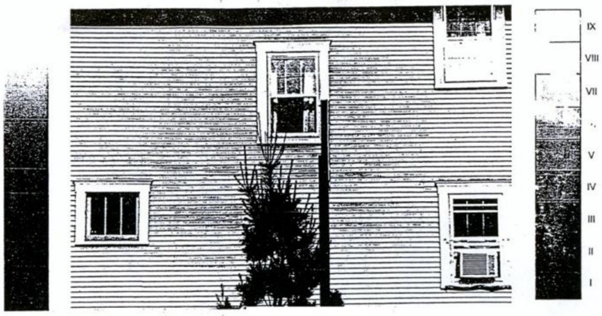
CARSON GRAVES
THE ZONE SYSTEM FOR 35mm PHOTOGRAPHERS



The tones in a photographic image continuously vary from white to black. Every area of the image represents a part of the continuous tone scale. The zone system organizes this infinite range of tones into more easily recognizable segments. Each tone of this photograph can now be identified as corresponding to a particular zone. Simplifying and naming the tones make it possible to control them in the image.

Maximum black, the greatest amount of density possible in the print, is zone I. Paper-base white is zone IX. Not only is this physical description attached to each of these zones, but there is an emotional value attached as well. A zone I tone not only is black, but it lacks any special feeling of substance, of an object existing in space. A zone IX tone is a highlight that also lacks substance of any sort. Both are simply flat, featureless, volumeless voids; one is as dark as printing paper will allow, the other is as light. This is an important consideration, as any area of a print that needs to have some sort of identity should avoid being placed in either zones I or IX.

Note on Terminology

Here, we should stop and make some special points. The zones that we are talking about are tones that exist on *black-and-white printing paper*. The language we are beginning to use to describe these tones is a language that aids us in translating the colors and fine shades of the world around us that are too subtle for any photographic material to render, into terms that the materials can understand. Learning to think in the zone system is learning to think like printing paper. Photographers use the term *previsualization*, and what it means is simply that the zone system allows you to predict the final tones on the printing paper as you view the scene through your viewfinder. Later on we will learn not only to predict, but to control and to change the zones as the need or desire arises.

Another point is terminology. When referring to zones we use roman numerals (zone I, zone V, zone IX, etc.). This terminology was developed to avoid confusion with the camera functions that use arabic numerals, such as f/8, or 4 as a shutter speed meaning 1/4 of a second. Learning and using the correct terminology will be of great benefit to you later on.

Dark Shadows and Bright Highlights

After zone I and zone IX, the next zones to consider are the ones that begin to show a change from the two extremes of maximum black and paper-base white. Zone II is a noticeably lighter tone on the print than maximum black. Zone VIII is the first appearance of gray in a print as it darkens from the paper base. Neither zone shows any real detail or texture; zone II is too dense and dark, zone VIII is too light. In fact, both might be mistaken for maximum black or white respectively unless they are compared to known values of zones I and IX. Most important, though, is the feeling or emotional value given zones II and VIII. Whereas zones I and IX are flat and empty in feeling, correct zone II and VIII values give the impression of depth and volume, the feeling of something being there but not yet defined. This is an important subtlety, because a dark and mysterious shadow in zone II will become flat and lifeless if it is rendered in zone I, and a glowing highlight in zone VIII will become empty in zone IX. Because confusion can arise in a subjective test for these values, the best way to make an evaluation is to use standard zone I and IX patches. A zone IX patch consists simply of a piece of unexposed print border; a zone I patch is a piece of paper that has been exposed to white light and normally developed to produce the darkest possible black tone. To use them, place the zone IX patch across a suspected zone VIII to see if indeed the zone VIII is a slightly darker tone. Likewise, a zone II should appear lighter compared to a standard zone I patch.

Zones with Texture and Detail

Zones III and VII are perhaps the most important zones in the process of previsualization because they are the ones that first show detail and texture in the dark and light areas of the print. Zone III might be described as the "darkest detailed shadow" and zone VII as the "lightest textured highlight." Usually, when we approach a scene to photograph it we have an idea of which areas we want to be the

darkest with detail or the lightest with texture; therefore, zones III and VII are the first that we previsualize.

Very often, there are definite objects or situations that can be used for comparative reference to these zones. For example, zone III is the tone of dark shadows cast by bushes, trees, or cars on grass, dirt, and gravel. The shadows are dark, but need the texture of the grass or gravel to retain a representational appearance in the print. A person with black hair or an animal with black fur would normally have these values rendered in zone III, as dark as possible but with detail and texture present. In short, any object or tone that is very dark but needs to be seen with detail on the print is a zone III.

Zone VII also has some specific reference points. White painted wood on a house when it is weathered and textured, for example, is a zone VII (smooth white siding would be zone VIII). Unbleached, loose-weave white fabric would be zone VII in a print compared to bleached, tight-weave sheets which would be zone VIII. As with zone III in the dark tones, zone VII is any object that is light, but needs to be rendered with detail and texture.

The Mid-tones

The remaining zones in the scale (IV, V, and VI) are best understood in relationship to each other. Zone V is a specific tone, the one provided by Kodak for its Neutral Density Test Card. You can buy this test card at most photo stores; it also comes with both *Kodak Color and Black and White Dataguides*. In the zone system, zone V is the middle of everything. Equidistant from white and black, it is the tone that marks the change in the gray scale from highlights to shadows. Every zone lighter than zone V is a highlight and every zone darker is a shadow. Zone V itself is neither a highlight nor a shadow.

From zone V we get reference points for zones IV and VI. Zone IV is the lightest of the shadow zones. Such tones as open shade (where detail is meant to be readily visible) or brown hair are standard zone IV values. Zone VI is the darkest highlight zone. Concrete sidewalks and Caucasian skin are standard zone VI values. With a gray card as a reference, and these few values as a guide, zone IV and VI can be easily distinguished as tones one shade darker and lighter than zone V.

Physical Equivalents for Zones

These zones are the translating devices that allow the world seen by the eyes to be understood as a black-and-white print. A successful translator should know not only what each zone looks like in the print, but should also have some starting points (physical equiva-

lents) taken from typical scenes that can be related to these zones. In a representational print, one in which all the tones look the way the eye normally sees them, the following physical equivalents occur in each zone:

ZONE I (The darkest tone that a print can be made to yield) Doorways and windows opening into unlit rooms.

ZONE II (The first noticeable tone above maximum black) Any very dark object for which a sense of space and volume is desired.

ZONE III (The "darkest detailed shadow") Deep shadows under bushes, cars, etc., in which a sense of detail and texture is desired. Also, black hair or black fur on animals.

ZONE IV (A medium dark tone) Average dark foliage, open shadow in landscape, recommended shadow value for portraits in sunlight, brown hair, new blue jeans.

ZONE V (Middle gray) Kodak Neutral Test Card, average weathered wood, grass in sunlight, most black skin.

ZONE VI (The first tone lighter than a gray card) Sandpiles, concrete sidewalks, clear north sky, Caucasian skin with sunlight falling on it, or skin photographed in overall shade or overcast light.

ZONE VII (The lightest textured highlight) Blond hair, cloudy bright skies, white painted textured wood, average snow, white clothes.

ZONE VIII (The last zone with any detail in it) Any very light object for which a sense of space and volume is desired. Smooth white painted wood, a piece of typing paper, a white sheet in the sunlight.

ZONE IX (The pure white of the paper base) A specular highlight in an image, such as the reflection of the sun off of glass, chrome, or water.

These equivalents are starting points. Many others could be added, and in fact trying to do so will aid your previsualization efforts. A method given later in this book can be used to test your guesses. (See p. 90.) A final point which will be made here but discussed later is that previsualization does not just apply to a representational image. Images that make the world appear as the eye sees it are only one choice that the photographer using the zone system can make.

Relationship of F-stops and Shutter Speeds

Before we relate the zones that have just been described to the way that we use our cameras, let's review the relationship of f-stops and shutter speeds. These two functions are the means for controlling the exposure of the film. An f-stop expresses the relationship of the focal length of the lens (hence "f" or "focal" stop) to the size of the hole (aperture) created by the adjustable diaphragm. The f-number is the denominator of a fraction which states the actual size of the aperture relative to the focal length. A 100mm focal-length lens at f/2 has an aperture diameter of ½ the focal length or 50mm. Thinking of f-stops this way will help clear up two usual points of confusion. First, as f-stops get larger in numerical value (2, 2.8, 4, etc.), the actual size of the aperture gets smaller since ½ is larger than ¼, and so on. Second, the same f-stops on different focal length lenses have different diameter apertures. For example, a 50mm lens at f/2 has an aperture diameter of only 25mm compared to twice that on a 100mm lens at f/2. In spite of the different size openings, both the 100mm lens and the 50mm lens will give an equal amount of exposure to a piece of film at f/2. This principle is true for all lenses of any focal length.

A change in an f-stop will change the exposure by a factor of two. Changing from f/5.6 to f/8 will cut the exposure in half. Changing from f/5.6 to f/4 will double it. This is why the standard progression of f-numbers seems to make no sense. The fractions expressed by the f-numbers are calculated to give apertures that relate to each other by this factor of two in terms of exposure, not mathematical logic. The best way to deal with this problem is to simply memorize the standard sequence so that you can avoid f-stops that don't change the exposure by this factor. The sequence goes: f/1.2 (the largest aperture normally found, lets in the most light), f/1.4, f/2, f/2.8, f/4, f/5.6, f/8, f/11, f/16, f/22, f/32, f/45. Knowing the sequence allows you to make changes in exposure quickly while looking through the camera and still know what the aperture will be. It also prevents the use of a nonstandard f-stop. Many camera manufacturers put a nonstandard f-stop (such as f/1.8, f/1.9, and f/3.5) on the maximum opening of their lenses. These do *not* express an exposure change by a factor of two and should be avoided in order to keep control of exposure.

Like f-stops, the numbers on the shutter speed dial of a camera are fractions of the actual speed; for example, 2 is ½ of a second, 60 is 1/60 of a second, and so on. From one number to the next, the exposure time is changed by a factor of two. The shutter speed marked 250 is twice as fast as 125; 30 is double the exposure time of 60.

Law of Reciprocity

Since f-stops and shutter speeds both affect exposure by a factor of two (even though they differ in the way they affect the look of the image) they are said to have a one-to-

Using different combinations of f-stops and shutter speeds both these images were shot at the same exposure. This is an example of the law of reciprocity. What f-stop and shutter speed you choose to use can affect the way the image looks. The left-hand photograph was shot with a fast shutter speed to stop the action. Since a large aperture (f-stop) had to be used, the image has very little depth of field and the background is out of focus. The photograph on the right was shot with a small aperture and the depth of field has increased to make the background sharp. The moving figure is blurred, however, because the small f-stop required a slow shutter speed.

Fast Shutter Speed, Shallow Depth of Field

Slow Shutter Speed, Great Depth of Field

one or *reciprocal* relationship. This fact, known as the Law of Reciprocity, means that in a given lighting situation a change can be made in either the shutter speed or the f-stop by making a corresponding opposite change in the other and still keep the same exposure. Thus, we can choose to affect motion or depth of field for any image we make.

It is interesting at this time to de-mystify an often misused term in photography, that of *reciprocity failure*. All reciprocity failure means is that in certain extreme situations when the shutter speed is either very fast (above 1/10,000 of a second) or very slow (slower than 1 second) the one-to-one relationship between shutter speeds and f-stops breaks down, or, the law of reciprocity fails. In this case a greater-than-predicted exposure is required to obtain a desired film density. In actual practice, the 35mm camera user will rarely encounter reciprocity failure.

Relation of Zones to Camera Controls

To complete our description of the zone system, we need to relate the two different ideas we have learned in this chapter: first, how the print is made up of various tones called zones and second, how the camera's f-stops and shutter speeds

function as exposure controls. The link between the two concepts occurs in the film's density where a change in exposure of one f-stop (or shutter speed) will change the tones in the print made from that negative by one zone. In other words: *Each zone in the zone system is related to the other zones by an exposure factor of one stop for each zone*. This is why there are nine zones instead of eight or ten. It takes nine stops to change film density from what will be rendered as maximum black to what will print as paper-base white on normal photographic enlarging paper.

Placement

The implication of this idea is that we have the final say over what tones occur in our prints. For example, if we have a zone V in a scene and want it to be a zone VI instead, we simply make a change in exposure of one stop. Because we are going from a darker zone to a lighter zone, more exposure is needed to increase the film density. The final exposure to produce a zone VI tone is one stop *more* than what was needed for the original zone V.

This sort of manipulation is called *placement*, and it enables a photographer to choose a tone in the original scene and place it in any zone that is needed for the final print. How this is done and the limitations that the materials put on this manipulation are the subjects of the next chapter, "Measuring Light." The important thing to remember now is that zones and the camera's exposure controls (f-stops and shutter speeds) are directly related. Any change in exposure will change the zones that appear in the final print and any change in zones (through previsualization) will require a change in exposure.

What Light Is—and Isn't

In 1803 an Englishman named Thomas Young proved through an elegantly simple and easily repeatable experiment that light was made up of continuous waves much like ocean waves or the way a string vibrates when it is stretched between two points and shaken.

In 1905 Albert Einstein developed a theory that light was composed of tiny discrete particles, which he called photons. This theory is one of the building blocks of a study of physics called quantum mechanics, and it won Einstein a Nobel Prize in 1921.

Neither theory, however, can disprove the other. Whether light is made up of waves like ripples on a pond or tiny particles shot out like bullets from a gun is a paradox that physicists can't yet resolve. One theory has even gone so far as to suggest (with appropriate mathematical proof) that light is a living organism that can make choices and respond to situations.[1]

Reflected Light

Fortunately, photographers don't have to know what light is made of in order to control it. The important thing to know is that light is reflected off everything we see, colors as well as shades of gray. In fact, what we think of as a physical presence is nothing more than the brain's interpretation of light that has bounced off of objects and entered our eyes.

Photographic film also "sees" reflected light. Density, in fact, is a product of reflected light. The surface of every object that we can see reflects a certain amount of the light that falls on it. A white sheet of typing paper (zone VIII—remember?) might reflect 90% of the light, whereas a zone II piece of black velvet would reflect only 5 to 6% of the same light. The percentage of overall (ambient) light that is reflected determines how light or dark an object appears to us. As a note of explanation, an object that reflected 0% of the ambient light wouldn't be visible and an object that reflected 100% would become a light source itself.

Colors, too, are a product of the percentage of reflected light. Whereas gray tones reflect the entire light spectrum evenly, colors reflect a percentage of only a part of the spectrum. Red objects, for example, reflect only the longer wavelengths while blue objects the shorter wavelengths. Any dark color reflects a small percentage of that wavelength and any light color a greater percentage.

Measuring reflected light and being able to relate it to previsualization is an important part of using the zone system.

Previous page: Being able to measure the light reflectance in a complex scene is the first step in controlling the tones of that scene. In this image the highly reflective snow required special placement to be rendered as a zone VII. Allowing the meter to "average" this scene would have produced an underexposure.

[1] *The Dancing Wu Li Masters: An Overview of the New Physics*, by Gary Zukav (New York: Bantam Books, 1979).

The Light Meter

The photographer can use two tools to measure reflected light. The most sensitive and widely used tool is the photographer's own eye. Unfortunately, our eyes are never constant; they are always adjusting for variations in light intensity so we can never get an accurate comparison between different objects.

The photographer's second best tool is the light meter. Most hand-held and all in-camera light meters read reflected light. Because they are electrical/mechanical devices, these meters are calibrated to measure light against a constant value. This allows them to distinguish between objects that have different reflectances. A reflected light meter will read zone IV brown hair and a zone VII white building differently in the same light: each reflects a different percentage of the light.

Some light meters, instead of reading reflected light, read the amount of light falling on a scene. Called incident meters, nearly all are hand-held devices distinguished by a white plastic dome or cone covering the light-sensitive cell (many reflected light meters have incident attachments). The primary problem with incident meters is that they give no indication of the relative reflectance of different tones. The white building in the example above would give the same reading as the brown hair if they were both measured with an incident meter.

Every tone has a specific reflectance value that determines how it will look relative to the other tones in a scene. The piece of white paper (zone VIII) reflects about 90% of the light striking it, whereas the dark cloth reflects only about 5-6% of the same light and is seen as a zone II. For comparison, a gray card (zone V) reflecting exactly 18% of the light is shown between the two. Caucasian skin tone reflects about 30-40% of the light.

Medium Gray

As mentioned earlier, every light meter must have a standard against which to measure light. This constant value built into the meter is a gray tone that reflects 18% of the light that falls on it. This means that any reading that a light meter gives a photographer (called an *indicated meter reading*) will render an average density on film equivalent to an 18% reflectance gray tone when printed. This will be true even if the tone metered is a zone III detailed shadow or zone VII white snow. The indicated meter reading produces a film density that makes the dark shadow appear lighter than previsualized and the white snow darker. Both will be made into a medium gray tone. Only when a scene in which there are approximately equal areas of dark shadows, bright highlights, and middle tones is metered will the various reflectance values average out to 18% or medium gray. Since most photographic scenes have about the same amount of dark and light tones in them, they average about 18% re-

flectance. Usually indicated meter readings of these scenes give adequate exposures.

The problem with average overall meter readings is the word *average*. These readings will not be correct when the tones in the scene do not reflect a combined 18% of the ambient light. A photographer relying on only average readings either accepts poor exposure (and print quality) for these scenes or learns to avoid them altogether. This can make the word *average* as much a judgment of the image as it is a measurement of light.

The consequences might be this: In a scene in which mostly dark tones are previsualized, an "average" reading will make it too light and spoil the feeling that a detailed zone III shadow will produce. The same will hold true for a scene composed of primarily light tones. The delicacy of a correct zone VII textured highlight will be destroyed by making it appear too dark and gray. As you begin to push your vision into picture-taking situations where the tones do not have an overall 18% reflectance, you will no longer be content to accept "average" as either a lighting condition or a description of your pictures.

The solution to this problem lies in relating the 18% reflectance value to the zone system scale that we discussed in Chapter 2. There is, in fact, a direct connection: the 18% reflectance tone that the light meter is calibrated to read is a medium gray identical to zone V.

Exposure Corrections for Placement

By relating an indicated meter reading of zone V to the zone system scale, a correct exposure (one producing on film the densities needed to print a previsualized tone) can easily be determined for any scene. Since the relationship between each zone in the gray scale is an exposure factor of two (one f-stop or shutter speed change), then knowing that the light meter always starts out at zone V means that you can correct an exposure to obtain any zone you want.

For example, to get the correct exposure for a previsualized zone IV head of dark brown hair, an indicated meter reading of 1/60 sec at f/8 must be closed down to 1/60 sec at f/11 (or 1/125 sec at f/8 depending on whether you want greater depth of field or stopped action). The reason is that at the indicated meter reading of 1/60 sec at f/8 the dark brown hair previsualized at zone IV would be rendered as medium gray (zone V). One stop less exposure creates a density on the film that will print as zone IV.

As we have mentioned, this exposure correction is called *placement*. Every zone from I to IX can be placed by counting the number of zones that it is from zone V and opening for highlights or closing for shadows one f-stop for each zone. A zone III shadow is placed by taking the indicated meter reading and stopping down two stops. Con-

versely, a zone VIII highlight is placed by opening up three stops from the indicated meter reading.

Placement, then, is the method by which you are able to relate the way your eye sees reflected light (previsualization!) to the way the light meter and film see reflected light. A systems analyst would call placement the point of interface between man and machine. The zone system simply says that placement—the two-step process of 1) previsualizing, and 2) adjusting the indicated meter reading to the previsualized zone—allows you complete control over the tones created by your exposures.

How to Use the Camera's Built-in Light Meter

To successfully place an exposure requires knowing how to make accurate light meter readings. The light meter built into most 35mm cameras works very well as long as you keep certain facts in mind. All of these meters average out the tones found in the viewfinder to zone V medium gray. This includes "center weighted" metering systems which reduce only the area in the viewfinder that most of the reading is made from. To use these meters to place exposures, a previsualized tone must be isolated so that the meter reads only the light reflected from that area. This means walking up to the tone so that it completely fills the viewfinder, and adjusting the camera's f-stops and shutter speeds so that the meter indicates the correct exposure in the usual manner. Next, adjust the indicated meter reading to place the exposure into the previsualized zone. Once that is done, step back to frame the entire scene, and, ignoring any further changes in what the meter indicates, take the picture.

One caution in this procedure is that the previsualized areas of the scene must be large enough to fill the viewfinder without forcing the camera so close that the lens (or the photographer) casts a shadow on the area and causes a false reading. With a normal (50mm) lens, a good size for the previsualized area is a minimum of 8 x 10 inches. If you are using a wide-angle lens and it prevents isolating a single tone, then substitute a longer focal length lens to take the reading, and switch back to the wide-angle for the exposure. It is not necessary for the area being metered to be in focus to measure the light reflected from it. In cases where the previsualized areas are too small or too far away to be metered accurately, a substitute usually can be found, a process we will discuss later. (See pp. 89-90.)

*Light meters built into 35mm cameras read the light reflected from all the objects that appear in the viewfinder. To accurately read the light reflected from a single tone it is necessary to get close enough to it so that the area of that tone completely fills the viewfinder (focus is not important). The settings that the meter recommends for that tone is the **indicated meter reading** and will then have to be placed according to the previsualization.*

Previous page: Light is an almost magical substance that makes certain photographs come alive. There is no secret to understanding its role in an image such as this. This image is simply a combination of previsualization and careful measurement of light.

Contrast and Previsualization

Until this point we have assumed that the amount of light reflectance always doubles or halves (a change of one stop) for each zone that we previsualize. This would mean that a zone IV shadow reflects half the amount of light that a zone V midtone reflects, and a zone VII textured highlight reflects four times (two stops) more light than the zone V. If light always acted in this manner, the zone system would end with previsualization and placement. But, just as quantum theory in physics speculates, light seems to think and act on its own, and more often than not measured reflectance values are greater or less than one stop per zone.

The problem is that previsualization is only our mental image of how we see zones and how we want the final print to look. It may or may not fit the actual reflectance when measured by a light meter. Just because we visualize two tones as being four zones apart (such as a zone III and a zone VII) does not mean that the zone VII will reflect four stops more light. The *intensity* of the ambient light, rather than our previsualization, affects what the meter reads.

Light Intensity and Contrast

To understand this, imagine an arbitrary unit of light intensity called a "lumen."[1] Suppose 10 lumens of light are falling on a scene in which a zone III (darkest detailed) shadow and a zone VIII (bright with little or no texture) highlight are previsualized. Imagine also that the zone III reflects 10% of the light falling on it, and the zone VIII 90%, which is approximately what they would reflect in a typical situation. With 10 lumens of ambient light, the zone III would reflect 1 lumen and the zone VIII 9 lumens. This makes the range of contrast for the scene 8 lumens, since contrast is the difference between the highlight reflectance and the shadow reflectance.

Now, imagine an increase in the amount of ambient light in the scene to 100 lumens. Our previsualization of the scene hasn't changed; we still want the final print to look the way we first saw it. The percentage of reflectance stays the same too since the objects are still made of the same substance. The only change is in the intensity of the light. But, with this change the zone III now reflects 10 lumens

[1] A lumen actually exists as a measurement of light intensity although in a slightly different context. It is the rate at which light falls on a certain measured area and is usually expressed in units of time, such as "lumen-seconds." That definition is not needed here.

of light and the zone VIII 90 lumens. This makes the range of contrast 80 lumens, a considerable increase from the first example. So, instead of contrast being a constant, it is actually relative to the overall intensity of light. We should always expect contrast to be different on a bright sunny day than it would be at dusk or when the light is dim.

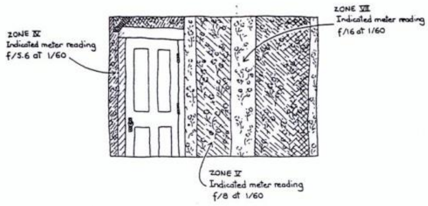
Kinds of Contrast

Three terms describe the different possibilities for contrast in a photographic scene. *Normal contrast* is when the light reflected equals one stop of exposure difference for each zone previsualized between highlights and shadows. *Low contrast* is when reflectance values are less than one stop for each previsualized zone. *High contrast* is when reflectance is greater than one stop per zone. Each of these contrast situations has a certain visual appearance and a way to relate that appearance to the zone system by using a light meter.

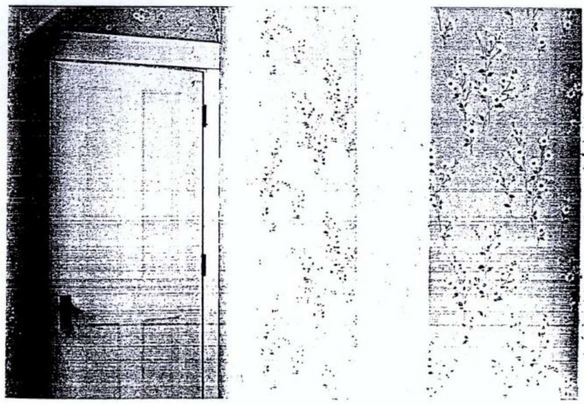
NORMAL CONTRAST

Normal contrast in a typical scene has a visual appearance of an even range of tones, not very dark in the shadows, not too brilliant in the highlights. The shadows cast by directional light appear fully defined but not too harsh. There is an overall pleasing, comfortable feeling from the light. Usually, normal contrast scenes are found in the open shade of the north side of a building on a sunny day, or out in the open on an overcast day between the hours of 10 A.M. and 3 P.M. Remember, however, that appearance to the eye is subjective when comparing reflectance values. Although experience and observation are useful in giving a general idea of the contrast of a scene, only careful measurements with a light meter will be a true indication.

In using the light meter to determine the contrast of a scene, the indicated meter readings from previsualized highlight zones and previsualized shadow zones are compared. It is easiest to express the comparison of these indicated meter readings as a difference in f-stops. In a normal contrast scene the number of stops difference between two zones should equal the number of zones. For example, in a scene in which a zone III and a zone VIII are previsualized, there should be a five stop difference in the indicated meter readings (subtract zone III from zone VIII to get a five zone difference). This difference in stops is always relative to the previsualization: normal contrast can be indicated by two stops of exposure difference when zones IV and VI are previsualized, or four stops of difference when the previsualized zones are III and VII. Remember that the comparison must be made between a shadow zone (I-IV) and a highlight zone (VI-IX). The differences within the shadow zones or the highlight zones only will not be enough to give an accurate determination of contrast.



***Normal Contrast:** Normal contrast occurs in an image when the number of f-stops between the indicated meter readings of the most important highlight and shadow zones equals the number of zones. In this image, the zone IV previsualized for the wall on the left had an indicated meter reading of f/5.6 at 1/60, and the zone VII wall in the middle of the frame had an indicated meter reading of f/16 at 1/60. These two tones are three stops apart in reflected light values and three zones apart in previsualization. Hence, normal contrast.*



LOW CONTRAST

Low contrast scenes occur when reflectance values are less than one stop for each previsualized zone. To the eye a low contrast scene is one of even, nondirectional light. Shadows cast by objects are either soft and indistinct or nonexistent. Low levels of light intensity most often produce a low contrast scene, but not always. A notable exception would be a landscape covered by snow or a light sandy beach on a sunny day. Because light sand and snow are highly reflective in all directions, a sunny day will simply "bounce" some of that excess light into the shadows, "filling" them in. The result is a low contrast scene.

As in normal contrast scenes, the only way to make more than an educated guess about low contrast is by measurement with a light meter. The reflectance of light from the previsualized highlights and shadows in a low contrast scene will create less of a difference in stops than there are zones. From a scene with a zone III and a zone VIII there would be only a four stop or less difference when the indicated meter readings from each zone are compared. Here, too, the range of stops indicating low contrast is relative to previsualization. Zones III and VII would reflect three or fewer stops of exposure difference; zones IV and VI only one stop difference.

HIGH CONTRAST

A high contrast situation, one in which there are more measured stops of exposure difference than zones previsualized, is characterized by strong intense light, casting deep, sharply defined shadows. Most bright sunlit scenes are high contrast, except for landscape scenes of snow or sandy beaches, as noted above. So, too, are scenes lit by bright artificial lights such as stage productions. Any scene in which the range of tones go from very bright in the highlights to very dark in the shadows will usually be high contrast.

A high contrast scene is defined by a greater number of stops between meter readings than there are zones between the previsualized highlights and shadows. Zones III and VIII will measure six or more stops difference, or zones IV and VII at least five stops when there is a high contrast situation. As in the other types of contrast situations, final determination must be made by comparing the indicated meter readings to the zones that are previsualized.

Specific Contrast Terminology

A shorthand notation has been developed to describe different kinds of contrast. Normal contrast is referred to simply as "N." Low contrast is called "N+" because there are more previsualized zones than metered stops. If there is one extra zone (for example, a scene in which there are three stops difference between zones III and VII) it is called N+1. When there are two extra zones (such as three stops between zones III and VIII) the term is N+2, and so on. High contrast is called "N−" since there are fewer zones than stops. One less zone (five stops, for example, between zones III and VII) is an N−1, and two fewer zones (seven stops between a III and an VIII) would be an N−2.

These terms will also be used to refer to development times for film in Chapter 5. "N" refers to a development time for normal contrast scenes, "N+" refers to an increase in development time to compensate for low contrast, and "N−" refers to a decrease in development time to compensate for high contrast.

Learning this terminology will be a convenience, but more important, using it enables you to specify the exact kind of contrast in a scene. As part of your vocabulary, these terms will help you to think more clearly about what you are photographing.

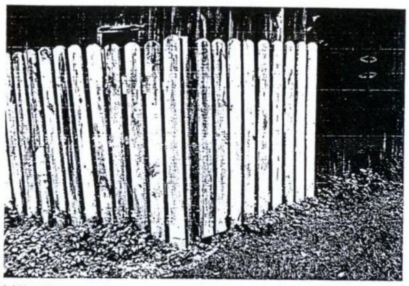
The Importance of Previsualization in Determining Contrast

Contrast is relative to previsualization and the measurement of reflected light by a light meter. A normal contrast scene occurs only when the previsualization of a highlight and a shadow zone fits the light meter's measurement of one stop for each zone. This is independent of any type of subject matter or lighting situation. The same is true for high and low contrast. Although general observations can be made, the ultimate determination is the relationship of previsualization to light meter measurement.

Through the exercise of your previsualization, you have the means to control the tones of any photographic scene that you might encounter. This makes it your responsibility for the final look of the photograph. Once equipment and procedural error are eliminated, any failure of the image to produce the desired result is one of previsualization. If a shadow is too dark or a highlight too light, then you must rethink how you mentally saw the photograph before exposure.

Previsualization failure will occur often as you learn the zone system. You may make prints where tones appear as previsualized, but the image does not possess your feelings at the time of previsualization. This happens because the translation of the mental equivalent of each zone into the actual print is a process that can be fully understood only through practice. When failure does happen, you must ask yourself whether the shadows and highlights were previsualized in the correct zones. Perhaps you might have obtained a better effect if you had placed a shadow in zone III instead of zone IV, giving the maximum effect of darkness while still retaining detail rather than a more open shadow tone. This is a differ-

Even when light reflectance remains the same, different previsualizations can create different contrast scenes. In (a), the barn wall on the right was previsualized as zone IV and the picket fence as zone VI. The indicated meter readings of these tones were only one stop apart, so an N+1 development was given the negative. In (b), the model's sweater was previsualized as zone IV and the white notebook as VIII. Here the readings of these tones were five stops apart and an N−1 development was needed. What changed (aside from the addition of the model) was the previsualization, not the light intensity, nor the reflectance values of the objects in the scene.



(a) N+1 Scene

(b) N−1 Scene

ence of one stop of exposure, or exactly half the amount of light that would be used in a zone IV previsualization. Or, perhaps a highlight should have been previsualized as VII instead of an VIII, utilizing the detail of the highlight area instead of just a rendering of an object existing but having no definite appearance. This will change the contrast of the scene. These factors make a difference in how the print looks, and these are precisely the factors that you now have direct control over.

Historical Background

In the nineteenth century photographers had to make their own film emulsions. Daguerreotypes, wet plates, even the first "dry" plates were all to a certain degree manufactured by the individual, often working in the field just before exposing. This did not allow for any standardization; each photographer had a jealously guarded formula worked out through trial and error. Exposure was intuitive and most photographers felt that through development they could alter the negative at will, correcting for mistakes in exposure and changing the relationships of the tones, independent of any other factor. Because there was no standard to observe, no one really understood the connection between exposure, development, and the final image.

At the end of the nineteenth century when consistent film emulsions began to be manufactured (George Eastman established his reputation making reliable dry plates), the superstitions surrounding film development were forced to change. Two amateur photographers and scientists named Charles Driffield and Ferdinand Hurter became interested in these new dry plates. They turned an old sewing machine and the light from a single candle into an experimental apparatus that showed for the first time that photographic materials gave consistent and predictable results.[1] What they discovered may seem familiar to us now, but it shocked the photographic world of the time, and it is worth repeating here because it forms the basic principle of the zone system.

Through careful testing, Hurter and Driffield discovered the true relationship between exposure and development as they related to film density. Density was first of all directly related to exposure. Contrary to what photographers believed at the time, no amount of development could correct for an under- or overexposed negative. Hurter and Driffield also discovered another interesting and for us a crucial fact. Changes in development, whether in time, temperature, chemical concentration, or even patterns of agitation, cause changes in film density, too. These development changes, however, affect density differently than changes in exposure. The highlights, areas of the negative that have received the greatest exposure, develop density more rapidly than the shadows. In fact, the lower shadow zones (III and below) that have received the least exposure in the negative change density hardly at all no matter how the development changes. These facts

Previous page: The bright sunlight in this scene created a high contrast situation. Without losing the sense of light, the densities of the negative were brought under control and made printable by a less-than-normal development time.

[1] The history of photography is a fascinating story. Two well-written and informative books on the subject are: Arnold Gassan's *A Chronology of Photography* (Rochester, NY: Light Impressions Corp., 1982) and Beaumont Newhall's *The History of Photography* (New York: The Museum of Modern Art, 1964).

are expressed in the zone system by the phrase "expose for the shadows and develop for the highlights." This simple statement is an acknowledgment that the shadow zone densities are affected primarily by exposure whereas the highlight densities can be altered by the act of changing development.

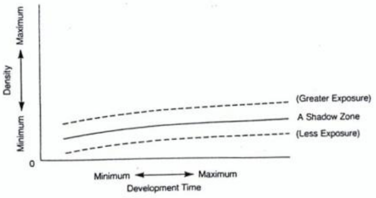
The Effect of Development on Shadows

Hurter and Driffield's discovery leads us to the final understanding of how to control the tones of our negatives. Exposure placement controls the primary shadow areas of our scene. Development doesn't have much effect on these densities. A graph will illustrate why, but before looking at the graph, a few words are in order about graphs in general.

A graph is a visual way of simplifying complex ideas. It is an abstraction, in this case an abstraction of what happens to film densities during development. It eliminates a lot of extra visual material that would distract us if we looked directly at the negative. In our graph we are showing the effect of different development times on film density. The horizontal axis, reading from left to right, represents increasing development time, and the vertical axis as it goes higher shows increased film density. Where the two meet is zero for both.

What we see is essentially a flat line, or what in geometry is called a curve with a small slope. This tells us that a shadow zone on film is not changed much by changes in development. As development time lengthens along the horizontal axis, the density does not move up the vertical axis. In fact, the only way to change the location of the curve is to change exposure. The dotted lines represent an increase or decrease in exposure, but again development is not a factor in the change. (See Figure 5-1.)

FIGURE 5-1.



Shadows are the zones most affected by changes in the exposure of the negative. These three negatives illustrate the information in the graph (Figure 5-1). The correct exposure (b) renders the zone III pants with adequate detail whereas the underexposure (a) does not. An overexposure such as (c) has as much detail in the shadows as (b) but also has extra density, which will show up in the print as more noticeable grain.

(a) Underexposed

(b) Correctly Exposed

(c) Overexposed

The Effect of Development on Highlights

A graph that shows what happens to highlight densities during development would look much different. The slope of the curve is greatly increased. Starting at about the same density as the shadow zone, the density of the highlight rapidly increases as development proceeds. What we see in this graph is that without changing exposure, a highlight can be changed in density by varying development. (See Figure 5-2.)

How Development Controls Contrast

These two points, that shadow densities are controlled by exposure and highlight densities are controlled by development, are the cornerstones of the zone system. "Expose for the shadows," as we have seen, refers to placement. "Develop for the highlights" refers to the amount of contrast wanted in the negative.

When we combine the graph of the shadow densities with the graph of the highlight densities, the result shows that development time determines how far apart the two will be. (See Figure 5-3.) This is exactly what we defined in Chapter 4 as contrast. At one point during development, both the highlight and shadow densities will produce the tones on the print that were previsualized. Before that time, the tones will be too close together and the image will be low in contrast, or flat. Longer than that time and there will be too much separation; the result will be high contrast. Because there are many possible ways to previsualize the contrast of a scene, there can be no standard development time for film. Each time we previsualize a scene to be photographed, whether it is N, N+1, or N−2, we are specifying a different development time, one that will develop the highlights to the density that fits our needs for the image. In black-and-white each film and developer combination is different, so that the only way to discover the actual time for a specific contrast is through testing. This is the subject of Chapter 7.

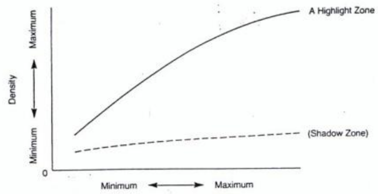


FIGURE 5-2.

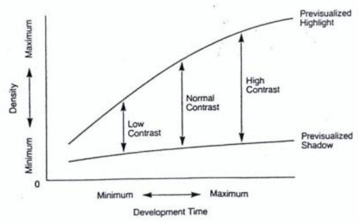


FIGURE 5-3.

As development time increases, so does contrast. There is only one point during development that the densities of the negative will produce the previsualized tones on a print. Print (a) illustrates underdevelopment. When the gray card is correctly printed, the white shirt (previsualized as zone VII) appears too dark and the black pants (previsualized as zone III) appear too light. Print (c) has the opposite problem. The negative was overdeveloped, causing the shirt to appear lighter than previsualized and the pants darker. The only print that fits the previsualization is (b), the one made from a correctly developed negative.

(a) Underdeveloped

(b) Correctly Developed

(c) Overdeveloped

Technical Control Versus Creativity

In some ways nineteenth century photographers were right about the final step in photographic creativity being in the development process. But they were wrong in assuming that changing the image with development could be subject to the whims of the photographer. Hurter and Driffield proved that density changes and contrast were a product of exposure first, and then development in a completely predictable chemical process. This was a great blow to photographic artists of the day. It reduced to simple cause and effect mechanism what to them had been artistic prerogatives. The photograph now seemed to rely too much on mechanical devices and chemical baths rather than the kind of pure and direct communication that a painter has with the canvas to be considered an art form.

A champion of art photography in the nineteenth century, a doctor named Peter Henry Emerson, even went so far as to publicly denounce the idea that photography could any longer be considered art when he heard about Hurter and Driffield's experiments. Interestingly, however, photography didn't change as a result of Emerson's dissatisfaction. In fact, even Emerson continued to make the same sensitive images of rural England that he had before renouncing photography.

An important lesson is to be learned from this. Before Hurter and Driffield's discovery, photography had been a creative medium only because photographers thought they could randomly apply technique to produce a desired result. Since that time has come the realization that only through the understanding and application of careful and predictable craft can photographers be free to visually express their feelings in harmony with the materials. As is true with any expressive form, the photographic materials require a certain discipline that has to be understood before it can be effectively used.

Making the Zone System Work

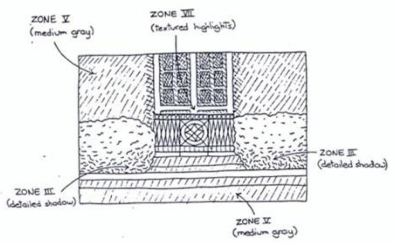
The pieces of the zone system puzzle are now complete. Putting them together and making them work is a relatively simple task. It involves, first, selecting a scene and deciding through previsualization how you want the final print to look. The next step is to meter the various previsualized areas. And, finally, use the indicated meter readings to determine placement for exposure and contrast for development time. Assuming that there are no technical flaws in the materials, equipment, or your testing procedures, the negative that you produce will print on #2 (normal contrast) paper without any difficult printing manipulation. This is one of the prime functions of the zone system, to simplify and take the guesswork out of the technical process. Let's break this process down and discuss each of the parts individually.

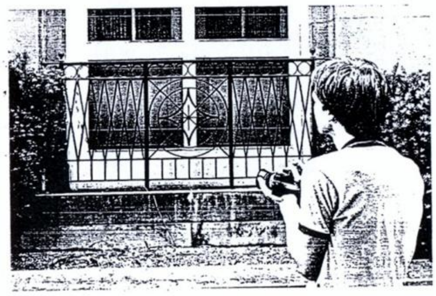
SUGGESTIONS TO AID PREVISUALIZATION

We know that previsualization means mentally sizing up an image before you make the exposure. It is a way to see the scene in the same tones of black-and-white that the film and enlarging paper do. But, given all the choices available, confusion can arise as to which zones are best to use to determine exposure and development.

In picking which areas of a scene to previsualize as the most important shadows and highlights, keep these suggestions in mind. First, the accuracy of placement and development determination is enhanced by choosing two zones that are as far apart on the zone system scale as possible. Second, with the first suggestion in mind, certain zones are easier to previsualize than others. Zone III is an example. In every scene there should be a shadow area that you want to be the darkest in the print and still have detail. This makes it likely that one of the first areas you previsualize will be a zone III. The highlight zones that are easiest to previsualize are zone VI, which can be related to Caucasian skin, and zone VII, which is the lightest zone with texture. This makes it as easy to pick

***Previsualization:** The first step in using the zone system is to look at the scene in front of you and form a mental image of the print that you wish to make from it. This is done by using the zone system to describe the print. Each zone will define a certain area, i.e., textured highlight, detailed shadow, and so forth. In this way the mental image can be turned into the technical operations such as exposure placement and development time that are needed to produce the final print. Sketching the scene in a notebook as you previsualize it will help you relate the vision to the craft.*





out as a zone III. In general, these zones will be easier to previsualize than the textureless zones (II and VIII) and will provide tones that are far enough apart to make the exposure placement and contrast readings accurate. It is almost never possible to get an accurate meter reading from zones I and IX since they are so extreme and usually appear in only small areas of an image.

Occasionally, it will be difficult to look at a scene and decide what areas are the most important shadows and highlights. This is usually a problem with flat scenes (N−1 or N−2). Very often, there are no distinct shadows or highlights which stand out. In this case, try squinting your eyes so that the image before you is thrown out of focus. When you are not distracted by "detail," the highlights and shadows seem to pop out and become more noticeable. Or, compare indicated meter readings of all the areas that you suspect might be the shadows and highlights. This way you can tell which area reflects the most light and judge accordingly how you want to previsualize the scene.

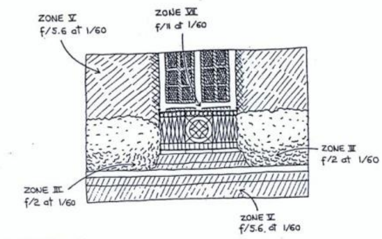
DETERMINING EXPOSURE

After you have previsualized a scene and established a mental image of the final print, the next step is to meter the important highlights and shadows and make a note of the indicated meter readings. (It helps to carry a pad and pencil with you when you are starting out.) If you feel confident about your previsualization, meter only one shadow and one highlight area. If you have any doubt, then it is important to meter all the possible shadows and highlights. When comparing the reflectance values of each area it may mean that you will have to change your previsualization. A shadow that you originally saw as a zone III may reflect more light than another area that is equally important to render with detail. This would mean a change of exposure and probably also contrast. When picking a shadow value for placement be sure to consider the other shadow values in the scene and their actual relation (in terms of indicated meter readings) to each other. Your placement will decide which areas are seen as detailed shadows (zone III), open shadows (zone IV), or simple dark areas (zone II). No change in development will undo your placement of the shadow zone. Until you are comfortable with the procedure it helps to make a sketch of the scene and label the areas that are previsualized along with their indicated meter readings. This will aid your previsualization and will help you to pick the best shadow value for placement.

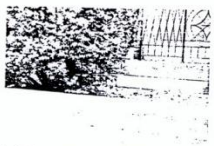
DETERMINING DEVELOPMENT

Since contrast is also decided by how the scene is previsualized, it is as important to accurately choose highlights for development as it is to decide the most important

***Metering:** Once a scene has been previsualized the previsualized areas are metered and the indicated readings recorded. From this information the contrast of the scene is determined by comparing the number of f-stops that separate the most important highlights and the most important shadows to the number of zones previsualized between them. Exposure is found by placing the shadow reading in the zone for which it was previsualized.*



CONTRAST is N
DEVELOPMENT is N
EXPOSURE is f/4 at 1/60 (f/2 at 1/60 placed in ZONE III = f/4 at 1/60)



(a) Shadow Left in Zone V

(b) Shadow Placed in Zone III

***Placement:** In this detail of the shadow area, print (a) is exposed for the indicated meter reading taken from that area. The result is that the shadow is rendered in zone V. Print (b) places the shadow where it was previsualized, in zone III, by stopping down the indicated meter reading two stops, one for each zone below zone V.*

shadow for exposure placement. In doing this, check several of the most important highlights with your light meter, keeping notes of the indicated readings. Before deciding upon the final development time (N, N−1, N+2, etc.), mentally visualize what will happen to the other highlights when you develop for the one you have chosen. Remember that once you have chosen a development time for a certain highlight, then the others will be lighter or darker by about one zone for each stop of reflectance difference. You may wish to make a change, either in previsualization or in the zone you develop for, or both, if what you are getting isn't what you want.

Personalizing the Zone System

The basic theories and working procedures of the zone system have now all been presented. Understanding how to relate exposure and development to the photograph that you want to make applies to all cameras in all situations. Even though it is possible to make the zone system more complicated and to adapt it to very specialized types of equipment, the fundamental ability to previsualize a scene and then translate that previsualization into actual working procedure is the real heart of using the system.

The remainder of this book outlines ways that you can personalize the zone system to your equipment, working methods, and the kinds of films that you use. The following chapters include: testing methods for determining exposure and development for black-and-white film; adapting zone system techniques to the needs of 35mm cameras with built-in light meters; and, finally, using the zone system with color films, how they differ from black-and-white and how color can change the way that you previsualize.