Chapter 13: Digital Imaging and the Zone System

Digital imaging as it relates to traditional photography and the Zone System, and how to create a high-quality original photograph.

Images in nature that you see with your eyes have the greatest beauty because they usually are illuminated by very wonderful light and have depth and texture that we can only simulate on a print or computer screen. The range of light, from the darkest black shadow to the brightest sparkling highlight, reflected from reality to our eyes is far greater than we can reproduce in any printed or screen image. Our eyes can adjust as we gaze into a shadow or squint to see a bright detail. When you look at a scene in nature, it has the best quality and the most detail. The T.V. set, which we watch so much, has the least amount of detail and sharpness. Go out and see the real world!

Transitions to the Digital World

There are many reasons to copy a scene from nature, a pretty face, or a product and reproduce the image so it can be carried around and seen again. How to do this, and get the best quality, is an important subject of this book. I give thanks to Ansel Adams, perhaps the most well-known nature photographer, and his great series of books, The Camera, The Negative, and The Print, for my introduction to an understanding of artistic photography. These titles by New York Graphic Society Books are must-reads for anyone who wants to understand how to take the best quality photographs. Ansel Adams: An Autobiography is also a wonderful book. Many of Adams’ discussions are about black-and-white photography, but the concepts still apply to color and even digital imaging. The depth and joy of his philosophies are something all people who deal with images should have a feeling for.

Although he died in 1984, before digital imaging became easily available and popular, Ansel Adams was ahead of his time and says in his book The Negative:

"I eagerly await new concepts and processes. I believe that the electronic image will be the next major advance. Such systems will have their own inherent and inescapable structural characteristics, and the artist and functional practitioner will again strive to comprehend and control them."

This chapter should help you to understand the nature of an original image and how to control and improve it in the digital world.

Achieving Your Visualization

The Zone System, developed by Ansel Adams in 1940, gives photographers a way to measure an image in nature and then capture it on film so it can be reproduced with the photographer’s intentions in mind. Adams uses the term "visualization" to explain a technique where photographers imagine what they want a photo to look like as a print before taking the photo. Once this image, the visualization, is in the photographer’s mind, the photographer uses the Zone System to get the correct data on the film so that visualization can be achieved in the darkroom. Getting the right data on the film or into a digital camera is very important in the process of creating a digital image too. We use the Zone System to explain what the right data is, and then we discuss how to get that data onto film or into a digital camera. If you get the right data into a digital camera, you can transfer it directly into
your computer. When you capture the image on film, you need to scan it correctly to make sure all the
information gets into your computer.

Capturing the Dynamic Range

When you look at an image in nature or in a photography studio, you can use a photographic light
meter to measure the range of brightness in the image. On a very sunny day, out in the bright sun, you
may have a very large range of brightness between the brightest and darkest parts of your image area.
We will call this range, from the brightest to the darkest part of an image, the dynamic range of that
image. Each photographic film, and each digital camera, has its own dynamic range of values from
brightest to darkest that the particular film or camera can capture, called its exposure latitude. Many
photographic films and digital cameras cannot capture the full dynamic range of brightness present in
the original scene, especially on a bright contrasty day. I’m sure you have all taken photographs where
the prints don’t show any details in the shadows or where a bright spot on a person’s forehead is
totally washed out. The objective of the Zone System is to measure, using a light meter, the
brightness range in the original scene and then adjust your camera so the parts of that brightness
range that you want to capture actually get onto the film or into the digital camera.

Dividing an Image into Zones

The Zone System divides an image into 11 zones from the brightest to the darkest. Ansel Adams uses
Roman numerals to denote the zones from 0 to X. These zones in the printed image reference how
light or dark each area will be. Zone 0 is pure black where there is no detail showing whatsoever. In a
photograph, a Zone 0 area would be solid black; in a halftone you would see no white dots in the
solid black ink. Zone I is still a very dark black, but it is not pure black and has no real measurable
detail. If you look at a Zone I halftone with the naked eye, it still looks black without detail, but if you
were to use a loupe or other magnifier, you would see very small white dots in a sea of black ink.

On the other end of the scale, Zone X is solid white, so in a print this would be the color of the paper;
in a halftone there would be no dots in a Zone X area. You would use Zone X to represent a specular
highlight like the reflection of the sun on a chrome bumper. Zone IX is a very bright white without
detail, but again you can see some very small halftone dots if you use a loupe. The range of image
brightness areas that will have obvious detail in the printed image include Zone II through Zone VIII.
Zone VIII will be very bright detail and Zone II will be very dark detail. In the middle of this area of
print detail is Zone V. In a black-and-white print, Zone V would print as middle gray, halfway
between pure black and pure white. In a color print, a Zone V area would print as normal color and
brightness for that area if you were looking at it in normal lighting conditions with your eyes adjusted
to it. When you set the exposure setting on your camera, areas in the image that have a brightness
equal to that exposure setting are getting a Zone V exposure. We will explain this further in this
chapter.

Getting a Good Exposure

Let’s talk for a moment about how you take a picture with a camera. We will use black-and-white
negative and color positive transparency as examples in this discussion. Normally, when you take a
transparency picture with a camera, you measure the range of brightness in the original scene and set
the exposure on your camera so as to reproduce the range of brightness on the film to look the same
way it did in the original scene. When you use an automatic exposure camera, the camera does this
for you. When you use a manual camera with a hand-held light meter, you need to do it manually.
Even though many of you probably have automatic cameras as I do, let’s describe the manual camera process so we all understand what needs to happen to take a good picture. The automatic cameras of today have computerized light meters that do all this for you, although you sometimes still need to do it manually to get exactly what you want. This discussion also applies to getting a good exposure with a digital camera.

**Measuring the Brightness**

To get a good exposure, you need to measure the brightness range of different subjects within the photograph. Let’s say you were taking a photograph of a Spanish home in Costa Rica. You want to set the exposure somewhere in the middle of the brightness range that occurs naturally in the setting. That middle position, wherever you set it, then becomes Zone V. A hand-held spot light meter allows you to point at any very small area in a scene and measure the amount of light reflected from that area. The light meter measures the brightness of light, the luminance, reflected from the metered part of the image. Unless you plan to use filters or different film to modify the light’s color, this is all you really need to measure regardless of whether you are taking a black-and-white or color photo.

In the Spanish home picture, the brightest areas are the little bit of sky at the top and the reflection of the sun in the right side of the window frame at the bottom. The darkest areas are the shadows in the bottom right corner. Measuring these with a light meter that allows spot readings might produce readings like exposure value 17 for the bright section of sky at the top and exposure value 7 for the dark shadow at the bottom. Each change in the exposure value settings on a professional light meter is equal to a difference of two in the amount of light measured.

**Figure 13.1**
The Spanish home in black-and-white showing, for each zone, the exposure value (EV) read by an exposure meter, the corresponding zones, and lastly the 0 to 255 digital value based on placing Zone V at exposure value 12 on the door.

In the building picture, if we have exposure value readings from 7 in the darkest area to 17 in the brightest area, there is a difference of 1,024 times the brightness from the darkest amount of light to the brightest amount of light. This is because each jump in the exposure value represents twice as much light. Here’s how we get 1,024 times as much light: exposure value 7 = 1 (the lowest amount of light), EV 8 = 2 (twice as much light), EV9 = 4, EV10 = 8, EV11 = 16, EV12 = 32, EV 13 = 64, EV14 = 128, EV15 = 256, EV16 = 512, EV17 (the brightest reading) = 1024. This is 1024 times as much light from the darkest area to the brightest.

**Placing the Zone V Exposure**

After measuring the range of exposure values within a scene that you want to photograph, you usually set the camera’s exposure to a value in the middle of that range. The value that you set your exposure to causes the areas that have that exposure value within the scene to show up as a middle gray value on the film and print in black-and-white or as a normal middle detail exposure in color. Where you set your exposure on the camera is called “where you are placing your Zone V exposure.” Here we are placing our Zone V exposure at exposure value 12, the reading we got from the door. Usually you set your exposure to the area within the image that you want to look best or most normal. If a person were standing on the steps in this photo, you might set the exposure to a reading that you would take off the person’s face.
When you decide where to set the exposure, you affect what happens to each of the zones within the image area, not just Zone V. If the Spanish home image were a transparency, it would reflect an exposure where you set Zone V based on the reading taken from the middle of the door. If the film is then processed correctly, the middle of the door in the transparency would look correct, as though you were looking straight at it with your eyes adjusted to it. When you set the exposure to the middle of the door, the areas that are lighter or darker around it, the zones above and below Zone V, become correspondingly lighter or darker on the film. The bright window, at exposure value 16, will then be placed at Zone IX and will show up as very bright and with almost no detail on the film. This is because it is four zones above, or 16 times brighter than, where we set our exposure (at exposure value 12).

**Figure 13.2**
The Spanish home in color showing, for each zone, the exposure value read by an exposure meter and the corresponding zone based on placing Zone V at exposure value 12 on the door. For the color image, the RGB digital values vary for each color channel depending on the color of the area.

If you were to set the exposure on the camera to exposure value 16, the exposure value for the bright window, you would do to the camera and film what happens to your eye when you move up very close to the bright part of a contrasty scene. The iris on your eye closes and you start to see a lot of detail in that bright area. It is no longer a white area with no detail, because the focus of your field of vision moves up and your eyes adjust to encompass just that area. If you set the exposure on your camera to exposure value 16, that bright window area in the picture would show up as a middle gray for black-and-white or a normal color in a transparency. By changing this exposure, you would then be placing Zone V at exposure value 16. Now the door would be at Zone I, 16 times darker, and everything darker than the door would be in Zone 0, totally black.

**Figure 13.3**
A stepwedge file of the 11 zones in the Zone System with the approximate corresponding digital values and percentages of black ink. The digital values shown here fall somewhere in the center of each zone. Where the actual zone values and digital values appear for each image depends on the type of output you choose. You have more latitude where the Zone I detail begins and Zone IX details end when you print at a higher resolution and line screen. If you are printing to newsprint, all of Zone I may print as 100% black and all of Zone IX as 100% white.

This would give you details in the highlights, but you would lose the details in the darker parts of the scene. By measuring the scene and noticing that the bottom of the stairs has exposure value 7 and the sky has exposure value 17, then setting the exposure on your camera in the middle at exposure value 12, you place Zone V there and thereby obtain the full range of these values on the film.

If you want to know more about the Zone System and how to take the best photographs, you should read Ansel Adams’ book *The Negative*. It contains very useful information. It also shows you some very good techniques for extending or shortening the exposure latitude of your film by under- or over-developing. Another great book on the Zone System is *The New Zone System Manual* by White, Zakia, and Lorenz from Morgan Press, Inc.
Utilizing Your Exposure Latitude

Different films and different digital cameras have different exposure latitudes. The exposure latitude of a film is the number of different exposure values it can record at once. The Zone System covers a range of 11 exposure values, a brightness going from 1 to 1,024 times as bright. Most films cannot capture detail in so broad a range of lighting situations. This range of light would be found in a contrasty scene on a sunny day with the sun shining directly on it. Some films can capture detail over a range of seven exposure values and some over a larger range. In Adams’ description of his zones, detail is captured only from Zone II through Zone VIII, or over a seven-zone range. Things in Zones 0, I, IX, and X are pretty much void of detail and either black or white. Some films have a lesser exposure latitude and others a greater one. Some digital cameras, like the Dicomed digital backs, have a larger dynamic range than most film. If you know the exposure latitude of your film or digital camera when taking a picture, you can determine which parts of the picture will have detail and which will be black or white by measuring the range of your image area and setting your exposure, your Zone V area, so the other zones, or brightness ranges, fall where you want them.

We could have gotten more details in the highlights in this picture by placing Zone V, our exposure setting, at exposure value 13 or 14 instead of 12, but then the shadow areas at exposure values 8 or 9, the areas underneath the roof and balcony overhangs, would have shown up as totally black. Some pictures will not be very contrasty, and you will know, by taking light measurements, that the exposure latitude of your film, or digital camera, can handle the total number of zones in the image. All you need to make sure of then is that you set the exposure in the middle of that range so all the areas of different exposure values fall within the latitude of the film or digital camera and you thus capture their detail.

Figure 13.4
Using the Curves tool, if you want to modify the colors or brightness of the items in a certain zone or zone range of the image, this diagram points out the part of the curve you would modify to change those zones. Using the Eyedropper tool with Curves, you can measure any part of the image and the location of its values will show up on the curve as a small circle. This makes it very easy to adjust any range of values or colors using Curves.

The measurements and diagrams in this chapter don’t accurately measure any particular film or camera. They simply illustrate how the process works.

The Advantages of a Digital Image

Once you have captured all the information you need on the film, you want to move it into your computer by doing the best possible scan. If you have a digital camera, you don’t need to scan; you can digitally transfer the image from the camera to the computer. Your objective is to make sure that your image retains all the zone detail you captured for you to play with. For more information on scanning and bringing images into the computer from Photo CD, see "Scanning, Resolution, Histograms, and Photo CD.”

Figure 13.5
The measurements and diagrams in this chapter don’t accurately measure any particular film or camera. They simply illustrate how the process works.
When you look at the histogram of a digital image using the Levels or Curves commands in Photoshop, you see all those values, all those zones, and you can move them around and adjust them with much more precision than you would have in the darkroom.


Looking at a scan of the Spanish home image in Levels, we can actually see how many values in the image fall within each zone. Notice that in this image many values fall in Zones I, II, and III. That's because this image has a lot of dark areas in it. There are not many values in Zones IX and X because this image does not have many very bright areas. To move the values that are in Zone V toward Zone IV, making the image brighter, or toward Zone VI, making the image darker, you can use the Brightness/Contrast slider in Levels. To move the values in Zones I and II over to Zone 0, making the shadows darker, you can use the Input Shadow slider. In later chapters, we show you how to use these techniques with the Levels command to give you more control over the different brightness and color zones in your images. We will also show you how to use Curves to do pretty much anything you want with your image data.

**Figure 13.6**
Here are the main controls of Levels and how the zones pointed out in the Spanish home image above show up in the histogram of that image. The approximate digital value, in the 0 to 255 range, is also shown for each zone.

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