical eye if you block out all surrounding extraneous objects.

Too often an otherwise beautiful close-up flower shot is spoiled by a confusing background, more than likely an out-of-focus one if you are working at a fast shutter speed and large lens opening. The simplest solution to the problem is to use a large cardboard as a background, about two feet or so behind the flowers, or if the card is not large enough to fill the frame of your picture, use a large piece of fabric held or hung behind the flowers. If fabric is used stretch it to eliminate bad wrinkles or folds, or have it sufficiently out of focus so that such folds will be softened.

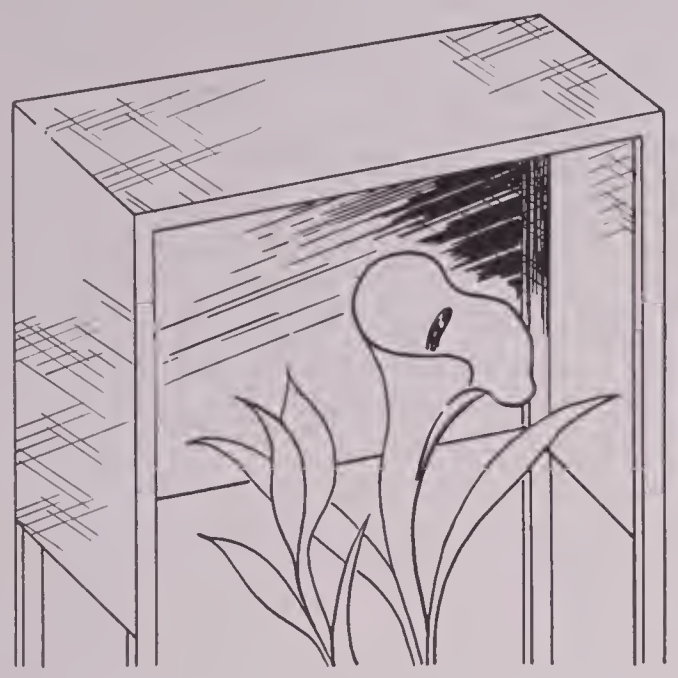
The color intensity and value of the background will have much to do with the effectiveness of your color result. If you are shooting very sharply back-lighted, the value of the background, regardless of its color, will go much darker than you may desire for this background will also be back-lighted unless the sun is so nearly overhead that the background can be lighted by a slight backward tilt.

Another aspect of this background problem is the choice of one of a color, intensity and value that will enhance the color of the flowers. The most dramatic effects are secured by using a background color that is complementary, or nearly so, to the color of the flowers. For still further emphasis on the dramatic, the value of the background should be in contrast to the value of the flowers. That is, use a background of slightly darker value than the flowers for light value flowers, and vice versa. A typical illustration of contrast in color, intensity and value would be brilliant yellow flowers against a grayed purple-blue background of slightly darker than medium value. Remember that a background of darker value than the flowers will go darker than it appears to the eye if your exposure is based on the yellow flowers, for the background will be on the underexposed side. If you were photographing a spike of dark blue delphinium, a good background would be a light tan or weak yellow.

In any event the background should be less intense in color than the color of the flowers, to keep the proper relationship between intensities and areas—the rule of "twice the area, half the intensity," etc.

Photographing Individual Flower Specimens

Such studies are extreme close-ups, of course. This fact makes it advisable to use the most diffused light we can find, or create,



122 *A light diffusing box for use in photographing growing flower specimens outdoors in full sunlight. A light frame covered with regular diffusing cloth.*

in order to hold local color and subtle modeling. If there is any subject that contrasty lighting will ruin more surely than close-up flower studies I have never encountered it.

The best light condition, without benefit of gadgets, is an overcast sky—not so light as to produce strong shadows—not so heavy as to create an excessively "blue" light condition. Insofar as shadows go, the angle at which you work to the light source will help you control this problem. But if you desire both good color saturation and soft modeling you will be quite fortunate if you find many days when the overcast creates the character of light one needs. Besides, why wait for such an infrequent condition if we can manufacture a better one, for use when and where we please.

The gadget illustrated is for use in full sunlight. It is simply an adaptation of the diffusing screen idea described in the chapter on "Reflectors and Diffusers." It is a "box" of light framework over which is stretched diffusing cloth, closed on top and three sides. The cloth need not extend to the ground as the device will not work successfully when the sun is extremely low. If you wish, the back side can be a lightweight plywood on which you can thumb-tack background cardboards.

The diffuser frame should be of ample dimensions, to allow plenty of working room at any angle. The light is better diffused when the box sides are not too close to the flower specimen and the possibility of cloth texture shadows is also eliminated.

Should you wish to shorten the value scale of the flower specimen still further, you can introduce the idea of a diffuser and reflector combination, the principle of which was illustrated in the chapter just mentioned. You can use a white card as a reflector, placing it on the inside of the diffuser frame opposite the side from which the light is entering the diffuser box. The angle of the card will depend upon the angle of light and upon what shadow areas you want filled in.

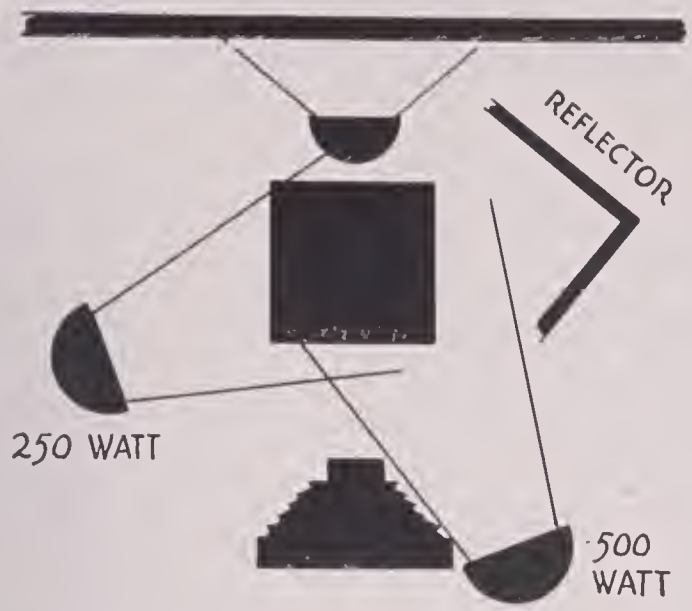
All this paraphernalia may seem a little cumbersome, but the effort in construction and use will be amply rewarded with the finest of color results. By-product advantages of this device are that it is protection against all but strong wind, and it permits photographing the flower specimen without cutting, so you do not have to hurry for fear the flower will wilt. It is my observation that specimen studies have a feeling of naturalness when photographed growing that one seldom secures with cut flowers.

Photographing Flowers by Artificial Light

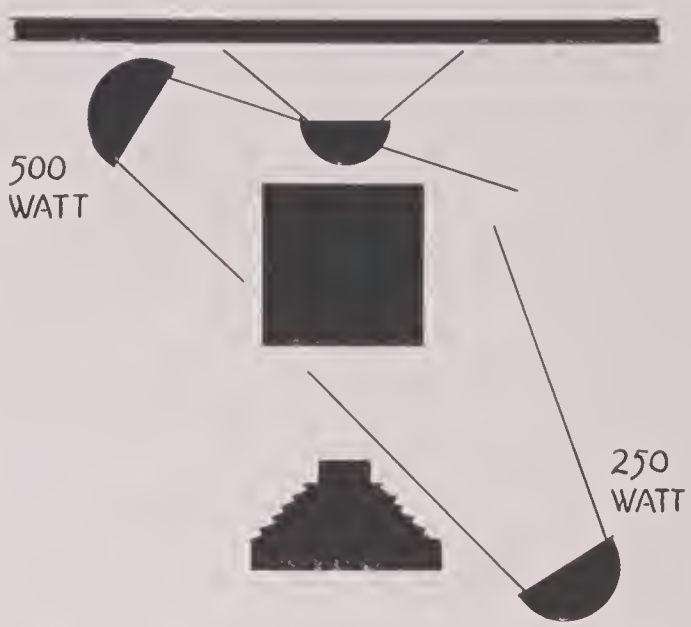
You are doubtless familiar with no end of lighting diagrams for photographing flowers in black and white by artificial light. In fact you can refer to the diagrams in the chapter on "Photofloods" for suggestions of conventional lighting arrangements.

But all such diagrams assume that the subject is "opaque," and that all light by which the exposure is made is light reflected back from the subject. Since most flower petals and some flower foliage are semi-transparent we have a new factor, for color work, that ordinary lighting diagrams do not consider. That factor is transmitted light. We should make all possible use of it in flower photography—even to a greater degree than has been suggested for outdoor work. And you have greater opportunity for effective use of transmitted light with artificial light sources than in sunlight.

It is rather difficult to outline definite lighting set-ups for flower studies because every type of flower presents a different problem. But if you wish to get maximum color saturation, place the strongest light source behind



123 *A simple lighting arrangement for photographing flowers with artificial light illumination. A side light will open up shadows created by the stronger front light. A reflector will help create a feeling of luminosity in flowers that are quite transparent.*



124 *Back-lighting of flower studies will increase color intensity in blossoms that transmit light readily, in the same way transmitted sunlight does. Since a single light behind the flowers will create dead shadows on the camera side of foliage, a front light is needed to open them up.*

and to one side of the subject. A narrow angle reflector is preferable, to force as much light through the flower petals as possible. Base your exposure on this transmitted light. Then turn off this back-light and flood the subject with a front light in a flatter reflector. Now with your light meter determine the distance at which this front light should be set so that an exposure by it alone would be one full f/ stop more than the back-lighting alone calls for. This front light will kill all hard front shadows.

Such "transmitted" light arrangements are solely for the purpose of securing maximum color saturation. Whether they give the type of modeling you prefer is something you will have to determine through experimentation.

Do not forget the importance of backgrounds. Select such as will accentuate and enhance the color of the flowers. And follow the same rules of intensity and value previously discussed. If the front light does not provide sufficient background illumination (and it seldom will), use a background light from below or to one side, depending upon which way you prefer to have the tone gradation of the background blend off.

If the flowers you are photographing do not lend themselves to this transmitted light technique, the best results will be secured under diffused light.

As a start on light placement (and at least two lights should be used), first place the principal and strongest light in front and to one side. Then fill in the shadows with a weaker side light, or if same size lamps are being used, pull this secondary light back from the subject to reduce its effective volume. Now set up a hinged white card on the side of the flowers opposite the principal light. This card will reflect back onto the flowers and will open up some shadow areas the secondary light may not reach. To soften the lights, hang a piece of diffusing (or similar) cloth over or in front of the two lamp reflectors. Then make your meter reading and calculate exposure.

In most such setups the background will require separate lighting, but it will not affect your exposure unless it is too close to the flowers and too strongly lighted.

Using Photoflash

I would not recommend photoflash for indoor flower photography because of the difficulty in determining the best placement of lights for the quality of delicate modeling flower studies demand. One exception might be if one uses small photofloods to arrange the lighting, and then replaces them with photoflash for the exposure. Flash does eliminate the hazard of wilting the flowers under

any prolonged impact of photoflood lights. If you make flash exposures you can only follow an exposure table for light distance, diaphragm opening, etc., for the type of flash lamp being used.

Synchronized flash in sunlight can, of course, be used in flower photography in the same way one would employ it on any other outdoor subject. But if flash is used for supplementary light, be sure you do not burn out delicate, high-keyed flower colors by over-lighting. Personally I prefer to use a reflector so that the effect of the supplementary light can be predetermined.

* * * * * * *

If this chapter has stimulated a new or increased interest in flower photography in color, and has helped you see nature as the marvelous source of color inspiration it is, your enjoyment of this phase of Kodachrome adventures will be long and satisfying.

Exposure Compensation for Photographing Close-up Objects

(Without Front or Supplemental Lenses)

Many is the time color workers wish to do close-up shots of such objects as individual specimens, but are uncertain as to what procedure is required to get best results. The old rule "open up for close-ups" is the right idea, but a trifle too indefinite, especially for color work.

Theoretically, whenever you focus on any object closer than eight (8) times the focal length of your lens, you should make some exposure compensation for the increased LENS-TO-FILM distance. The closer you work to the object, the more imperative the compensation.

For instance, when lens-to-film distance is 5 inches and you are using a 4 inch lens, 6½ inches with a 5 inch lens, or 10 inches with an 8 inch lens, you should use one-half (½) larger f/ stop than "normal" exposure. If lens-to-film distance is equal to lens-to-object distance, you are obliged to increase "normal" exposure by four (4) times.

You can readily figure what compensation must be made, in all cases, by the following formula:

$$\text{f/ stop "Normal" Exposure} \times \frac{\text{Focal length of lens}}{\text{Lens-to-film distance}} = \text{f/ stop to be Used}$$

To work out two typical examples:

Indicated f/ stop				f/ stop to be used
f/ 8	×	4″ Lens / 5″ L-to-F	=	f/ 6.1—approximately 1.5 normal exposure
f/16	×	5″ Lens / 10″ L-to-F	=	f/ 8 or 4 times "normal" exposure

(NOTE: Most published formulas reverse the fraction portion of the equation—putting lens-to-film distance (as numerator) over focal length of lens (as denominator). This gives you the "effective aperture" calculation, from which you have to determine either the necessary increase in exposure interval or larger f/ stop opening.)

It is usually not practicable to make the exposure compensation by increasing the f/ stop opening, for the closer you work to the object, the less depth of focus you have at any given stop. For instance, if you focus a 4″ lens on an object 10 feet distant, at f/11 you will hold reasonably sharp focus on all objects from 7′ 6″ to 15′. But if you focus on an object 3 feet distant, at f/11 you will hold reasonable sharpness only from 2′ 9″ to 3′ 4″, or a depth of only 7″.

Obviously, the better strategy is to use smallest possible f/ stop and increase the exposure time interval. You make the calculation to find how much exposure increase is necessary. If it is twice "normal," make the shot at 1/5 second instead of 1/10, or 1 second instead of ½ second, and so on.

It is often helpful to know the relation of image size (on the film) to object size, especially if one is using other than a ground glass focusing camera. These relationships are roughly:

When Lens-to-Film Distance is	Image size, in relation to object size is (approx.)
¼ more than focal length of lens	¼ object size
½ more than focal length of lens	½ object size
Double the focal length of lens	Equal, or actual size
3 times the focal length of lens	2 times actual size
4 times the focal length of lens	3 times actual size

Film Speed Decreases Under Prolonged Exposure

This problem arises when exposure times are from 10 to 15 seconds and up. Kodachrome, like most film, is rated as to speed for instantaneous exposures—1 second or shorter. Type "A" has a Weston rating of 12; Type "B" is Weston 6. But if you are doing a close-up shot of a small object—so close that image size on the film is ¾ to actual size of the object, not only should you make exposure allowance to compensate for the relations of lens-to-object and lens-to-film distances, as explained above, but you will get better results if you arbitrarily decrease the film speed rating progressively as you prolong the exposure interval. There are no tables or graphs for this compensation. I can only give you the result of my own experience, which is this:

For exposures of 10 to 20 seconds decrease film speed one-fourth (¼), to Weston 9 (Type "A"), Weston 5 (Type "B"); for exposures of 20 to 40 seconds decrease film speed one-third (⅓), to Weston 8 (Type "A"), Weston 4 (Type "B"); and for exposures of 40 seconds to 2 or 3 minutes decrease film speed one-half (½), to Weston 6 (Type "A"), Weston 3 (Type "B").

SUNSETS, SPECIAL EFFECTS, TRICK SHOTS

YOU will, I trust, be tolerant of the rather unrelated subject matter of this chapter. In constructing a book on a subject that has as many facets as does Kodachrome photography, one is likely to find stray "pieces" of the subject left over after everything has been classified and put in its proper niche.

But that need not indicate that these unclassified items have no interest nor effective possibilities for real adventurers in color photography.

Sunsets and Sunrises

One of the most fascinating of out-of-the-ordinary color subjects is sunsets, or sunrises, if you have those early rising habits which Benjamin Franklin recommended so highly. In my limited experience with problems of color photography at such an unholy hour, I am inclined to believe that sunrises can easily surpass sunsets in sheer beauty. Early morning atmosphere is usually clearer than the evening air. The evening haze may add a pleasing overall glow to an interesting cloud sky at sunset, but given equally good cloud formations in the morning, sunrise colors are more brilliant and more sharply defined.

Perhaps my sunrise experience is too limited to be of much value, but the only fault I have found with such effects is that they do not last for the extended duration common to the average sunset. Sunrises seem to build up rapidly and then "explode" in one grand burst of gorgeous color. Another instant and the effect is gone, swallowed up in the light of day. The finest sunrise I ever photographed faded so rapidly that I could not change cut film holders quick enough to get a second shot.

On the assumption that your primary interest is in the evening rather than the early hours of the day, you will prefer some suggestions on Kodachrome exposures of sunsets.

If you have a light meter, make readings directly toward the sun when and after it reaches a point some 10 degrees above the horizon. To play safe open up ½ stop more than the meter reading indicates, especially if there is any time interval between the reading and the exposure, as the light rapidly weakens as the sun approaches the horizon.

If no meter is used, and if the sky and clouds are getting direct light from an unobscured sun, the following table can be used with good average results. Your exposures need not be as accurate on sunsets as on most color subjects because either over- or underexposure, to any reasonable degree, will still produce a beautiful effect. Overexposure will result in more delicate coloring and a feeling of more light than was present. Underexposure will produce an opposite result, of course.

SUNSET EXPOSURES

Light Condition	35 mm. and Bantam	Movies	Cut Film
Sun 5 to 10 degrees above the horizon	1/25 at f/8-f/16	at f/7-f/16	1/25 at f/9-f/11
Sun at the horizon	1/25 at f/3.5-f/5	at f/4.5-f/5	1/25 at f/4.5-f/6.3
Afterglow, just after the sun has gone	1/10 at f/4.5-f/7	at f/3.2	1/10 at f/4.5-f/6.3
Afterglow, 15-30 minutes after sunset	1/2 at f/3.5-f/5	at f/1.9*	1/2 at f/4.5-f/5.6

* At half speed, 8 frames a second.

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All good sunsets are excellent Kodachrome subjects, and especially so if they can be shot across water, to add interest and pattern to the foreground which might otherwise be an indistinguishable dark, colorless mass.

There is such a wide range of light volume in sunsets that you should analyze them in terms of "average," or "lighter" or "darker" than average, in the same way you judge subjects in full sunlight. If the color is weak and high key, use the smaller f/ stops recommended. If the sunset is one of deep color, with dark reds, heavy blues and purples, use the larger of the f/ stops given. If average, work somewhere in between the extremes indicated.

Sunsets across water have moré life and interest because sky illumination will give the water a sufficient exposure to make it a definite, but secondary, part of the picture. If you catch the sun at the horizon its reflection across the expanse of water adds a directional line and a feeling of perspective.

Or better still, silhouette a foreground tree or other object that can be recognized in silhouette. This foreground pattern will break up the emptiness of the picture where there is little or no color, and will add "depth" and distance.

Rainbows

We color shooters are always chasing rainbows but seldom do we capture a good shot of one. About the only suggestion I can offer is that you deliberately underexpose such shots. Use an exposure of ½ to 1 full f/ stop smaller than you think correct. If such stop underexposes the balance of the scene so much the better, for it will only add to the dramatics of the effect, and will focus all the attention on the rainbow, which is, after all, the picture.

Electric Signs

Street scenes in which there are large splashes of neon signs are intriguing color subjects, especially if the shot tells some kind of story. If you are interested only in catching an effect of lights the shot can be made any time after dark, but if you want a better record of the whole scene, make the shot while there is still some twilight and just after the lights come on. In this way you can hold good form in buildings and often some color in the sky, and all with no sacrifice in the effect of the lights except that they will not show the extreme contrast of a shot after dark.

No exposure suggestions will help much as each scene presents its own problem. It is better to work toward overexposure, or rather

for more exposure than you suspect is necessary, for you are working with very weak light in comparison with sunlight. The scene seems light, it is true, but in reality very little light is present.

Whether you use Daylight or Artificial Light type Kodachrome is very much a matter of taste. Remember you are, primarily, photographing a light source instead of light reflected from a color object. For instance, if a green neon sign is a principal foreground color spot, the Daylight type film will record it as such. If an individual is standing near such sign, that individual's flesh tones will record as greenish regardless of the type of film used, although there will be a slight difference in the "kind" of green recorded.

Colored Light Sources

Brief mention has been made previously of the use of colored light for backgrounds or to add a cool or warm cast to some area in a composition.

But there are still further adventures that offer promise of dramatic and artistic color effects. With the use of colored cellophane or gelatine sheets over light sources, you can create any color effect desired. If you undertake such experiments go all the way in creating a dramatic effect. Get entirely away from realism. Do not attempt to keep natural local color in one area of the composition while you light the rest of it with colored lights. This spot of "naturalness" will either detract from the full effect of the unnatural color portions of the compositions, or the reverse. When you have realism in such a composition your eye and brain tries to adjust everything else in the composition to this "known" quantity.

Create illusions or moods with your colored lights in the same way stage lighting is handled for especially dramatic scenes in "unreal" color.

This phase of color photography has been ignored by professional and amateur alike, and probably because we are all so strongly influenced by a fixed idea that color shots are not good color pictures unless they are rigidly realistic. Painters produce some of their most effective results by painting the subject in a color key that is different than both the color of the subject and the color of the light source.

Many miniature camera enthusiasts, using fast lenses, capture excellent Kodachrome shots of theatrical performances in very "unreal" light, but it never occurs to them that they can create the same or better "colored" light conditions in their own homes.

This "painting with colored lights" is a phase of color photography that should stimulate your imagination and creative instincts.

Moonlight Effects

The use of a blue light source at night, in line with the suggestions just made, can create an illusion of moonlight. One simple idea is to place a figure in an open window or doorway and light it both from outdoors and indoors with blue light. Use the stronger light outside at a height that will suggest a moon 90 degrees or so above the horizon. Then place the indoor light to open up the shadow side of the scene, but keep the volume of this light below that of the outside light, either by using a smaller lamp or at greater distance. A little experimenting with lights and figure position can produce some effective results.

Perhaps you have had the urge to capture outdoor moonlight effects. You can do it but not by moonlight. If you recall the diagram showing the color sensitivity of Artificial Light type Kodachrome you remember that the film is much more sensitive to blue than to reds and yellows. In consequence Artificial Light type Kodachrome used in Daylight without a conversion filter seems to record only blue. Of course, the other colors register in a degree but the visual effect is predominantly blue.

When shooting moonlight effects it is safest to select subjects that one usually considers most interesting by moonlight, such as a lake under a moonlit cloud sky, with the moon partly obscured by a passing cloud, but still casting a light reflection across the water. Follow the same pattern in daylight, with a partially obscured sun, and shoot at some angle toward the sun that will include it in the composition, and at the same time create an interesting light pattern on the water.

You can use Artificial Light type Kodachrome on such shots without a filter but I have secured a better feeling of moonlight color quality by using an Eastman CC15 or Harrison C1 filter.

This kind of color shooting is purely a stunt, but one that has possibilities which few color enthusiasts have recognized. Give such shots about the same to ½ f/ stop more exposure than you would give the same scene with Daylight type Kodachrome.

Stereo Color Shots

A common remark is that projected Kodachrome transparencies seem to have a third dimension quality. This is due in most scenes to "color perspective." We know that distant hills have a color feeling of distance not conveyed as realistically by the monochromatic tones of a black and white.

But real, or exaggerated, third dimension can only be secured through employment of the old stereo idea which fascinated the average American household a generation ago. The popularity of those stereo outfits is evidence that our emotional demands are not fully satisfied short of full realism in pictures, and no two-dimension reproduction of a scene is as dramatic as one in three dimensions.

This stereo idea has been revived for the 35 mm. color worker through the development of stereoscopic attachments for use in taking, viewing and projecting 35 mm. transparencies. These attachments will add much to your enjoyment of most of the color subjects you photograph.

Here is a new idea, and for the moment it is only an idea, for I have not yet had the opportunity to prove what I am going to propose.

This new medium of Kodacolor, which provides color prints at such an economical figure, seems to offer the means for reviving the original idea of stereoscopic pictures. If you have one of the old viewers somewhere in the attic, or can locate one among family or friends, I believe you have a new thrill in store.

Remember, I am making this suggestion with my fingers crossed, but the idea intrigues me sufficiently to prompt some early experiments. Especially since I recently discovered a forty year old viewer in a storage trunk whose contents reminds one of the Gay 90's. At least the promise of results warrants buying a few extra negatives and prints for the stereo effect that should be secured.

As you know, a stereo camera is a two-lens affair, with the distance between lenses being about that of the spacing of the eyes of the average human being. The third dimension effect in the final pictures is secured because one lens "sees" around the objects in the composition a little on one side while the other lens catches a little of the opposite side of those same objects.

Now for our little experiment with stereo views in Kodacolor prints. No Kodacolor film is available for regular stereo cameras but you can duplicate the result of the two lens camera by making two separate exposures of the same scene by moving the camera 2½ to 3 inches to right or left for the second exposure. This sidewise movement must be at dead right angles to the camera axis.

If you are handy with tools you can construct a tripod head with a sliding channel, to which you rigidly attach the camera. A bumper stop at either end of the channel can be spaced so that the camera is moved completely to the right, for instance, for the first exposure, and then completely to the left for the second. The distance of sidewise travel of the camera should be about 2½ inches, as we said before.

When you get the Kodacolor prints, mount them in same position as taken—print at right hand from negative taken in right-hand position of camera, etc. For the small cost of one extra negative and one extra print of the same scene it would seem that the idea is worth the small gamble.

Since you are making two exposures of the same scene you must avoid movement in the subject or the camera. A sufficiently heavy tripod should be used to insure stability.

Luck to you adventurous souls who may attempt this new idea made possible by the recent introduction of the new color medium of Kodacolor.

Pola Screens

Although this device can be used for special effects it seems to fit more properly into a discussion of filters. Its description and use is being covered in the chapter on "Filters and Color Meters."

CHAPTER 14

BETTER MOVIES IN KODACHROME

NO phase of color photography has brought more enjoyment to more people than has Kodachrome movies.

Just as color brings to still photography that added element of realism and emotional stimulus, Kodachrome movies add the element of movement to color to complete the realistic interpretation of the living, active world about us.

Kodachrome movies "bring 'em back alive." A flower gently swaying in the breeze, the flutter of leaves on the trees, or the ripple of a brook are infinitely more real and exciting when captured in Kodachrome movies. They are alive, dramatic, stimulating, completely satisfying.

While it is true that pictures tell a more universally understood story than do words, color pictures in action tell *all* the story. They leave nothing in doubt. The viewer does not wonder what has happened, or what is about to happen. He *sees* it happen.

All of which suggests that movies should be what the name implies. One of the two or three faults common to amateur movie makers is that they use their movie camera as a still camera too much of the time. They fail to realize that movement is the essence of interest in any movie reproduction of a scene, regardless of how static the subject being photographed may seem to be. If there is no movement in the scene, create movement. Add a touch that will inject a bit of animation.

Do not misunderstand me. You need not have violent action to create interest. Study the professional movies analytically, especially those done in color. Notice how many scenes (the majority in most pictures) are only "still" pictures to which has been added such restrained action as a gesture of the hand, a turn of the head, and only an occasional movement of a figure from one side of the frame entirely across the picture, in one continuous action. Note how many times figures move only a short distance in a scene, come to rest for a period, and then move to another location in the scene.

Remember that most professional movies are nothing but a series of still pictures, painstakingly planned and carefully posed, to which has been added a minimum of violent action. When such violent action is introduced it is all the more dramatic because of its contrast with the more restrained action of earlier scenes.

True it is that sound eliminates the necessity for the pantomime of silent days, but the best pantomime is usually not expressed in violent action.

The amateur movie enthusiast can learn much from the technique of the professional. Since your interest is color, sit through a few Technicolor movies a second time, and the second time around devote all your attention to a studied analysis of color composition and arrangement. Notice how emphasis is placed on the principal character or on the center of interest in a scene through color or colors that contrast with the surroundings. Sometimes the contrast is secured entirely with color, sometimes with values, sometimes both. You may remember instances where emphasis was secured through use of white, black or gray against rather colorful backgrounds. And if you have been rather observing you have noticed that there has been much refinement in color composition in the professional movies and with this refinement has come a more subtle and artistic use of color. The point is that color is being made to tell some of the story that black and white always left untold.

I am suggesting this study of professional color movies because whatever you find that demonstrates good use of color is no accident, you may be sure. Such scenes are the product of much talent and vast expenditures of time and money, and you can profit greatly from what has cost the producer thousands of dollars to learn and to prove.

But to get back to the idea of movement in the color movies you make. Perhaps you want a record of such an inanimate object as a statue or monument and feel that the introduction of a figure is a contradiction in that the figure is not a part of the story of the object. You are partly right in your desire to hold attention on the subject. But remember that things are more impressive by contrast or comparison.

To be specific, your subject is a white monument fifty feet high, and it seems beautiful enough silhouetted against a vivid blue sky. But its inanimate character can be made more static by comparison with movement. Its stark whiteness can be made to appear even whiter through association with some color. Its size can be emphasized through "measuring" it with some object like an individual whose size one knows.

I suggest you make the first footage of the monument base, close-up, and after a few feet have a colorfully dressed figure walk into the scene toward the monument from near the camera position, with his or her attention directed to the close-up detail on which your camera is focused. Continue the footage as the figure walks out of the scene, in the general direction at which she entered the picture. Cut that scene and move back until you can include the entire monument in your framing, and make some footage of the entire subject. You will have added color interest and movement through the introduction of the figure in the first scene, and the viewer will be left with a clear conception of the monument's size, color, location and surroundings through the all inclusive framing of the last scene.

The foregoing is only one suggestion as to how such a subject may be given added interest but by no means must the suggestion be interpreted as an arbitrary rule. I am only endeavoring to stimulate your imagination, to help you create more color and pictorial interest in subjects that seem drab and static.

You can use your movie as a "still" camera if you wish but you will be money ahead if you use a still camera for still color subjects, for no less than fifteen or twenty feet of film is required to do justice to any such expansive scene as a landscape, especially if there are several points of interest that must be seen and understood by the viewer in order that he grasp the whole story. It is necessary to use more footage on such scenes when you are photographing them in color, for the color makes many objects identifiable that are lost in black and white. There is more to "see" in color, and the scene must be held long enough on the projection screen so that everything can be seen and appreciated.

Use every device to get movement as long as the movement does not detract from your story. A swaying tree branch cut into the sky will not detract from the scene and it adds life and a feeling of the breeze. If a lake or stream is a foreground part of a landscape, move in close enough to get some water movement at the front and bottom of your picture. It may be no more than the faintest ripple of windblown water, but it is animation.

Or suppose you are photographing a flower garden. The result will be infinitely more pleasing if a slight breeze creates a little stir, especially among some of the foreground flowers.

These and many other devices will give movies *movement*, and movement is a first essential of the medium.

Outdoor Color Movie Problems

As in all color photography, atmospheric conditions have much to do with the quality and intensity of colors in distant scenes. We are inclined to think of sunshine as sunshine, but it is far from a constant condition. It is no more of a variable in intensity than it is in color quality, and these variations in color quality affect the color quality of your color results, sometimes seriously, sometimes only in moderate degree.

Since the subject of outdoor light conditions is covered rather thoroughly in the chapter on "Sunlight Characteristics" I suggest you read those pages carefully, as an understanding of these conditions will help you analyze

and correct some of the difficulties that may have disturbed you. Many conditions can be corrected or compensated for with color correction filters, as described in the chapter on "Filters and Color Meters," and these filters are just as applicable to Kodachrome movies as any other size or style of Kodachrome, for the emulsion is all balanced to the same sunlight condition.

There is one phase of color movie making that is a little different than still color work, and that is in the matter of color composition.

Movies are viewed enlarged to several hundred times the size of the film frame, which is both an advantage and disadvantage, as the case may be, but there is also the element of viewing interval, which is often and unfortunately much too short. This combination of factors suggests a little different technique in color composition for Kodachrome movies.

If you have read the chapter on "Color Composition" you probably have the impression that strong and contrasting colors are somewhat taboo in good color composition. But that applies more specifically to still color because we view a still picture for as long an interval as we wish, or we go back to it again and again. In movies the short time interval in which the viewer must grasp a clear conception of the scene necessitates more distinct separation between objects, masses and areas, in both color and value.

If you will think of the footage on one scene as a single still color picture and then visualize yourself with a handful of still color prints, we can illustrate the point. With no advance explanation as to the subject of the still picture, hand them one at a time to a friend and take them away from him at ten or fifteen second intervals, abruptly and without warning. You would not expect him to get a very clear conception of what he had seen. But that is exactly what happens when your movies flit from scene to scene. The viewer's eyes and mind become only partly adjusted to a scene when it disappears and another flashes onto the screen.

To carry the still picture analogy yet further, the more "postery" these still pictures are (which you show your friend) the quicker he could grasp the whole story as well as a clear impression of the individual elements in the composition.

All of which suggests, and often dictates that color compositions for Kodachrome movies should be as simple as possible; that the colors be larger masses; and that the colors should be fairly intense and more contrasting than is usually permissible in the best still color work. Such simplification and such contrast is an adaptation of poster art technique minus the "flatness" of what we usually call poster colors. Compare your movie shots that have strong, well massed color in well separated areas with other shots that are broken up and spotted with little dots of color and see if you do not agree that the postery scenes are more dramatic and in general more satisfying.

Landscapes in Kodachrome Movies

In line with this idea of simple color contrasts, you can often strengthen a composition and add much to a feeling of depth and perspective in landscape scenes by the use of intense warm colors in the foreground. Such colors are what we call "advancing" ones, and they contrast well with the blues and greens of the landscape—colors that are "receding" in the impressions they create.

Just a moment ago we suggested that atmospheric conditions have much to do with the color quality of distant scenes in Kodachrome movies. Some days are "clear," others "hazy" even under a cloudless sky. The atmosphere is usually clearest following a rain storm, as you have no doubt noticed. Plus this clear air all surfaces such as foliage, rocks, etc., are washed clean, exposing all colors brilliantly and at their maximum intensity. Most surfaces have more color when they are damp or wet. This is particularly true of the walls of a canyon or cliff.

Of course you cannot limit your movie making of landscapes to such ideal days, but I mention this condition only to encourage you to make the most of such days when you have the opportunity. For some inexplicable reason we do not appreciate these ideal conditions when they exist as much as we feel the lack of them on days that are unfavorable for color shooting.

By way of contrast let us consider what we might do on a day when atmospheric haze dulls all distant objects and all but obliterates form and definition toward the horizon. Un-

der such conditions Kodachrome movies will usually record an excessively blue cast that will be much more pronounced in the film than was visually apparent when you shot the scene. One method of correction is to frame the subject in such a way as to include more foreground and less of the distance. The haze will not noticeably affect objects within 100 to 200 yards of the camera. If you cannot add color to the foreground, or cannot make it the dominant area in the composition you can partially correct this "blue cast" with a color correction filter. A list of such filters and a description of their uses appears in the chapter on filters. Any filter for use on daylight type Kodachrome, for instance, works equally well on movies or stills.

While we are on the subject of haze may I suggest that you confine your angle of shooting on distant scenes to any angle north of an east and west line through the camera position. Whenever you shoot at an angle into the south of this east and west line you are shooting into the sun, even when it is at the highest point in the sky, in the latitudes common to the United States. Those of you who are world travelers need only to observe as to whether the sun is in front or behind the zenith, in relation to your camera angle.

General atmospheric haze is troublesome enough at best, but when you try to penetrate it in any direction toward the sun the film will record no more clarity than your eye sees, and to that lack of clarity is added the blue haze color mentioned before. Such atmospheric conditions are a "screen" that has a certain opacity, plus all the halation around millions of particles of dust and moisture in the air.

This does not mean that you should never shoot back-lighted subjects. Some of them are very dramatic. But you must not let your brain deceive you into seeing color because you know a certain color exists in the subject. You can deceive yourself but you cannot fool Kodachrome.

Do not suspect that landscapes should always be photographed in flat light just because of the haze conditions just mentioned. The objectionable condition against which we offer the caution is common to "toward the sun" shots, but side-lighting, with the sun at something less than a 90 degree angle (preferably 40 to 75 degrees) is a very desirable light angle for distant scenes *if* such lighting adds form and strength to the composition. The need for more contrast between light and shadow is for the "poster" strength and simplicity we suggested in use of color contrasts.

To go into more detail now on landscape problems in Kodachrome would only be to repeat much that has already been said in chapters 5 and 10. Study the problems outlined in those pages for they apply directly and equally to *all* Kodachrome work, whether movies or stills.

Close-up Subjects Outdoors

We have been talking about the desirability of "poster" simplicity in compositions of distant scenes. It is often more than a little difficult to frame such compositions out of many landscapes, but all effort should be directed toward such simplification.

When we turn to close-up compositions the problem of color mass and simplicity in line and form is much easier, and is often cared for more or less automatically. Because the objects in most close-up compositions can be identified more readily one needs less color contrast and much less contrast between light and shadow areas to achieve the same visual result we try to get in distant subjects. In fact, as in all color work, close-up "black" shadows are very distracting and should be avoided in Kodachrome movies if at all possible. If you use a light meter be sure that shadow areas do not call for more than two f/ stops more exposure than do the lightest areas (small highlights excepted).

For example, shadow readings might call for stop f/5.6 and light areas for stop f/11. Both would be within the effective range of the Kodachrome film, although neither extreme would be *faithfully* recorded if the exposure was based on a compromise half way between the extremes, or stop f/8.

If the composition is made up of darker than average colors (even in full sunlight) the best exposure would favor the lower meter readings or a little more open than stop f/8. On the other hand if the colors are lighter than average and they comprise the majority of the composition, favor the higher readings and use a diaphragm opening half way between f/8 and f/11.

All exposures are "compromises." No one

exposure can faithfully record all the light and dark colors in every composition. Instead of basing exposures on a meter setting half way between the readings on light and dark areas, base the exposure on the principal point of interest in the picture. If you are photographing people, and they are all wearing dark clothes, do not try to record the clothing faithfully (especially on close-ups) but expose for the flesh—a little on the underexposed side. Then to avoid losing the line and form of the figures place them against a background that is considerably lighter than the clothing, but darker than the flesh colors.

If you are interested in extreme close-ups of people you can adapt and employ many of the suggestions incorporated in chapter 11 on "Portraits," etc.

Flower Studies Outdoors

No type of subject offers greater opportunity for color and variety of treatment than flower and garden shots. Flower subjects have always been a favorite of the worker in still Kodachrome photography, but you movie enthusiasts can capture the whole gamut of flower life, from the close-up action of a bud bursting into full bloom, to the beauty of dazzling masses of color swaying in a gentle breeze.

Rather than repeat all that has been said in chapter 12 on "Flowers and Gardens," I suggest that you read this chapter for ideas on lighting, close-ups, and so on. Every idea can be adapted to your movie making with the added interest of movement.

But one technique that can be employed only by the movie camera owner is that of photographing the opening of a flower bud. It is a painstaking task but the fascinating results more than justify the effort.

First, watch the behavior of a certain specie of flower, to determine the interval from the first indication of the burst of the bud to the full opening of the flower. Set the camera on a rigid tripod, at an angle to the flower and the sun that will take advantage of the best average conditions during the elapsed working time. Next place some background behind the flower so as to isolate it from surrounding confusion. Use some judgment in the selection of color and value of this background so that it will enhance the beauty of the flower. In general the background should be a color that is a complement or near complement to that of the flower's color. If the flower is a light color use a background that is a little darker than the flower, and vice versa.

At the first indication that the flower bud is starting to open run the camera while you count slowly up to 10. If your counting takes about 10 seconds you will have exposed about 160 frames. Expose an equal amount of footage at regular intervals from then on until the flower is fully open. The interval between exposures must be determined by the total elapsed time it takes the flower to fully open. The closer together you space these exposure intervals the smoother the action or the feeling of continuous opening of the flower when the film is projected. To further smooth out this action you can expose fewer frames each time, and shorten the interval between exposures. If your camera can be set at half speed, or 8 frames per second, so much the better.

To avoid too much change in the position of the flower between exposures it is advisable to protect it from wind or other disturbance. The only action you are after is that of the flower in the process of coming into full bloom, and any other movement will only detract from that desired result.

An elaboration of this flower opening movie idea is to make a 50 or 100 foot record of a growing garden, over a period of four to six weeks, with a few feet of film shot each day or two.

Interest in such a movie record might be increased through making the first shots of some member of the family giving the final touches to the planting of the garden.

Obviously this four to six week film idea can be done most conveniently if you own a magazine type camera for otherwise you will be obliged to retire the camera from other use during the period.

While such ideas require some planning and more than an ordinary amount of effort they are the kind of thing that is enjoyed for ever and a day, once you get them made.

Night Kodachrome Movies Outdoors

Street scenes that include colorfully illuminated signs, lighted fountains, fireworks, fires, camp fires, and such are all fascinating sub-

jeets for the movie enthusiast whose camera is equipped with a fast lens.

You ean use either Type A (artifieial light) or Daylight Kodaehrome as you are photographing light sourees instead of refleeted light. If Daylight type film is used everything will be a little more toward the red side than if Type A is used. Anything you ean photograph at night on Super X Pan film ean be held equally well on Type A Kodachrome.

It is impossible to make any rigid rules for exposure of such seenes as they vary so mueh in amount of light present. Underexposure is a more eommon failing than overexposure, so give the film all the light possible—f/1.9 to f/2.7 for average seenes, and for those where less light is present use the same f/ stops but half speed.

Night Kodachrome Movies Indoors

As a preliminary to any serious Kodachrome movie making at night indoors read the chapter "Kodaehrome by Artifieial Light."

Since movie camera lenses most eommonly used have a narrower angle of view than do most still eamera lenses, the movie maker must make some revision in tables usually given for light plaeement and exposure in still Kodaehrome work.

The surest procedure is to include in your composition only sueh area as ean be evenly and well lighted, and then to base all exposures on earefully made meter readings.

In figuring areas to be eovered by the lights remember that an area 3 x 4 feet comprises twice as many square feet as does an area 2 x 3 feet, and that there are four times as many square feet in an area 4 x 6 feet as in one 2 x 3 feet.

Sinee shadows in artifieial light work are often more objeetionable than in outdoor color movies, get as mueh separation and contrast in eolor as you can in your eomposition, without overdoing it, of eourse. The brightness range for the best eolor results should be somewhat shorter for indoor work than for sunlight shooting. Keep this range within about 1½ f/ stops if possible.

If you use refleetors on the photofloods that throw a "hot spot" focus the hot spot on the shadow areas where you need the most light, and never superimpose two or more hot spots on the same area.

Some experimenting with light placement in line with suggestions in chapter 7 will help you develop your own best teehnique. Above all, avoid the eommon fault of piling all light into the eentral part of the composition with the result that the outside of the final pieture will be badly underexposed. Be sure the even illumination eovers more than the area included in the frame.

Most common errors in artifieial light work, unless you use a light meter to eheek all areas, are

—wrong distanee of lamps-to-subjeet
—extreme variations in line voltage
—use of old, exhausted photofloods
—dirty or extremely ineffieient reflectors

A Few General Suggestions

Restrain every temptation to do too much panorama shooting. If the seene demands it, then work with a tripod whieh is carefully leveled before you start shooting. Certain subjects can be panoramed in black and white that are all but ruined when photographed in eolor. Black and white tones blend from one into another as one panorams, but when the same seene is projeeted in eolor the eye dwells on color spots in an attempt to identify eaeh objeet, no matter how small. And as the scene moves sidewise aeross the screen the eye is forced to jump from eolor spot to eolor spot, which is very fatiguing.

* * * * * * *

In ehanging scenes, from one in flat light to one that is side or back-lighted, use an exposure that will keep all seenes in the same value or brightness "key." Nothing is more disturbing when viewing a movie than to have an overexposed seene followed by a badly underexposed one. You lose much of the first of the underexposed scene until the eyes beeome accustomed to the new light eondition.

* * * * * * *

Use a light meter for movie use whieh has an angle of view that corresponds to the angle of the lens you use. The average meter eovers about a 30 degree arc and readings made with such meters include much more area than the ordinary movie eamera lens. If, however, you are using a wide angle lens the regular meter will serve better than a movie one.

* * * * * * *

Do not use Daylight Type Kodaehrome in-

doors except with blue photofloods. And always use a light meter to calculate exposures because artificial light tables are for use with regular photofloods, and not the blue or daylight type of lamp.

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Type A Kodachrome can be used in sunlight if converted to daylight balance with a conversion filter. There is no loss in speed through such conversion, and you can use the same film factor as for Daylight type, which is Weston 8 or GE 12.

* * * * * * *

A good rule for movie making of such colorful subjects as fall foliage and flower gardens is to make the first scenes from such distance as will include the area you want in one frame, and then follow with a close-up of the most colorful part of the original scene. This close-up will register the "local" color of the scene more forcibly.

* * * * * * *

Kodachrome movie techniques are susceptible to as much refinement as any other phase of color photography. Improved results are ample reward for any and all efforts necessary to produce them. Again may I urge you to study the very effective use of color in the best of the professional movies.

* * * * * * *

This chapter has been confined, primarily, to those Kodachrome problems peculiar to movie work. May I assure you that practically all the previous chapters cover Kodachrome problems that are just as applicable to movie making as to still color work.

EXPOSURE TABLE FOR OUTDOOR KODACHROME MOVIES IN FULL SUNLIGHT

(Film rating Weston 8, GE 12)

General Tone Value of the Subject	*16 frames per sec.*	*8 frames per sec.*
Very Dark	f/4.5	f/6.3
Dark	f/5.6	f/8
AVERAGE	f/8	f/11
Light	f/11	f/16
Very Light	f/14	f/20

EXPOSURE TABLE FOR TYPE A KODACHROME BY PHOTOFLOOD LIGHT

(Film rating Weston 12, GE 20)

Number and Size of Photofloods	*Shutter Speed*	*3 ft*	*4½ ft*	*5 ft*	*6½ ft*	*7 ft*	*9 ft*	*13 ft*
Two No.1 or	Normal	f/5.6	f/4	f/3.5	f/2.8	f/2.2	f/1.9	
One No. 2	½ Speed	f/8	f/6.3	f/5.6	f/3.5	f/3.2	f/1.8	
Four No. 1 or	Normal	f/7	f/5.6	f/5	f/4.5	f/3.5	f/2.8	f/1.9
Two No. 2	½ Speed	f/10	f/8	f/7	f/5	f/5.6	f/3.5	f/2.8

For darker than average subjects, use ½ f/ stop larger
For lighter than average subjects, use ½ f/ stop smaller
Calculations are based on the use of new or nearly new photoflood lamps in Kodaflectors or equally efficient reflectors

EXPOSURE CONVERSION FOR VARIOUS CAMERA SPEEDS

Frames per second	DIAPHRAGM OPENING (f number)													
16	*2*	*2.8*	*3.2*	*4*	*4.5*	*5.6*	*6.3*	*8*	*9.1*	*11.3*	*12.5*	*16*	*18*	*22*
8	2.8	4	4.5	5.6	6.3	8	9.1	11.3	12.5	16	18	22	25	32
12	2.3	3.2	4	4.5	5.6	6.3	8	9.1	11.3	12.5	16	18	22	25
24	1.8	2.3	2.8	3.2	4	4.5	5.6	6.3	8	9.1	11.3	12.5	16	18
32	1.4	2	2.3	2.8	3.2	4	4.5	5.6	6.3	8	9.1	11.3	12.5	16
48		1.8	2	2.3	2.8	3.2	4	4.5	5.6	6.3	8	9.1	11.3	12.5
64		1.4	1.8	2	2.3	2.8	3.2	4	4.5	5.6	6.3	8	9.1	11.3

KODACOLOR—A MEDIUM FOR EVERYBODY

This versatile member of the color family offers the snap-shot enthusiast a thrilling medium of expression. It is a negative and print process differing from black and white in that the final image of both the negative and print positive is a colored dye image instead of being made with blackened silver.

The negative is not only in "reverse" as regards tones of light and shade, but the dye color image is also in reverse in color, or in colors that are complementary to those in the subject to which the film is exposed. Study the reproduction of the negative on the facing page and compare the colors in the main masses with the complementary colors in the same areas in the positive paper print.

Kodacolor is one of the very real contributions to amateur, snap-shot photography. It will bring new pleasure and added enthusiasm to millions of camera fans, old and young alike. As the film can be used in any roll-film camera equipped with a lens and shutter that will produce good black and white pictures, literally it is a medium for the millions.

Now color completes the story for the snap-shooter, for color tells *all* the story that can only be partially recorded within the limitations of monochromatic photography.

CHAPTER 15

KODACOLOR - A MEDIUM FOR EVERYBODY

THIS versatile medium, developed primarily for the "snap-shooter," is an especially prepared roll film negative material from which snap-shot size color prints may be had at a popular price. The wide range of negative sizes brings the medium within reach of millions—from the owner of the lowly and too often maligned box camera up to the finest of roll film equipment.

This is not to imply that Kodacolor is a "poor man's" Kodachrome — it is for everybody—for all those thousand and one snap-shot subjects that we all delight in having in black and white. Now color makes them *alive* —not merely monochromatic records of an event, a scene, a friend, or a member of the family.

The medium requires no more care, experience nor pains than *should be* exercised in the taking of any black and white shot. Any roll film camera equipped with a lens and shutter that will produce good black and white pictures will produce good snap-shot records in Kodacolor.

If you are an accomplished worker in Kodachrome, and have developed an eye for delicate and subtle color, and if you are critical in analyzing fidelity of color reproduction you will instantly recognize that Kodacolor and Kodachrome are in no wise competitive in results and effects.

Nowhere in the manufacturer's literature is there any statement, direct or implied, that Kodacolor is anything more than just what the literature says—"a color medium for snap-shooters."

If you have never worked in Kodachrome, Kodacolor will be an interesting beginning in color, for it can teach you much in the way of color composition, what type of lighting is best for color, and other fundamentals.

This new medium of Kodacolor must not be confused with a movie color process in use some years ago, and sold under the same trade name. The present Kodacolor bears no resemblance, either in processes or results, to the former medium which has been out of use for several years.

Strange as it may seem, there is little in photography that is new, not excepting Kodacolor. The general theory of the medium was worked out years ago, but the inventors of the process were unable to "stabilize" the sensitizers and the dye couplers with the materials available to them at that time.

The Kodacolor Negative and Positive

Those of you who are interested in the science and mechanics of things may like a little insight into this color process that is both alike and still different from that used in Kodachrome. In both processes, the film is a triple-coated or tri-pack emulsion, on one transparent base or support. The film's three light-sensitive layers are sensitive to the three colors that are approximately complementary to the three colors in the positive—the paper print in color.

The layer nearest the base is red-sensitive; the middle layer is green-sensitive; over this is a filter layer to absorb blue; and the top layer is blue-sensitive. If you recall the earlier explanation of the light-sensitive layer arrangement of Kodachrome, you remember that the red-sensitive layer becomes the blue-green dye layer in the Kodachrome transparency; the green-sensitive layer becomes the magenta dye layer; and the blue-sensitive layer becomes the yellow dye layer.

In a Kodachrome these three dye layers are on the transparent acetate base, to be viewed by transmitted light. In a Kodacolor print,

126 *Exposed in full sunlight, flat lighted, based on a compromise meter reading of Weston 250. This would give an exposure of 1/25 at f/16 or 1/50 at f/11.*

the three dye layers yellow, magenta and blue-green, are in the gelatin on the paper support, to be viewed by reflected light.

To this point, Kodacolor and Kodachrome are similar. They are both film materials that record the subject in *negative* or reverse tones. That is, the darkest areas in the subject are the lightest areas in the negative. You never see a Kodachrome *negative* (for it is in that state only in the laboratory processing). You see only the dye-layer positive transparency, as the negative Kodachrome is reversed into a positive image. There is never but one piece of film material.

The Kodacolor process consists of (1) the negative film, which remains as such in the same way as does a black and white negative, and (2) the paper positive, or color print, which is in the same relationship to the negative as is a black and white paper print to a black and white negative.

But the Kodacolor negative is in *color* instead of black and white or tones of light and shade. These colors are those to which the three layers of the Kodacolor negative are sensitive—red, green and blue. These are the approximate complements of the blue-green, magenta and yellow of the Kodacolor paper print.

The process differs from Kodachrome in the method in which the dye color is "inserted." In Kodacolor the "dye" is in the emulsion in the form of infinitesimal particles of organic compounds, insoluble in water. The film is processed with a developer of which the oxidation product reacts with the three couplers, each in its own layer, and thus a dye image is produced with the silver image in each layer. After the silver has been removed, a negative is obtained composed of dyes, as explained before. When the negative is printed upon a paper coated with a similar set of emulsions, a color print is obtained in which the colors of the original subject are reproduced as faithfully as the limitations of the medium permit.

Color Rendition

It is manifestly unfair to make arbitrary statements about the "quality" of the results secured with any color process, because too many factors influence what one person may think good and another one consider unsatisfactory. One's own "eye for color" sets the standard.

Without any wish to detract from the obvious merits of this medium of Kodacolor, I must confess to a conviction that seldom do the paper prints do justice to the apparent quality of the negatives from which they are made. One proof is the quality of Wash-Off Relief Color Prints made from Kodacolor negatives. No doubt Kodacolor print quality will be improved.

My experience and observation is that reds, all reds, record very well and rather faithfully, in Kodacolor, when properly exposed. Blues seem to have more of a "sameness" than in Kodachrome. All blue skies seem to record as the same blue, which is a departure from reality because there is much variation in sky color. Yellows do not register with the same brilliance and intensity as they do in Kodachrome. This seeming deficiency in yellow affects the color saturation in greens and causes all of them to tend toward a blue-green cast. This is especially noticeable in foliage that is, in local color, more on the yellow-green side.

Flesh tones record very satisfactorily but with a slight deficiency in yellow, and the modeling shadows on a face sometimes show an excess of red in shadows that should con-

tain more cool color. If a choice must be made between too much warmth or too much coolness in a face, certainly an excess of warmth is preferable.

Kodacolor is just as susceptible to the influence of reflected colored light as Kodachrome (or any other color medium), so do not criticize a red cast on a face if that color cast is caused by light reflected from a red dress, for instance.

This brief resumé of the fidelity of color rendition of Kodacolor, based as it is upon very limited experience, must not be considered as severe criticism of the medium, but rather as a suggestion as to what type of color subjects are the best subjects for Kodacolor.

An Analysis of Test Shots

Figure 126 is a good, typical Kodacolor subject. The figure in a brilliant red dress gives warmth and a feeling of color saturation to the whole scene. The shadow areas in the large masses of foliage are not as colorless in the Kodacolor print as the black and white reproduction suggests. Other areas in full sun are reproduced very pleasingly, in both tone value and color.

Figure 127 is one of those subjects that is immensely more interesting in Kodacolor than in a black and white, but it is not a good subject for the medium. The composition does not include enough warm color and the dark foliage areas do not separate, in the color print, as well as they do in the black and white reproduction. As mentioned before, the greens have less color saturation than they have in the subject, and they are somewhat on the "blue" side, a part of which is the effect of blue sky reflection in the leaves turned toward the sky.

Figure 128 depends entirely upon the color in the figure for color effect, for all the other areas are neutral or grayed, light value colors. As a test, this shot was made under a heavy overcast sky in light so weak (about 3 p.m.) that flesh tones measured Weston 25. Such light is badly out of balance in color quality, and is usually excessively blue. Inasmuch as a Color Temperature Meter was not used to check the light, I can only report the result in the Kodacolor print. The foreground tree recorded with a decided pinkish cast instead of with a blue cast, as one would expect, since

127 *Exposed in full sunlight, based on Weston 250 (1/25 at f/16 or 1/50 at f/11). This slightly underexposed the background foliage and tended toward overexposure in the lightest foreground areas.*

the local color of the bark is a cool neutral and should have appeared decidedly bluer under this light condition. If one were making the shot in Kodachrome, the light condition would have suggested the use of one of the Eastman or Harrison Color Correction Filters —one of the "warm" filters—to compensate for this out-of-balance in the color quality of the light.

It should be added that the manufacturer warns, "Do not use a color filter of any type with Kodacolor Film, as the pictures will assume the color of the filter."

Figure 129 is another shot that violates the manufacturer's instructions, in that the illumination was Daylight (blue) Photoflood. Film instructions say that such photofloods will usually add excess yellow to the result, and that Photoflash (the No. 21B lamp, daylight type) should always be used for indoor artificial light work. I presume this caution is given because there is too much likelihood that old and partially exhausted photofloods may be often used, and photofloods burn "yellower" as they age. Flash is a more constant light quality. Another exposure of this subject, made with photoflash, rendered some colors more faithfully, others not as well. Between the two, I personally prefer the result secured with the photoflood illumination.

128 *This shot was made under a very heavy overcast sky. Meter readings on flesh were Weston 25—a very weak light. Exposure used was 1/10 at f/8.*

In spite of this experience it would be consistently safer to use the photoflash recommended for the film.

Figure 130 was made with Photoflash illumination, as recommended for the film. In this case as in all others where photoflash is employed as the sole light source, the result depends as much upon the placement of the lights as any other factor. Often more so. The color result, in Kodacolor, was not very satisfactory. Due to a deficiency in yellow, the greens were not crisp and fresh as they were in the same shot made in Kodachrome, under the same conditions. Based solely on these two experiences with Kodacolor and photoflash illumination I am inclined to suggest that you should not expect as consistently satisfactory results, in color rendition, as in full sunlight.

Figure 131 is an ideal subject for Kodacolor. The red dress is exceptionally brilliant and faithful in color. The white wall gives good value contrast and the dark green foliage contrasts against that in turn. The shadows on the wall and door are open and luminous and give excellent feeling of the light condition, which was brilliant noon-day sun. The green foliage is somewhat deficient in yellow, but it must be remembered that such foliage turned rather directly toward the sky will be affected, in color, by the blue reflected from the sky. Since the predominating color in the tile border around the door is much the same kind of blue-green as the dye color used in Kodacolor, this tile is reproduced in very faithful color. In color contrast, value contrast and kind of color, this subject might be considered as the type that will produce uniformly pleasing and satisfactory results in Kodacolor.

Exposure Calculations

The recommended basic exposure for Kodacolor, for average subjects in full, direct sunlight, is 1/50 of a second at f/8 to f/11. May I repeat again what has been emphasized so

129 *Photoflood illumination, 1 second at f/22, based on average meter readings of the subject. Film instructions recommend photoflash rather than photoflood. In either case, the blue, daylight type lamp must be used.*

often, that all suggested exposures are based on the assumption that your shutter is reasonably accurate and that it operates at the speed at which you set it.

The exposure table on next page will serve as a working guide, and as something against which to check your equipment. If you follow these tables and your exposures are consistently over- or underexposed, try making a percentage compensation in f/ stop setting until you have found a factor that works with your shutter. Either that or have the shutter checked and reset. The suggestions for shutter checking in Chapter 17 will help you determine the percentage of error in your equipment, if you wish to do such checking yourself.

Remember that since Kodacolor negatives are exactly like a black and white negative in respect to tones of light and shade, and general density, you follow the same rules for checking over- and underexposure. An overexposed negative will be too heavy (or have too much density), and an underexposed negative will be thin (or have too little density). The prints, likewise, will follow the same general rule as for black and white, except for such compensations as the processing laboratory makes in developing and printing.

131 *Exposed in full, direct sunlight, practically flat-lighted. A reflector was used to soften the modeling shadows on the face. Exposure 1/25 at f/16.*

130 *This still life was exposed by daylight type (blue) photoflash, at the exposure given in the table for a lamp-to-subject distance of 5 feet.*

Black and White Prints from Kodacolor Negatives

Kodacolor negatives can be used for black and white prints, either by contact or projection printing, with rather surprising results. The quality of such black and white prints is superior to those made from black and white negatives exposed under the same conditions, in many cases. It is hardly likely that Kodacolor negatives will be exposed purposely for use in printing black and white prints, but they will serve the double purpose, and with excellent results.

But a word of caution. Handle Kodacolor negatives with more care than most people give black and white negatives, as they are very susceptible to scratches and abrasions

which will show up in a most pronounced fashion in black and white enlargements.

All Rules for Good Color Work Apply Equally to Kodacolor

Every phase of color photography discussed in all the preceding pages, except actual exposure tables that apply *only* to Kodachrome, is equally applicable to Kodacolor in problems you will encounter in color composition, color characteristics, methods for determining exposures under various light conditions, and the whole gamut of factors that affect color results. To go into detail in respect to any of these influences would be only to duplicate what has been said before. You will get better results with Kodacolor if you follow the fundamental rules for good color work. So do not assume that because Kodacolor is not mentioned in all references to Kodachrome techniques that Kodacolor is immune to those influences that produce maximum color results, generally speaking, regardless of the color medium used.

Film and Print Sizes

At the moment, Kodacolor is available in the following roll film sizes:

Kodacolor Roll Number	*Negative Size in Inches*	*Maximum Number of Exposures*	*PRINT SIZE**
C127	1⅝x2½	6	2⅞x4½
C127	1⅝x1⅝	9	2⅞x2⅞
C127	1 9/16x1 3/16	12	2⅞x3¾
C120	2¼x3¼	6	2⅞x4¼
C620	2¼x3¼	6	2⅞x4¼
C120	2¼x2½	8	2⅞x3¼
C120	2¼x2¼	9	2⅞x2⅞
C620	2¼x1⅝	12	2⅞x4
C120	2¼x1⅝	12	2⅞x4
C116	2½x4¼	6	2⅞x5
C616	2½x4¼	6	2⅞x5
C616	2½x2⅛	11	2⅞x3¼
C122	3¼x5½	6	2⅞x5⅛
C122	3¼x2¾	11	2⅞x3¼

* Approximate size of the face of the print, exclusive of margins. All prints use full area of the negative except the 3¼x5½ size, where there is a loss of about ⅜ inch on side and ends. In using this film make allowance for this loss in framing your picture.

KODACOLOR EXPOSURE TABLE—DAYLIGHT

(FILM SPEED RATING: WESTON 20, GE 32)

Shutter Speeds	*Kind of Subject*	*Bright Summer Sun*	*Open Shade Sunny Day*	*Hazy Sun (Soft Shadows)*	*Cloudy (No Shadows)*
1/5	Light		f/14	f/32	f/18
	Average		f/12.7	f/25	f/14
	Dark	f/29	f/11	f/20	f/12.7
1/10	Light	f/32	f/10	f/22	f/12.7
	Average	f/25	f/9	f/18	f/10
	Dark	f/20	f/8	f/14	f/9
1/25	Light	f/20	f/6.3	f/14	f/8
	Average	f/16	f/5.6	f/11	f/6.3
	Dark	f/12.7	f/5	f/9	f/5.6
1/50	Light	f/14	f/4.5	f/10	f/5.6
	Average	f/11	f/4	f/8	f/4.5
	Dark	f/9	f/3.5	f/6.3	f/4

IN WINTERTIME, use one f/ stop larger than settings listed above.

PHOTOFLASH EXPOSURE TABLE FOR KODACOLOR

(For exposures made with ONE (1) No. 21B PHOTOFLASH LAMP in an efficient reflector. Shutter "open and shut.")

Lamp-to-Subject Distance	*5 ft.*	*7 ft.*	*10 ft.*	*14 ft.*
f/ stop setting	f/11	f/8	f/5.6	f4

NOTE: Use no filter. If a second light is used for side-lighting, and if it is a greater distance from subject than primary light, no exposure allowance need be made for this additional light.

FILTERS FOR COLOR, COLOR METERS

YOU will recall the discussions in previous chapters about the sensitivity balance of Kodachrome film to certain light sources. The daylight type film is balanced for sunlight with a color temperature of about 5400 degrees Kelvin; the artificial light type to about 3400 degrees Kelvin for Type A and the Type B (cut film) is balanced for use with 3200 degree lamps. (See tables of ratings on pages 68 and 92.)

If we theoretically separate the three emulsion layers of Kodachrome and think of each of them as a separate emulsion on a separate support, we would have three positive images —one in yellow, one in magenta, and one in blue-green. In effect the three colored positives would resemble the three dyed matrices used in making a Wash-off Relief Color Print.

Let us assume that our original subject included a large area of light gray. If the Kodachrome recorded that gray faithfully it would do so by maintaining a delicate balance between the very faint deposit of all three colors (yellow, magenta, blue-green), superimposed, for the neutral gray is composed of those three dye colors.

But if the magenta (red) layer of the Kodachrome is too heavy in color, when that layer is superimposed over the yellow and blue-green layers the gray area will have too much red for a proper balance with the other two colors. The gray area will now be a pinkish gray instead of the neutral gray in the subject.

How did that excess red get into the Kodachrome? The light source would have contained more red in relation to the other two colors than the light to which the film is balanced.

We have used a light neutral gray for checking because out-of-balance color can be more easily detected in such a high value, neutral color. Why not use white as a check? If the neutral gray used was high enough in value it would appear as white, for white in Kodachrome is only an approximation of white—it is actually a very high value gray composed of all three dye colors in Kodachrome.

In the test we easily detect the surplus red, for instance, in the light gray. But if there is surplus red in the gray there is also that same amount of surplus red in every color and every area in that same Kodachrome, visually undetectable though it may be. Increase the surplus red to the extreme, as in sunset light, and the red predominates in every color, even though it may not appear as red. Colors that are red or closely related to red have red added as red color. In complementary colors, such as green foliage, the red added to the green tends to annihilate both colors and the result, in the extreme, is a dark, almost colorless value.

Color Correction Filters

No further evidence is needed to support the necessity for some method of compensating for out-of-balance light conditions. The Kodachrome film is going to record the color as it is and not as you know or think it is.

The only way to correct for out-of-blance light is to correct the color balance of the light source. And the most direct way to bring the light into proper balance is through a correction filter at the camera lens. If the light is too cool—a color temperature towards the blue—a warm or complementary color filter holds back the excess blue and transmits the warm colors. Or a cool filter will hold back the excess red in late afternoon light, for instance, and allow the blue to "catch up" with it.

In artificial light work the light source does not vary to the extreme extent that sunlight can and does. A variation of less than 100

degrees Kelvin is hardly noticeable in the Kodachrome result. But sunlight color temperatures vary as much as three or four thousand degrees, as you will notice by referring to the Kelvin table shown on page 68.

This suggestion that artificial light varies only within relatively close limits, and that sunlight varies greatly, would seem to indicate that there is little need for color correction by artificial light, and that it is a necessity outdoors. It does not work out quite that way. Your indoor artificial light shots are close-ups and the colors of the subject are not influenced by atmosphere. Any over-all color cast, such as would be caused by old and partially exhausted photofloods, would be instantly noticed as false color. On the other hand, every landscape (except for its immediate foreground) is greatly influenced by atmospheric conditions. The same scene may look different in color and value on a dozen successive days, and during different times of day. The indoor subject is always the same under the same artificial light conditions, and the eye quickly detects any variation from "normal."

Getting back to artificial light problems, if you are working with a wiring system in which you have voltage control, and if all lights being used at one time are comparatively new and of the same type and wattage, you can often bring the color temperature of the lights into balance through control of the voltage. The voltage in the line must be higher than that for which the lamps are rated. If you can make no such corrections in line voltage you are obliged to resort to correction filters.

Color Temperature Meters

Assuming correction filters will bring the light source into proper balance for the film type we are using, we then need some means of determining to what extent the light is out of balance, whether too warm or too cool, and what filter must be used to make the proper correction. One needs no such device to detect the "red" light at sunset, but even then we cannot visually determine how much correction is required to eliminate all or most of this excess red.

Two reliable color temperature meters are available—the Eastman Color Temperature Meter and the Harrison Color Meter. The Eastman meter is designed for artificial light use primarily, and the Harrison meter is for both sunlight and artificial light sources.

The Eastman meter is calibrated to detect variations in color temperature to within 50 degrees Kelvin. The Harrison meter is designed to cover a much wider variation in color temperatures, and depends upon visual detection of subtle variations.

132 *The Eastman Color Temperature Meter, designed primarily for use in checking the color quality, or color balance, of artificial light sources.*

Eastman Color Temperature Meter

The meter must first be adjusted to the color sensitivity of the operator's eye, which is easily done with accessories furnished with the meter. Once set it stays constant to that eye setting.

In use you set the meter for the color temperature for which the film is balanced, then look into the eye piece with meter pointed at a white card (provided with the meter) upon which the light source is falling. You do not see the card, but a divided field of color, one-half of which is a constant yellow. If the light source is burning at the proper color temperature the two halves of the field seen in the eye piece will match in color. If the light source is too yellow or reddish, the variable half of the field will appear to have a reddish cast. If too blue, it will appear a bluish or greenish cast.

To determine what filter will bring the light source into balance, interpose the correction filters, one at a time, between the meter and the white card until you find the one that makes the two halves of the meter field appear to match in color.

Or if you want to know how many degrees off balance the light source is, turn the dial of the meter (while pointed at the card) until you balance the two halves of the meter field. Calibrations on the meter will tell at what color temperature the lamps are burning.

This meter is extremely sensitive to a narrow range of color temperatures and is an excellent one for artificial light work. Its use in sunlight is limited by the limited scope of the meter's coverage.

133 *The Harrison Color Meter, designed for use in checking the color balance of all light sources.*

Harrison Color Meter

This meter operates somewhat as does the Eastman meter in that you look through the eye piece at a white card which is turned to catch full, flat light from the source. But with the Harrison meter you see the card rather than a divided color field.

In use you turn the meter dial until the white card appears quite bluish, then rotate the dial counter clockwise until the card appears pinkish. Then turn back and forth between these two points until you find the spot where the card seems to be free of either a bluish or pinkish cast.

The markings on the meter designate what filter is to be used, depending upon the type of light source.

If the reading at the setting at which the white card is neither bluish nor pinkish says "O," then the light is in balance and no filter is necessary.

Eastman Color Temperature Filter Set

. A set of seven filters are provided for use with the Eastman Color Temperature Meter. Four of them are bluish in color and are to be used to compensate for excess warm color in the light source; three are yellowish in cast, and are for correcting excess cool color in the light balance.

These filters are available in gelatin squares; in "B" glass squares or circles, unmounted.

Three "Warm" Filters	*Filter Factor*
CC 13	none
CC 14	none
CC 15	none
Four "Cool" Filters	*Filter Factor*
CC 3	none
CC 4	none
CC 5	1.5
CC 6	2

Harrison Filters for Kodachrome

Twelve "Warm" Filters "Coralite"	*Filter Factor*	*Twelve "Cool" Filters* "Blue"	*Filter Factor*
C ⅛	None	B ⅛	None
C ¼	None	B ¼	1.2
C ½	None	B ½	1.4
C 1	1.3	B 1	1.8
C 2	1.5	B 2	2.
C 3	1.6	B 3	2.5
*C 4	1.7	‡B 4	2.8
C 5	1.9	B 5	3.1
C 6	2.	B 6	3.6
C 7	2.2	B 7	3.8
†C 8	2.5	§B 8	4.1
C 9	2.8	B 9	4.9

* C 4 for conversion of Type A to Daylight use.
† C 8 for conversion of Type B to Daylight use.
‡ B 4 for conversion of Daylight to Type A use.
§ B 8 for conversion of Daylight (cut film) to Type B use.

Using Filters Without a Meter

As mentioned in previous pages, I have had quite successful results with both Harrison and Eastman filters, in sunlight conditions, without checking the color temperature of the light with a meter.

Daylight Kodachrome is balanced for Washington, D. C., average noonday summer sun. In the clear, rarefied atmosphere at high altitudes in the Colorado Rockies, it is reasonable to suppose that the sunlight is "bluer" or whiter than it is at lower altitudes or at sea level. Even limited experience will prove that this is true, as a rule. Instead of using a haze filter in these high altitudes I get much better results with an Eastman CC 13 or CC

14 or a Harrison C 1. The haze filter does no damage, but it does not seem to give sufficient correction, nor as pleasing correction, perhaps I should say.

Another use of filters, without dependence upon a meter check, is on scenes that are predominantly one color, such as the Puget Sound country, where the average composition is likely to be made up of water, trees and sky. Kodachrome records such scenes with more of a blue cast than your eye sees it. Deliberate warming up of the Kodachrome through use of a C 1 or CC 14 filter will result in the Kodachrome appearing more nearly like the subject appears when you are there. I might add that in the presence of bright, warm sunshine our senses seem to become confused and the "cool" scenes appear much warmer on a warm day than they really are.

Still another use of correction filters is to *add* color to an already predominant color. The best color shots I ever made of the Painted Desert in Arizona were with a warm filter. The intensity of the warm color of this colorful expanse was increased through use of a filter, and the Kodachrome looked more nearly like one *thinks* the color of the Desert is when he is on the scene.

Other Filters for Kodachrome

EASTMAN FILTERS

Filter for Photoflood	Converts 35 mm. and Movie Daylight type Kodachrome for use with Photoflood (Reduces film speed to Weston 3 or GE 5).
Haze Filter	Absorbs ultraviolet, to reduce distant haze.
Type A Filter	Permits use of Type A Kodachrome in daylight, giving it the same speed as daylight type film.
"A" Diffusion Disk	For slight diffusion.
"B" Diffusion Disk	For moderate diffusion.

(Both Disks designed for portrait work.)

(FOR DAYLIGHT TYPE KODACHROME)

Wratten No. 1	Reduces bluish cast under heavy overcast sky, or in pictures taken in open shade under a clear blue sky; for distant scenes or high-altitude aerial shots.
Wratten No. 2A	Same purpose as No. 1 except gives more correction.
CC 15	Also for use with Kodatron Speedlamp.
CC 33	Compensating filter for Daylight Fluorescent Lamps.
CC 23 and 43	Compensating combination for White Flame Carbon arc lamps.

(FOR TYPE B KODACHROME)

Wratten No. 2A	For use when mazda photoflash is sole light source.
CC 15	For use when mazda photoflash is sole light source.
CC 25 and CC 34	Compensating filter combination for White Flouorescent Lamps.
Wratten No. 85B	To convert Type B film to daylight use (Reduces film speed to Weston 4 or GE 6).

These filters are all for specific uses and their use assumes that the color balance of the light source is correct. For instance, if you use a Wratten 85B filter to convert Type B Kodachrome to daylight use the results will be satisfactory only *if* the sunlight color temperature at the time is about 5400 degrees Kelvin. As involved as this sounds, it is no more of a problem than if you were shooting with daylight type film, for the Kodachrome result would be off color in any event if the light was badly out of balance.

Pola-Screens

In the early days of 35 mm. Kodachrome it was my observation that there was an "epidemic" of Pola-Screen enthusiasm, without much regard to this filter's true function. Properly used such a screen does produce rich dark blue skies, and some of the earlier Kodachrome did seem to be improved by the use of such a device as the Pola-Screen.

Like all other correction or compensating filters, the Pola-Screen does have definite uses. Sometimes its use is almost imperative.

The principal uses to which a Pola-Screen can be put are:

1. To darken the blue in the sky. Used at the camera lens, with camera axis approximately 90 degrees to the sun's rays.

2. It will penetrate atmospheric haze more effectively than a haze filter.

3. To reduce or eliminate reflections from surfaces 32 to 37 degrees to the camera axis.

4. Two Pola-Screens, used together at the camera, will serve as a variable neutral density filter, for use in photographing acetylene welding and such intense lights.

5. Two Pola-Screens are needed for best reproduction of oil paintings. One is provided for use over the light source and the other at the camera. They are not interchangeable.

As a closing caution, may I suggest that you use correction filters with restraint, and then only after you have thoroughly digested all the information furnished as to their use, by the manufacturer.

CHAPTER 17

THE CARE AND CHECKING OF EQUIPMENT

EVERYTHING that has been said in these or any other pages about exposure calculations is nullified in practice if your shutter mechanism is out of time or if it operates erratically.

For some reason most of us assume without question that the shutter speed markings on our cameras mean what they say; that when we set the shutter for ½ or 1/25 second that the exposure interval will be that—no more, no less.

Would that such were true. In black and white work a 50% inaccuracy in shutter speed makes but little difference in what we can get out of the final print for we can compensate for incorrect exposure through manipulation in print making, and sometimes in the development of the negative itself.

One reason we are not too critical of exposure variations in black and white is due to the fact that the average human eye cannot detect less than a 10% variation in black and white tones (or brightness). But those same eyes can readily distinguish even a 5% variation in color value. Since over- or under-exposure changes the local color of an object (as well as its value) our eyes spot this subtle difference in value *because* it is in color.

In these pages we have talked about accuracy in exposure within ⅓ f/ stop. If you are to even approach any such accurate determination you must know at what speeds your shutter operates. It will simplify your problem considerably if you can have your shutter adjusted so that it operates with precision accuracy. I have never been able to secure such adjustments. If you cannot get your shutter set to coincide with the exact intervals for which it is calibrated, it is imperative that you *know* the percentage of error. Next to knowing this, it is highly important that you know that your shutters operate *consistently*, even though consistently in error.

This inaccuracy in shutter speeds is not necessarily any indication that the mechanism is inferior. The three shutters I use most frequently (and they are recognized as of first quality) stay consistently fast or slow in spite of all efforts of the experts to make them perform otherwise. One shutter operates within 5% of correct at all speeds below 1/50. Another is consistently fast, from 40% fast at ½ second to 60% fast at 1/25. The third shutter is just as consistently slow, being 20% slow at ½ second up to 50% slow at 1/10.

Knowing the percentage of error at each speed I make the proper compensation in diaphragm settings. The problem is much simplified if all speeds are slow or fast in the same percentage, for then you need only determine what new film factor will compensate for this fast or slow error. For instance, if you are shooting 35 mm. Kodachrome, which is rated at Weston 8 or GE 12, and your shutter is 33% fast, you can use your Weston meter set on factor 6, and your calculations will call for ⅓ f/ stop more exposure, which will compensate for the 33% error in shutter speed.

So much for the necessity for *knowing* your shutter speeds. We will outline a method for checking and calibrating such speeds in just a moment.

While we are on the subject of the need for precision "tools" in color work we must not forget the necessity for a good lens—a color-corrected lens—in order to record the color quality which the Kodachrome film is capable of capturing.

Without going into the intricacies of lenses too deeply, it will be helpful if we have some understanding of deficiencies in lenses that make them unusable for color work.

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A synchronous electric motor adapted for use in checking the accuracy of between-the-lens shutters. The lights are photographed as the turntable revolves, and the exposure interval is recorded by the degrees the extended light travels.

Two common deficiencies, neither of which you can correct, are (1) discoloration in lenses, usually due to age, and (2) insufficient color correction.

Discoloration in the lens glass or more likely in the lens cement will result in an overall color cast in your transparencies regardless of light condition. Usually this cast is a "brassy" sort of color, producing a cast in the transparency about like the color of a K1 filter. You cannot overcome this condition successfully with a color correction filter. You will do better to confine your use of such a lens to black and white work, where such color cast may actually serve as a slight filter correction. I have a thirty year old lens that is so strongly discolored that it gives a correction equivalent to a K2 filter. For black and white it is quite all right.

The second deficiency in lenses—that of insufficient color correction—practically eliminates them for color shooting.

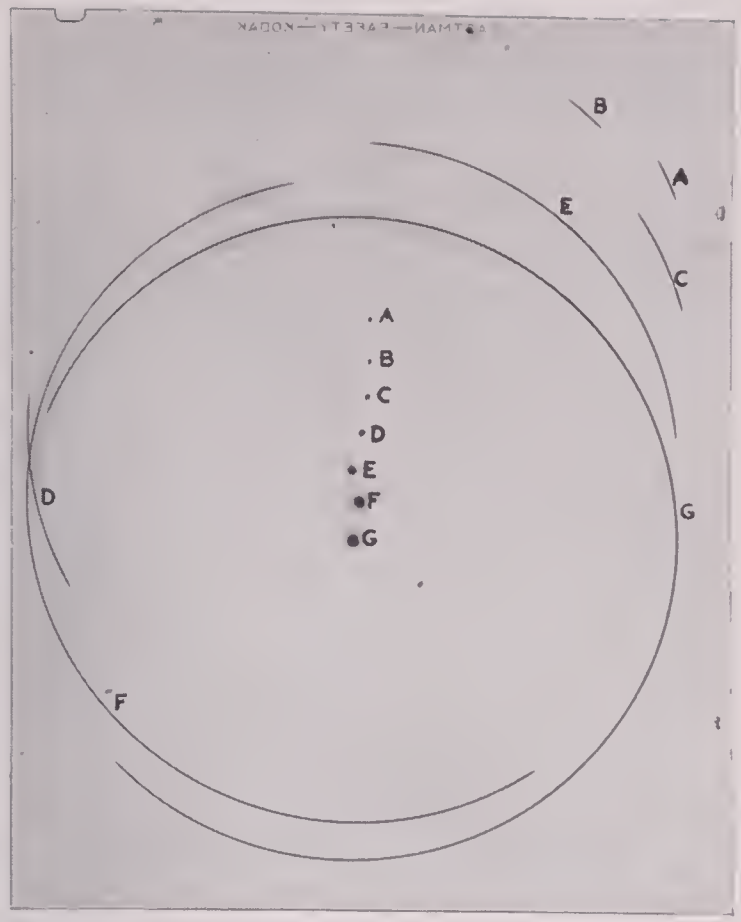
As you know the various color bands in the spectrum have different wave lengths. Due to this difference in wave length each color tends to come to focus at a different point or at a different plane. With a lens that is not color corrected, when the blue wave lengths are in proper focus on the film in the camera, the green will be slightly out of focus, and the red very much more so. In a Kodachrome transparency made with a very bad lens, the outlines of trees, for instance, may show up with a faint red tinge. This effect is caused by a difference in size between the blue and the red image on the film.

These deficiencies in lenses and shutters need not disturb you too much for you can check and calibrate your shutter, and if you have any one of dozens of good lenses the chances are very good that it is sufficiently color corrected to produce satisfactory results.

Checking Shutter Speeds

If you have any reason to suspect that your Kodachrome exposures are not as accurate as your calculations suggest they should be, by all means check your shutter before you make another color shot. Do not blame all your difficulties on processing and such, for 10 to 1 the fault is in your shutter.

A simple gadget for checking between-the-lens shutters can be improvised with a synchronous phonograph motor. This type is preferable to a spring propelled motor because the speed of an electric one is constant.



135 *A reproduction of a negative on which seven shutter speeds were recorded with the device shown in Figure 134.*

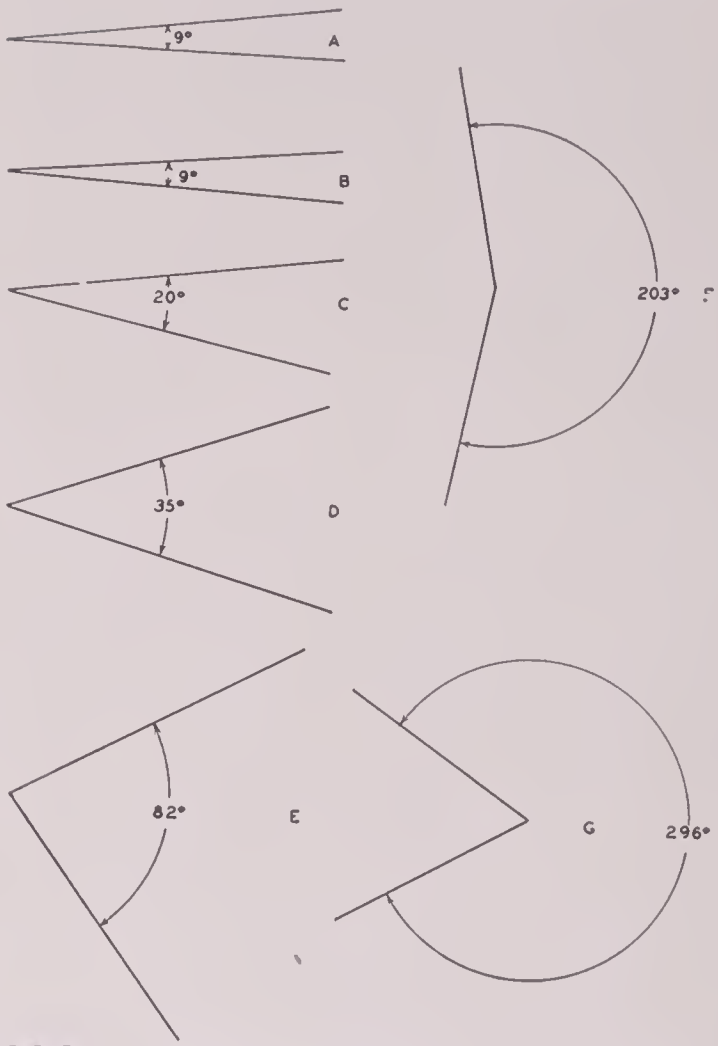
As illustrated in Figure 134, wire two focusing type flashlight bulbs in a circuit with a flashlight battery. Mount battery on the turntable in any way so it will stay put. Mount one bulb centered over the center point of the turntable, and the other bulb on an arm (twisted wire is suffieient) extending to the edge of the turntablc or a little beyond.

With the motor and lights on the floor set your camera on a tripod, with the camera centered over the turntable, some three feet above the motor.

Load the camera with Super X or other fast film, turn on the flashlight bulbs and revolve the turntable to check position of the lights on the ground glass or in the finder. Be surc the light on thc extension arm stays well within the area of the film.

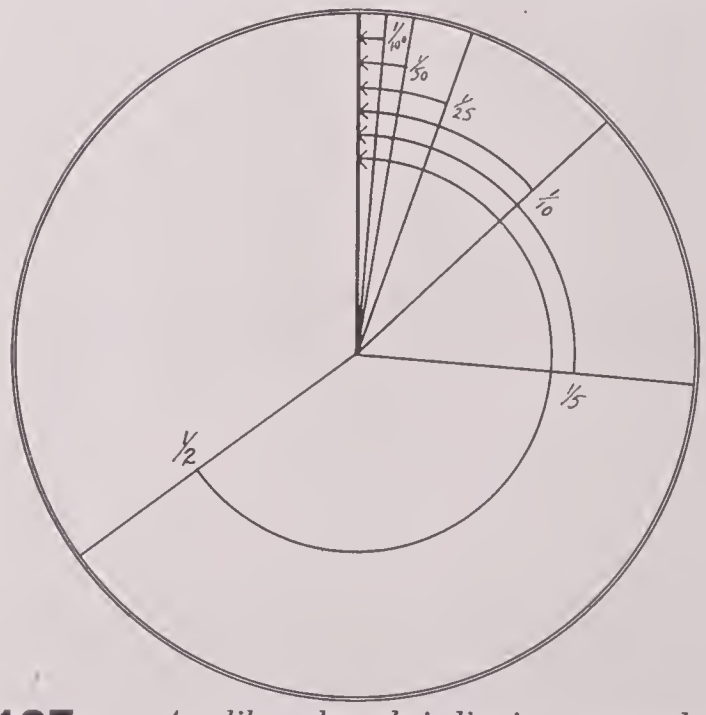
With eamera position set, stop diaphragm to f/6.3 or f/8, turn out room lights, start the motor and make an exposure at your slowest shutter speed. Stop the motor, turn on room lights and set shutter for the next faster speed.

The flashlight bulbs will expose a dot for the eenter light and a line in an arc from the extension arm light, as shown in Figure 135.



136 *Analysis of the accuracy of the shutter tested.*

TEST	Measured Speed (Seconds)		Indicated Speed (Seconds)	% of Error
B	9/468	.019	.02 (1/50)	Fast 5.0%
C	20/468	.043	.04 (1/25)	Slow 7.5%
D	35/468	.075	.10 (1/10)	Fast 25.0%
E	82/468	.175	.20 (1/5)	Fast 12.5%
F	203/468	.434	.50 (1/2)	Fast 13.2%
G	296/468	.633	1.00 (1)	Fast 36.7%



137 *A calibrated card, indicating correct degrees for shutter speeds from ½ to 1/100 second.*

If you want to conserve film you can expose several speeds on one film. If you are using small size film I would recommend exposing a new frame for each speed, as all possible confusion will be eliminated. If your film is 4x5 or larger you can easily make four exposures on one film (one exposure on each quarter area of the film).

Now to check the speeds. A synchronous motor revolves the turntable 78 revolutions per minute. In one second it will revolve 78/60ths of a revolution or 1.3 revolution. Since one revolution is 360 degrees, 1.3 revolution is 468 degrees. That means that the flashlight bulb on the extension arm will revolve 468 degrees in 1 second, 234 degrees in ½ second, 94 degrees in 1/5 second, 47 degrees in 1/10 second, about 19 degrees in 1/25 second, and so on.

With a sharp needle, scratch lines on the film from the center dot of each shutter speed exposure to the ends of the arc described during that exposure. With a protractor you can quickly determine the degrees of each angle, as shown in Figure 136.

If you have a 35 mm. still projector a very simple and perhaps more accurate method of checking negative recordings is to make each exposure in a film area size small enough so that it can be cut from the film, inserted between slide glass and projected onto a large card (about 24″ x 24″) on which you have described a circle marked off in segments determined by the degrees before mentioned—468 for 1 second, 94 for 1/5 and the other degrees for other speeds. See Figure 137. This enlarged size will make possible a more accurate check of the exact angle and arc made by each shutter speed. A protractor can be used to determine the percentage of error in speeds, by measuring the angle of the arc on the film and calculating the slow or fast variation from the segments on the graph.

Checking Color Correction Of Lenses

There are two simple tests anyone can make, and the results are just as easily checked.

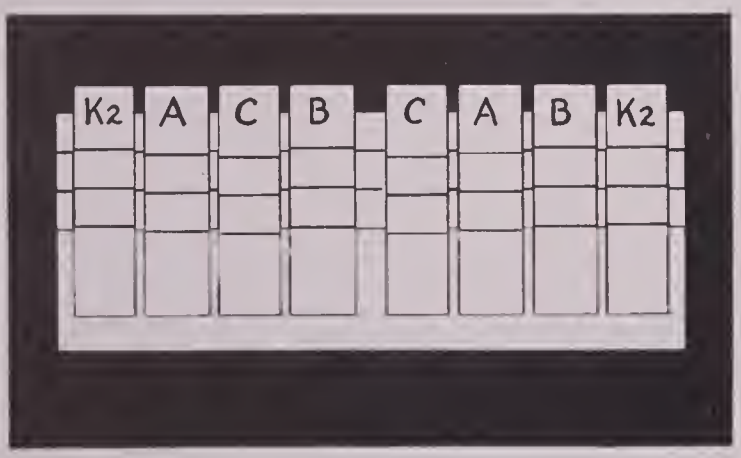
1. Stretch two or three small wires across the face of a light box or illuminator. Over these wires place strips of gelatine filters, as indicated in Figure 138. These filters must be K2 (yellow), C (blue), B (green), A (red).

Turn on the light in the box, turn out the lights in the room, and photograph the light box on panchromatic film.

If your lens is corrected for lateral color the wires will appear as straight, unbroken lines. If not color corrected the wires will appear as broken lines, as indicated by Figure 138.

2. The second method is to stretch several fine white threads, parallel, across a black velvet background. Make three exposures on panchromatic *plates*, each through one of the Wratten tricolor *gelatine* filters. After plates have been processed and dried, make a contact positive plate from one of the negative plates. All plates should be developed to low contrast.

When the positive plate has been processed and dried, register it (emulsion to emulsion) on each of the other two negatives, over an illuminator. If the thread lines at the outer edges of the plates do not register, the lens is not suitable for good color work. Any lack of register will be due to the fact that the images made separately through the red, green and blue filters are not the same size.



138 *Device for checking color correction of lenses, as described in text.*

139 *Parallel white threads on a black background is another device for checking lateral color correction.*

MAKING COLOR PRINTS FROM KODACHROME

EVEN though every *good* Kodachrome is a fine color record of the subject it captured, and is satisfying and sometimes thrilling, every Kodachrome enthusiast gets an occasional shot that cries for perpetuation in color print form.

All of us are by now accustomed to viewing transparencies direct or by projection, but nothing will ever completely take the place of a good color print. And every prize Kodachrome transparency will bring you redoubled pleasure if you make (or have made) a full color, enlarged print of it. And no small amount of that pleasure can be enjoyed in the process of making the print.

At the outset I should warn you that this discussion will not include detailed instructions for making color prints. Space does not permit detailing all the methods and processes available—Wash-off Relief, Chromotone, Neotone, Orthotone, Carbro, and several others that are variations of one or more of these better known methods. Such instructions can be secured from the manufacturers of the materials used in each process.

Rather, this chapter will attempt to assure you that the making of good color prints is not as difficult nor as mysterious as so much technical data may suggest.

For several reasons we will confine our principal considerations to the technique of Wash-off Relief prints, the Eastman process, or Curtis Orthotone which is very similar. One reason for suggesting this method is that it more nearly approaches the character of Kodachrome. Both transparency and print are made up of dye images and dye colors, and the imbibition or dye printing medium seems to more accurately reproduce the brilliance and color scale of the Kodachrome original.

A perfectly natural question is, "What is a Wash-off Relief color print from Kodachrome?". It is merely a process by which one figuratively takes a Kodachrome apart and then puts it back together again, same size or larger, but on a paper support instead of on a transparent one.

How is the Kodachrome taken apart—each of the three dye image layers separated and isolated? If you are familiar with the structure of Kodachrome you know that it is made up of three superimposed emulsion layers, the top one being dyed yellow, the middle one magenta, and the bottom one (next to the support) is dyed cyan or blue-green.

The dyes used in making a Wash-off Relief print are these same three colors, although the dyes supplied for the Eastman and Curtis processes vary slightly in kind of color. For instance, the Curtis yellow is more toward a lemon; the Eastman is more of a chrome yellow. The character of your subject suggests which yellow will more nearly reproduce the Kodachrome. While we are digressing a bit, it might be added that a lemon yellow will produce better greens but it is difficult to make a good chrome orange with it.

If we are going to "separate" the three Kodachrome layers we must get the yellow image layer "out" of the transparency and into some form which we can use in making the yellow image in the color print. The same is true of the magenta and the blue-green.

Making Separation Negatives

As you probably know, the first step in separating the three Kodachrome layers is the making of *separation negatives*, each of

(Continued on page 217)

PHOTOGRAPHING AUTUMN COLOR IN KODACHROME

One of the most thrilling color subjects for Kodachrome photography is the clean, fresh brilliance of gorgeous masses of frost-painted Autumn foliage.

The Kodachrome shot reproduced here only partially expresses the full intensity of the color in either the Kodachrome transparency or the scene itself. Literally, this Aspen grove was bathed in colored light—colored light transmitted and reflected through and by the thousands of quaking leaves, some brilliant little colored mirrors, others transmitting colored light almost as effectively as though they were color filters. Under such conditions the light itself seems to be colored at the source. Evidence of this colored light is observed on the ground and on the bark of the trees, in the illustration herewith.

Such subjects are intensely colorful even in flat light. But when shot back-lighted, the light transmitted through the foliage adds to the intensity of the color in somewhat the same way transmitted light increases the intensity of the color in a Kodachrome transparency.

DATA: Exposed on 4x5 cut film Kodachrome; Camera, Speed Graphic; Lens, 5¼ inch Zeiss Tessar; Filter, Harrison "Coralite" C½ (to increase color saturation). The reproduction is four color process, letterpress, plates made direct from the transparency.

which is a *negative* image of one of the three colors. Since we must first go to a negative image and then to a positive image (the positives which are used in transferring the dye to the paper), these negatives must be made through color filters that are complementary to the color layers in the Kodachrome and likewise complementary to the three colors used as printing dyes.

That means using a green filter to make a *negative* image of the magenta Kodachrome layer. We call that the green record or the red printer negative. A blue filter makes the yellow printer negative, and a red filter is used for the blue-green printer negative. If this process was carried to its ultimate conclusion, and the negatives were dyed in the colors they represent, the one made with the red filter would be dyed red, and the green and blue filter negatives would be dyed in their respective colors.

At this point you may have a clearer understanding of the graphs shown on the first page of the chapter on "Sunlight Characteristics" (Figure 26) and the similar one on the first page of the "Artificial Light" chapter (Figure 43). Those graphs may have seemed a little confusing in that they show the three emulsion layers of Kodachrome as being sensitive to blue, green and red, when we know that the three layers or dye images in a Kodachrome transparency are yellow, magenta and blue-green.

Now that you realize that a Kodachrome film in the camera is a *negative* in tone values as well as color, the mystery of this matter of blue, green and red sensitivity is clarified.

But to get back to our separation negatives. If you have ever inspected a set of such negatives, the illustrations Figures 144, 145 and 146 will help you see what happens when a Kodachrome transparency is brought back, so to speak, to its original negative condition —the condition you have created when you expose it to a color subject. The principal difference is that the three Kodachrome negatives are superimposed on one support, while we are now seeing three separate and isolated ones.

The negatives illustrated are those used in making a Wash-off Relief color print of the Indian Head subject which appears as the frontispiece of this book.

Compare each of these three negatives with their corresponding positives shown in Figures 147, 148 and 149. If you can visualize these three positives in their respective dye colors you will see one in tones of yellow, the second in tones of magenta, and the third in blue-green. And there you have the three layers or dye images of the original Kodachrome.

So much for this phase of separating a Kodachrome transparency into its three constituent dye layers.

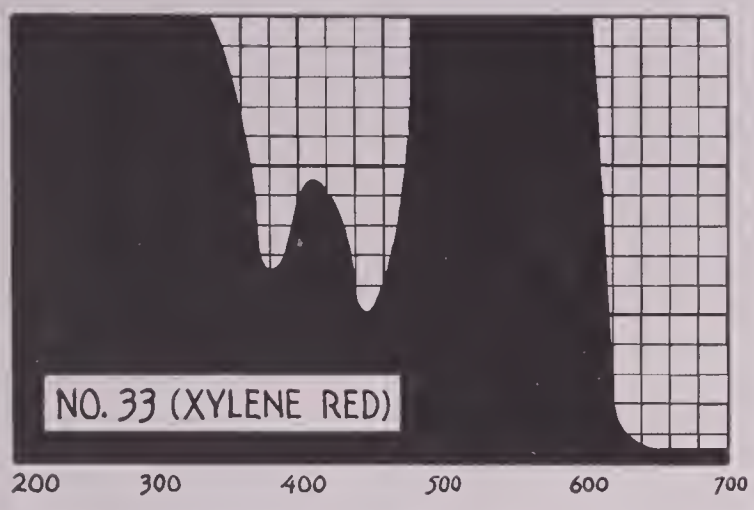
Masking for Contrast Control

To avoid confusion in describing separation negatives and their function, we purposely omitted mention of one step in the process that is imperative in more cases than not. This step is masking the Kodachrome transparency with a light silver negative mask before making the separation negatives through the three color filters.

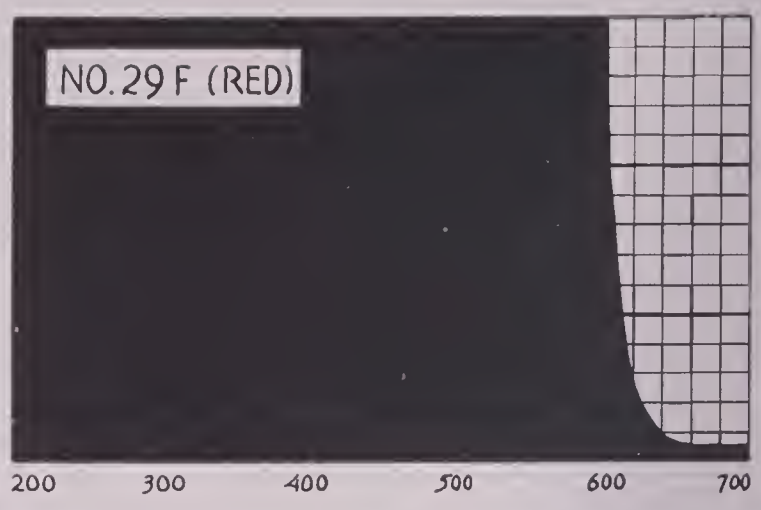
If you have ever done much photographic copying you know that the copy usually lacks much of the tonal quality of the original. The copy looks "hard"—the lightest tones of the original are "bald" in the copy and where the original had detail in dark shadows the copy records only a flat mass of black sans detail.

When separation negatives are made without a mask on the transparency, the already excessive contrast of the Kodachrome (and most Kodachromes are on the contrasty side) will cause the negatives to block up in the highlight areas and lose detail in the shadows.

The most common remedy is a silver negative mask. This mask's function is to shorten the scale of the Kodachrome so that the negatives will have about the length of scale found in the original Kodachrome. This mask is made on a Wratten Tricolor plate by exposing the plate through the back of the Kodachrome. (This permits exposing the negative's emulsion to emulsion of the Kodachrome, for maximum sharpness.) This exposure must be short enough to give fair coverage in all the light tone areas with little or no deposit in the shadow portions of the Kodachrome. As a negative it is a total loss, for it must be too weak to make any kind of paper print. Proper exposure time must be determined through experience, and varies somewhat with each Kodachrome, but a safe starting point is to give the mask about one-third the exposure



140 *Wratten Filter used in making "Contrast Control" Negative Mask.*



141 *The Filter for making the Separation Negative from which the Blue-Green Printing Matrix is made.*

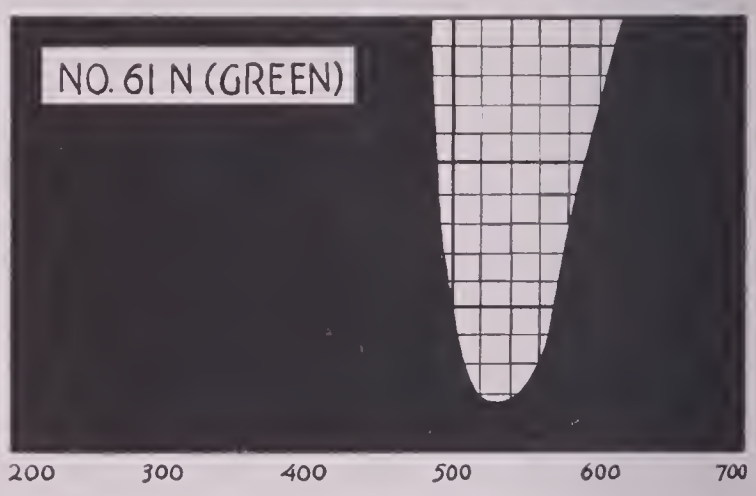
necessary to make a good black and white negative from that particular Kodachrome—good enough to make an average quality paper print.

If the mask negative is too weak it will do little or no good. If it is too heavy it will cause a reversal in tone scale when the mask is superimposed on the Kodachrome. That is, the light tones of the Kodachrome will appear as dark or darker than the middle tones.

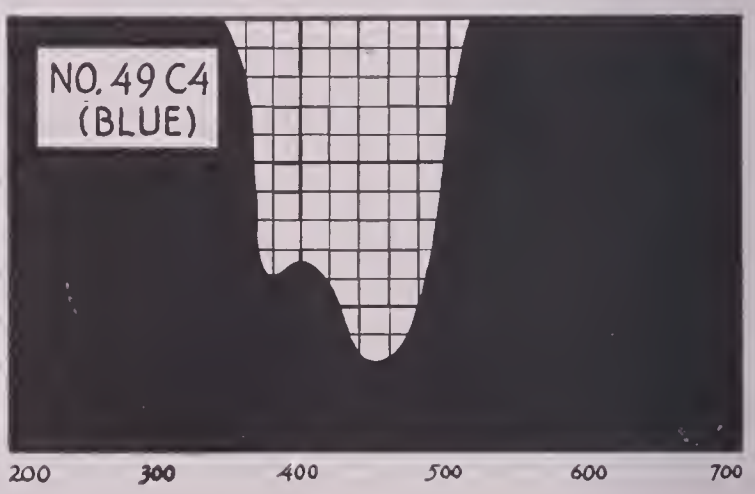
Mask negatives should be developed to low contrast—for three minutes in DK-20 developed at 70 degrees Fahrenheit. At the end of three minutes put the mask negative in a 1% acetic stop bath, then fix in fresh, acid hardening hypo long enough to remove all or most of the "pinkish" dye backing on the plate. Then wash thoroughly and dry.

When dry, place the mask face up on a light box and register the Kodachrome emulsion side up, and tape to hold in position with "Scotch" Cellulose tape around the margins of the Kodachrome. As is obvious, this process will be much simplified if the mask negative is next size larger than the Kodachrome, for you will then have liberal margins on the plate for the tape.

The mask should be made through a filter. For general use the Wratten No. 33 serves very well. However, there is another trick used by some workers in this mask making that often enhances results. It is the use of filters of other colors—the color used being determined by the color in the Kodachrome which you want to emphasize, or at least hold with a minimum of loss in color saturation in the print. Suppose the subject is a bed of



142 *The Filter for making the Separation Negative from which the Magenta Printing Matrix is made.*



143 *The Filter for making the Separation Negative from which the Yellow Printing Matrix is made.*

yellow tulips and that the blossoms occupy a rather large area. A yellow filter for the mask making will build up the density of the mask in that area; this excess density will appear as less than normal density on the

yellow printer negative (made through the blue filter) ; and the density, in this area, will then be greater in the yellow positive, or printing matrix, which in turn will impart a greater intensity of yellow to that portion in the print.

Now that the mask is made, you are ready to make the separation negatives. The mask will hold back the highlights and permit an exposure that will tend to hold detail (if there is any in the Kodachrome) in the shadows.

From here on follow the best and latest instructions you can find, in proceeding with the exposure and development of the separation negatives.

Making the Printing Positives

Assuming your separation negatives are in "balance" (an elusive term at best) the next step is to expose, develop, bleach, fix, harden and wash the Wash-off Relief film, in line with whatever instructions you have chosen to follow. These relief gelatin positives, or matrices, are your printing "plates," except that you use dyes instead of printer's ink, and the transfer of color to paper is through imbibition instead of contact pressure as in letterpress printing.

There are several ways to check this matter of balance. One is through the expensive, scientific (but sometimes fallible) way of densitometer readings of the negatives, to check their density as well as scale of contrast. If you prefer less science and more of the personal touch in your print making, you can safely depend upon visual comparison of bromide prints made from the three negatives, all prints given the same exposure and development.

If the Kodachrome contains any area of white, light gray or practically neutral gray, that area should have an identical tone value in each of the three bromides. As we have discussed before, a neutral gray is made with a balanced amount of each of the three dye colors in the Kodachrome, and likewise in the color print. If the red is a little too strong the gray will not be neutral, but will appear as a pinkish gray. If too strong in blue or yellow, the gray will have a cast of the excess color.

Obviously then, a comparison of the three bromides will give you an accurate check, for if the whites or grays "balance" in the three bromides, the separation negatives may be said to be in balance.

A third method for checking balance is through the use of a gray scale. You can buy silver gray scales for inclusion with the Kodachrome when you make separation negatives, placing it so it will appear on the margin of the negatives and outside the print area. This silver gray scale idea is quite helpful to the beginner, as it gives him a definite yardstick by which to judge exposure and development times. He will know that these two operations have been done correctly when and if the gray scales match in the three negatives. In practice these gray scales are not so accurate in determining color balance, due to the fact that they are a silver image and the Kodachrome is a dye image. Even though the scales match, you will probably find it necessary to do some manipulating of dye balance when you get to the making of the print itself.

The ideal arrangement would be to have a gray scale photographed in the Kodachrome. It would be ideal *if* the gray scale could be set at the edge of the composition in such a way that it got the same full illumination the scene is getting and *if* at the same time the gray scale could be shielded from all influence of surrounding reflected, colored light. And that is next to impossible, as you can realize. If the scale is turned slightly toward the sky it will appear bluish in the Kodachrome instead of neutral gray; if it is turned toward the ground, or is near a tree or bush, these surfaces will cast some of their own color on the scale.

By and large, the best guide is careful study of the Kodachrome itself and then through experience learn how to compensate for the differences in the various Kodachromes with which you work. But in these compensations do not go far afield in the matter of exposure and development times, for a little alteration one way or another goes a long way in affecting final color balance in the print.

The one point we have not proved in all these balance checks is that of the general "key" or overall value the color print is going to have in comparison with the Kodachrome.

144 (above) (below) 145 146

144—Negative made with Blue Filter, from which Yellow Printing Matrix is made.

145—Negative made with Red Filter, from which Blue-Green Printing Matrix is made.

146—Negative made with Green Filter, from which Magenta Printing Matrix is made.

If the negatives have too much density and the matrices, or printing positives have too little, the color print will be keyed too high and the principal loss will be in color saturation, with probably considerable loss of tone in the highlights. The print will be "anemic." If the matrices are too heavy, the print will be dark and heavy, and what appears as very dark, low value color in the Kodachrome will be all but colorless near blacks in the print. Remember that the three dye colors, heavily superimposed, create a black or visually colorless dark gray.

Some correction for excessively thin or dense matrices can be secured through alteration of the acid percentage in the printing dyes, as your instructions will tell you. However, no such alteration will put tone where

147

148 (above) (below) 149

147—Yellow Positive from Blue Filter Negative, Figure 144.

148—Magenta Positive from Green Filter Negative, Figure 146.

149—Blue-Green Positive from Red Filter Negative, Figure 145.

none appears in the matrix, nor detail in a shadow that is too dense on the matrix, or on all three matrices.

While your thought is on this matter of balance, study the reproductions of the positives used in making the Indian Head print. Compare the tone values (or such of them as can be preserved in a reduced size halftone printing plate) with the colors in the Color Plate in the front of the book. First compare the whites in the three positives, then the weak intensity colors, and last, the strong, relatively pure colors. But the significant truth is that few colors in our pictures are *pure* colors, fortunately. You will notice that the strongest colors in the Indian Head picture contain a more or less "tempering" amount of the other two colors.

Retouching Separation Negatives

Do not be careless in handling Kodachrome transparencies from which you expect to make color prints. Principally because dust spots and other defects cannot be successfully retouched out in separation negatives by anyone except a professional color retoucher for when one negative is retouched, the other two negatives must be retouched in the same area, and in proper color balance.

Some correction can be made in entire areas, such as holding back the excess red in a sky, for instance, by painting a thin coat of mucosine over this area of the green filter negative (the magenta printer). But this must be done lightly and evenly or the result will be streaks in the sky.

This inability to retouch separation negatives makes make-up—careful make-up—imperative in portrait work. Do a careful, flawless job of make-up on the subject and there is no necessity for retouching.

Retouching Color Prints

In spite of your best efforts, finished prints will invariably show small spots where one or more of the three colors are missing. Matrices will often get slightly scratched or pitted in handling. Suppose you get a scratch in the sky area of the red matrix. This scratch will appear green in the print, as it is minus red. You can carefully spot in the red (using the red dye) with a fine soft brush. Do not try to add too much color at one time. Put on a little red, greatly diluted with water, then when dry add a little more, and so on. Do not work on one spot too long at a time as you may destroy the gelatin.

Another spotting method in cases like the scratch in the sky is to fill in the red on the print after you have transferred the red and before you transfer the yellow and blue.

Progressive Steps in Print Making

The following list of the consecutive steps in color print making are not to be interpreted as *complete* instructions but rather to give you a comprehensive grasp of the undertaking, and some of the materials necessary. If you wish to try your hand at this fascinating phase of color photography, and prefer to follow the dye printing method, I urge you to get the latest issued instructions (they are revised occasionally) on the Eastman Wash-off Relief or Curtis Orthotone process before attempting any serious print making. Study those instructions until you thoroughly understand every step—the effort will save you time and material.

1. Make Contrast Control Mask on Wratten Panchromatic plate (not film). Expose, in contact, through the *back* of the Kodachrome, if you are going to make the separation negatives by contact. Masks can be made emulsion to emulsion if negatives are to be made by projection. Exposure should be about ⅓ time needed for a good printable negative from that Kodachrome. Develop 2½ to 3 minutes in DK20 at 70°F. Fix, wash, sponge off water spots and dry in dustless room.

2. Register Mask and Kodachrome. Hold in position with Scotch Cellulose tape. The task will be easier if you have made the Mask on a plate one size larger than the Kodachrome.

3. If Kodachrome is 3¼x4¼ or larger, make separation negatives by contact. With Mask made through the back of the Kodachrome, the Kodachrome and separation negative material will be emulsion to emulsion, as it should be. Use mazda light source, deep in a printing box, and diffused for even illumination. Photoflood lamps will permit shorter exposure, which is often desirable.

4. Use Tri-X Panchromatic film for negatives. Separation filters are Wratten No. 29 (Red), No. 61 (Green), and No. 49 C4 (Blue). No exposure times can be given because of variations in light source. But filter factors under normal conditions are about

Red (No. 29)	10 Seconds
Green (No. 61)	40 Seconds
Blue (No. 49)	90 Seconds

Only through tests can you determine proper ratios for your working conditions. (Read the suggestions on a previous page for determining balance.)

5. Tray develop the three separation negatives, together, in DK20 at 70°, and do not carry contrast too far. In fact the negatives should, by ordinary printing standards, be very much on the "soft" side. Density variation will not cause much trouble, within reasonable limits, but excess contrast will defy all efforts at securing a good print.

Fix, wash, sponge off and hang to dry, all three by the same corresponding corner.

6. When separation negatives are dry, you are ready to expose the Wash-off Relief film —the positives with which you transfer the dye to the paper support. If you are printing by contact, use a small light source three feet or more from an 8x10 inch film—somewhat closer if smaller film is being used. If you are printing by projection, mark film carrier so that all negatives will occupy the same position, otherwise you may waste much on the margins of the print, through lack of register on margins.

Make test exposures with the *red filter negative* on strips of the Wash-off film, placed to catch extremes of contrast in the negative, and be sure to include the highest light in the picture. Develop this positive film strip (no need to fix it) and examine by Safelight O or OA. The highlights should show the faintest trace of "veiling"—no bald spots. If highlights are bald, give next test strip more exposure. When test produces a satisfactory result, expose Wash-off Relief film, from each negative, according to time determined by the test. *Expose through the support side of the film.*

7. Develop positives in DK50 at 70°, for five minutes. Develop each separately, and each in the same amount of fresh developer. Tray develop, and rock continuously and uniformly.

8. Wash each positive separately, for 10 minutes in running water with an Automatic Tray Siphon.

9. Bleach the positives in the solution listed in your instructions. If tray bleached, rock continuously to insure uniform action.

10. You now develop the three relief images (the positives) in water kept at or near 125° Fahrenheit. If developed in a tray, do each positive separately, and gently agitate. Tilt tray so that loosened gelatin will flow out with the run-off water, otherwise it will settle and adhere to the film. About four or five minutes should give full development. If the safe edges of the film are not clear of all gelatin the films are not fully washed out.

10a. A preferable method is to first develop the reliefs in two or three changes of hot water, then finish development (about 2 minutes) in a generous amount of a 20% solution of ammonium thiocyanate, at about 68°. This solution does not break down readily and may be used for a considerable period.

11. Drain the positives and put in Fixing Bath, each in a separate tray.

12. After fixing, give a thorough washing in circulating water.

13. The gelatin of the positives should be hardened with a formalin bath, to protect them against damage in later handling. Whether you "bleach" the stain image is a matter of choice.

14. After positives are dryed, place each in its proper dye bath (according to instructions), put a piece of pre-mordanted support paper to soak in water, and when the positives are fully dyed rinse each and then superimpose the three on a white slab or in a large clean tray, in register, to check color balance. The superimposed positives, in effect, form a transparency. In this superimposed state the result will appear a little less red, with a faint greenish cast—or should—as the red will come up in transferring and drying. This greenish cast is partly due to the fact that you are seeing the dye image through three layers of film support.

15. As your instructions will tell you, the amount of dye pickup or color saturation, in any one or all of the positives can be controlled within limits by increasing or decreasing the amount of acid in the dye.

16. After you have the color balance established, place the positives back in their respective dye baths and squeegee the paper support onto a plate glass, then rinse the red printer positive, lay on the paper to allow working margin all around, and let this red transfer for the proper time. A piece of plate glass laid on the positive will keep it in firm contact with the paper. After the red has transferred, register the yellow by first squeegeeing a sheet of thin Kodaloid over the paper support, leaving a working margin at the top of the print. When the yellow is in register, squeegee it lightly as a final check, then with it firmly held at top edge (with a bulldog clip), carefully lift the yellow positive, slip the Kodaloid out, and then squeegee the yellow positive firmly and evenly. After this has transfered, follow the same process with the blue.

Like every worthwhile art, color print making requires a deft touch and great pains and practice no end. Do not become overconfident

with "beginner's" luck—there is more to the technique of color print making than meets the eye. But the same is true of all the arts, and real print making is certainly a real art.

Black and White Prints from Kodachrome

Any good quality, properly exposed Kodachrome will make an excellent black and white negative, although it is sometimes necessary to use a filter to produce the best tone quality.

No filter is necessary if the Kodachrome has good contrast in both color and value. However, most transparencies taken in flat light, of subjects that have little color contrast, produce a somewhat "flat" negative unless a filter is used. This flatness can be overcome to a degree by developing the negative for more contrast than is normally desired.

For general use the No. 33 Xylene Red Filter, graph of which is shown on page 218, produces negatives rich in tone quality. A K1 or K2 Filter works best on color subjects with weak Kodachrome skies, as well as on others where such filters will give the proper correction. Even green or red filters can be used for dramatic effects.

Panatomic X is a good film for negatives from Kodachrome. If you are working with 35 mm. Kodachrome, make a 3¼x4¼ or 4x5 negative by projection, to eliminate all possibility of grain if you should make 11x14 or larger prints. If your Kodachrome is 2¼x3¼ or larger, contact negatives should cause no grain trouble.

Properly made negatives from good Kodachromes can produce black and white prints of exceptional quality.

Making Duplicate Kodachromes

Before you become too enthusiastic about "multiplying" some of your prize Kodachromes, remember that there is always considerable loss in any photographic copying. Duplicating a Kodachrome is no exception, and the loss is often quite noticeable because one's eyes detect loss in color much more readily than they detect the same percentage of loss in black and white tones.

If you wish to duplicate a Kodachrome, first make test exposures on panchromatic film until you get a negative of proper density. Then expose Artificial Light type Kodachrome for an exposure interval based on the relation between the film speed of the Kodachrome and the panchromatic film used. If the pan film has three times the speed of Kodachrome (both by artificial light), expose the Kodachrome three times that given the pan film.

A common and serious problem is the tendency toward excess contrast in the duplicates. The best remedy is to mask the original Kodachrome with a negative silver mask. as described for Contrast Control, on page 217.

Study the Color Plates

If you have not tried your hand at color print making, I suggest you first study the reproductions of the negatives and positives of the "Indian Head" print (pages 218, 220, 221). This will give you some idea of the cut of the filters, and what tones in the positives produce what colors. Then turn back to the Color Plates in this book and try to analyze each one in terms of the three colors which made the image in the original Kodachrome from which these color plates were made.

Such studied examination will help you see what colors combine to make other colors, and how subtle variations are created with such slight deposit of two or three of the three dye colors yellow, magenta and blue-green.

Art in Color Prints

It is all well and good to be technically proficient, but logarithms and a slide rule will not necessarily produce artistically pleasing pictures. This is not to encourage careless work or disregard of the "rules," but do not become enslaved to an obsession to faithfully reproduce every Kodachrome. Oftentimes some deviation from the Kodachrome will result in a finer print.

In line with this thought may I suggest that you study the Kodachrome copy from an art viewpoint before you start print making processes on that shot. Decide whether you can improve upon its color quality or color effect, and point your efforts in that direction. Also learn which Kodachromes will make good prints and which will not. No need to waste time and material on a bad piece of color copy.

P.S.

THE previous two hundred and eighteen pages have talked color—nothing but color—so much so that one could easily acquire a distorted perspective of this fascinating subject. Not that color and color photography have been oversold in these pages, but we may have lost sight of color's proper relationship to the general scheme of things.

Without deprecating its importance, and certainly without discouraging your interest and my interest in this intriguing phase of our environment, color alone is as formless as sound. It must be admitted that color *without form* is not a complete art, and of the two, form is unquestionably the more important.

It has been said, and rather pertinently, that color bears the same relationship to form that music does to language. Music and color appeal to the emotions—form and language appeal to the intellect. Combine music with language and color with form and you call into play qualities of both mind and feeling.

The next time you hear someone criticize a work in color because it is not a riot of boisterous hues remember that only civilized, educated and cultivated tastes can appreciate the more subtle and harmonious use of color.

A famous French historian points out that the lower down in the scale of civilization one explores, the more stress is laid on color and the less on form.

On the one extreme we find the African savage who delights in wild splashes of intense color, but he has no appreciation for the importance of form. On the other extreme, Greek art and architecture has never been surpassed in beauty of form, and color was used primarily to complement and enhance that beauty.

There are significant suggestions in this thought of the relationship of form and color.

* * * * *

If you are not a movie enthusiast you probably missed the suggestion in Chapter 15 that you study professional color movies for what they may teach in lighting for color; in color schemes; color emphasis on the theme or center of interest in the picture. Note how often an entire setting is done in related colors against which is spotted a principal figure

in a complementary or contrasting color. Quite often there is equal contrast in both value and intensity of the colors used.

It has cost the movie producer thousands of dollars to learn how to create pleasingly effective use of color. You can profit by being observing.

* * * * *

There is no point in "fussing" with the exacting demands of color photography unless you enjoy doing the job as much as you thrill to the result of well planned efforts.

You learn and progress when you coordinate manual efforts with a mental picture of the result you are striving to produce. If you cannot see a beautiful picture before your camera there is even less likelihood that the final result will be beautiful.

* * * * *

Do not attempt to follow the technique or style of any color photographer. Do your own thinking. Start with a motive—a desire to create a picture—to tell a story. You can buy gadgets and expensive equipment but they will never substitute for creative ability. The expensive equipment has no power to make a picture by itself, any more than does a paint brush or an artist's canvas. Do not worry too much about developing technique, that will come automatically as you progress in this medium of color.

* * * * *

Remember that all efforts at exposure calculations are worse than wasted if your shutter is erratic or out of adjustment. Defective shutters are the greatest wasters of film.

* * * * *

If you sometimes feel that the portrait painter has the advantage of being able to alter his picture as he works remember that you, as a color photographer, more than counter that with your ability to capture, in an instant, that spark of animation, tilt of head, swing of figure, or other momentary pose that "makes" a portrait. The painter is obliged to paint from memory that fleeting expression you catch with a click of the shutter.

* * * * *

For the sake of your progress in color photography I hope you are regularly disappointed when you first view every new lot of your Kodachromes as they come from the processing laboratory. This should not discourage you, but your fresh eye will instantly spot how you could have improved every shot. Then is the time to be excessively critical of your own work.

After a few days those same shots will look pretty good. No doubt they are better than your first impression of them, if you are at all critical. But do not forget your first reaction, and make the next shots better for your self-criticism.

* * * * *

While reading some of the early chapters some of you may have felt that there was too much art and not enough photography in those discussions. I have no inclination to question your first impression. But I believe the "art" angle (if you wish to call it that) will help you develop

a fuller and more enjoyable appreciation of color—all color everywhere —and this cultivated "eye for color" will automatically become the basis for your own greatly improved color photography.

* * * * *

Have you checked or had your shutter checked lately? Why waste expensive film on "guess" exposures?

* * * * *

Do not be hesitant in attempting Kodachrome shots under unusual and dramatic light, such as storms, "sunbursts," landscapes in late evening light and other shots under "unorthodox" conditions. It is a little difficult to determine exposure on such scenes, but you have considerable leeway as you are after a dramatic effect rather than a faithful rendition of color.

The artist's mental approach to landscape pictures is just the opposite of that of the average color photographer. The artist would seldom paint a landscape under a noonday sun and cloudless sky. The condition is too ordinary to be either impressive or artistic.

Too many color photographers shy away from the situation the artist would be delighted to find. True, the photographer cannot "compensate" for unfavorably lighted areas in the composition, but many is the color shot—dramatic shot—passed by only because the photographer falsely believes he must always have full, brilliant sunshine for effective Kodachrome results. The next time you happen upon a "dramatic" scene, shoot it. It will give you courage to tackle the unusual.

* * * * *

Many a time I have seen Kodachrome enthusiasts pass up beautiful landscape shots because of cloud shadows. Too bad. If they could only realize that distant cloud shadows add strength and color saturation to often otherwise monotonous expanses. Such shadows will not go black in Kodachrome (as foreground shadows often will) as they are luminous, unless, of course, they fall on excessively dark surfaces.

And thankful you should be when cloud shadows give strength to distant horizons which would otherwise fade into the sky in a washy indefiniteness.

* * * * *

If many of the ideas suggested in these pages seem too obvious, remember that it is the obvious that is too often overlooked. You know many of the things you should do better than they have been expressed herein, but do you remember them at the right time? It is all well and good to think in grandiose terms but fine pictures are the result of doing a number of small things well, with all coordinated toward a common purpose.

* * * * *

Remind me to remind you that most of your exposure difficulties may be due to a faulty shutter. It may be erratic, or it may be consistently out of time. (No, you are mistaken, I do not own a shutter checking business.)

If any of you have suspected that the full color illustrations shown in this book are presented as the ultimate of perfection, may I disabuse your mind of any such conception. Every subject was selected because it demonstrated some phase of color photography, and not as a salon exhibit. The reproductions cannot convey certain subtle characteristics of the original Kodachromes for there is much unavoidable loss in engraving and printing processes.

* * * * *

If you have a "technical" mind, the mechanics of color photography will come easily. But do not be so technically perfect in your approach to every color problem that you forget what really makes a picture. Correct exposure and faithful rendition of colors in the subject should be taken for granted, and not considered as the ultimate accomplishment. Too many technically minded individuals never get beyond the act of making "color records" of photographic subjects. A fine color record is not necessarily a picture.

* * * * *

Before I close, permit me to mention, again, that little matter of being sure your shutter is operating properly.

* * * * *

If you have learned half as much from reading the previous ninety thousand words as I have in writing them, you have greatly added to your fund of knowledge on this immense subject of color photography. It is one thing to know a thousand and one miscellaneous and unrelated facts that are the accumulation of a quarter of a century of experience in the graphic arts, and quite another matter to correlate and systematize those facts in written (and I hope, intelligent) form so that some one else can profit from those experiences and the conclusions to be drawn from them. It has been a marvelous exercise in ordering my own thinking, and in making me skeptical of every hastily arrived at conclusion.

I assure you that you will find no purposely presented overstatement of any fact in this book. Where positive proof is not available, the latest known information is given, or the statement is qualified.

If this book adds even a whit to your progress and success in color photography it will be through having expanded your horizons, sharpened your perceptions and inspired a new appreciation for the possibilities in this comparatively new and yet but little understood medium of expression.

And, above all, I hope I have been able to suggest a new kind of mental approach to the beauty, serene dignity and spiritual quality of the World in which we work and play. Make that beauty a part of your life. Record and perpetuate those beauties through this marvelous medium of color photography.

THE END

ALPHABETICAL INDEX

ALPHABETICAL INDEX—Continued