

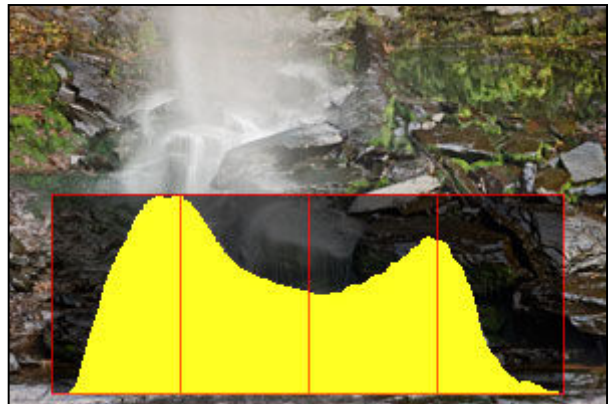
CHAPTER 7 - HISTOGRAMS

In the field, the histogram is the single most important tool you use to evaluate image exposure. With the histogram, you can be certain that your image has no important areas that suffer highlight or shadow clipping. While Photoshop and Camera Raw can work wonders adjusting contrast and tonal balance, they simply cannot recover any image information in areas that are badly clipped.

The following images describe how my Nikon D200 presents the histogram to the photographer. You should get out your camera's manual and learn how to access all the histograms your camera maybe able to display. My D200 has 5 pages of information it can display on the LCD panel, two of them contain histograms. The menu system also lets you include or remove individual pages from this sequence. It is important that you check your menu system and be sure all pages with histogram information are part of your display sequence!

The 4-way jog dial on the back of the camera lets me move from page-to-page or image-to-image as necessary. During image review, the up and down jog directions move sequentially through the selected information pages for one image, and the left and right jog positions move sequentially through different images. In this way, I can set the display page to the luminosity histogram, and then move through a whole series of images looking for clipping. This might be series of exposure bracketed images, or a series of panorama images. If I'm aware of the possibility of clipping in a single channel, I can set the channel histogram for that channel and perform the same image sequence review.

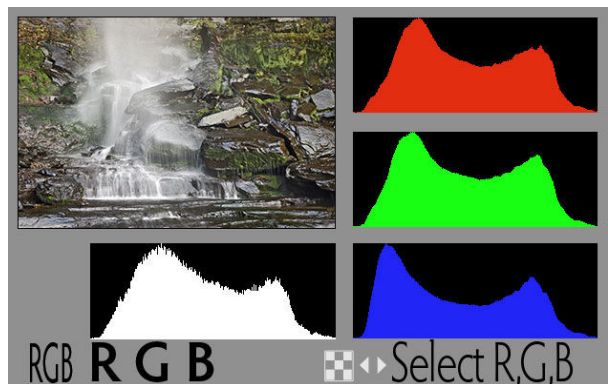
This is the luminance histogram I see on my Nikon D200. The left end of the yellow histogram represents full black, the right end full white. If there was luminosity clipping in this image, due to the white areas in the water, there would a large spike at the right end of the histogram. There is no spike on the right so no part of the image suffers from highlight clipping. There is no spike on the left so no part of the image is suffering from shadow clipping.



The D200 also can display the luminance and RGB histograms on a single screen. All look good for this image. No spikes at either end for all channels. The small checker board and arrow heads in the center bottom are a reminder that by holding down the corresponding button on the camera back and using the jog dial, each of the 4 channels can be selected individually. In the small image thumbnail, clipped pixels in the selected channel will blink.

This image was made in late autumn, on a very overcast day so the scene luminance range reflects the inherent dynamic range of the objects themselves. The histogram fits nicely within the dynamic range capability of the camera.

There are many, many images whose luminance range is so great that some part of a single frame will be clipped.



Remember, this usually results from scene illumination, not the inherent contrast of the objects in the scene. Later in the book we will look at ways to take multiple exposures from the tripod, and combine these into a single, well balanced image that in fact does show good details in all areas, shadows, midtones and highlights. The histogram is the tool that you will use to be sure that a frame taken to capture highlight areas, and a frame taken to capture shadow detail, are correctly exposed. For some scenes, only two exposures may be necessary. For some scenes, as many as nine frames may be needed. There's a whole chapter on high dynamic range (HDR) images to follow!

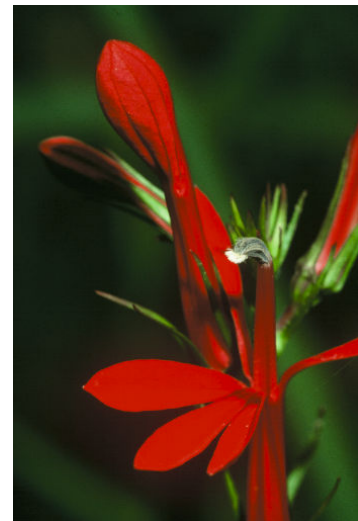
LUMINANCE HISTOGRAMS

Luminance is the amount light coming from your subject and is independent of color. It is closely related to the exposure value (EV) we mentioned earlier and forms the basis for how your camera's light meter selects an f/stop and shutter speed. Because luminance is a kind of average, highlight clipping in the luminance histogram only occurs when all three color channels are at their maximum value. Shadow clipping occurs only when all three are zero. For many images, such as the landscape above, the luminance histogram is perfect for discovering exposure problems. The area of the image most likely to be problematic is the water. Both white and bright, clipping would occur in this part of the image first.

The only truly black areas of the images are the small shadows beneath the rocks. There is nothing important here and these areas will be rendered black in the final print.

CHANNEL HISTOGRAMS

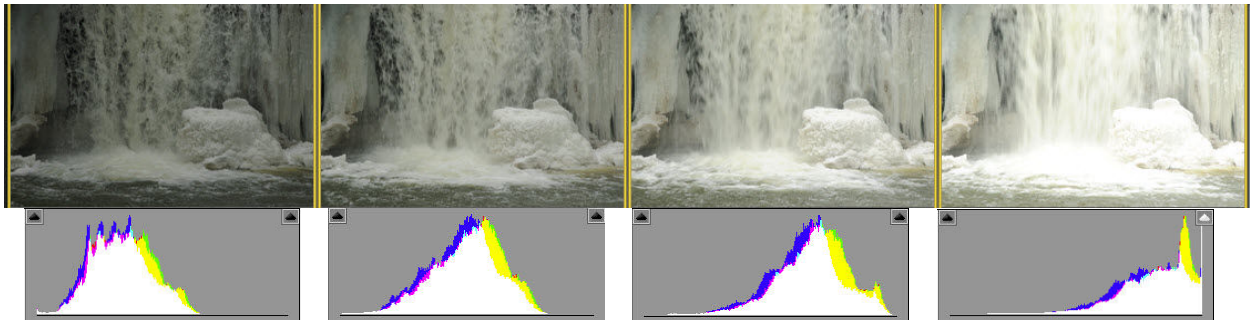
When a single color tends to predominate in an image, the green of a landscape, or the red of a Cardinal Flower, clipping can occur in a single channel which will not be seen in the luminance histogram. This is where channel histograms become important. In terms of the image, if a color channel is clipped, the clipped area will not show any color variation; it will be the same, uniform patch of color and textures may be lost. Here's a petal from the Cardinal Flower. Note that the lower three-part petal is clipped to the same featureless patch of red, while the upper flower shows nice color texture.



INTERPRETING HISTOGRAMS

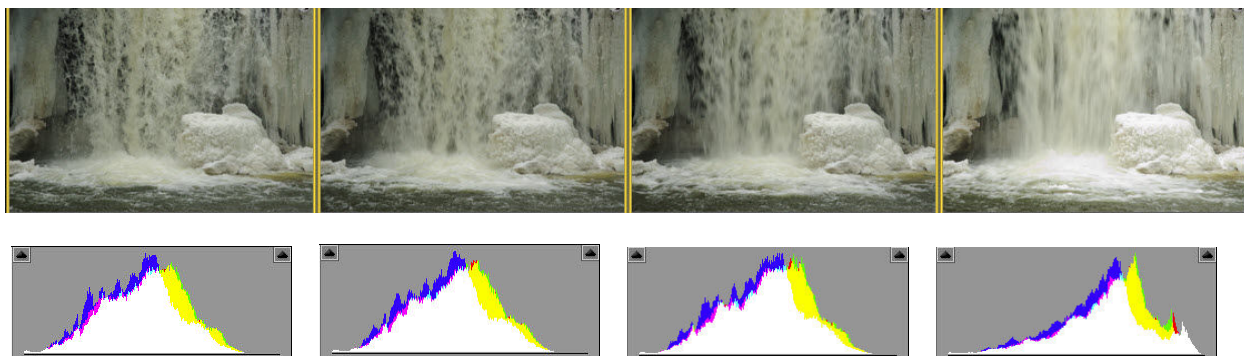
The histogram is the tool that you will use to determine if the exposure will give you the image you want! If you need detail in highlight or shadow areas, or both, you have to be sure there is no clipping in those areas. In addition, if your histogram fits entirely within the histogram, you should adjust your exposure to place the histogram toward the right (bright) side of the display, without clipping. This is the same as the transparency film guideline of 'expose for the highlights'.

Here are four photographs taken at Christman Sanctuary during a brief winter thaw. A large block of ice had broken off from the water fall and it held was a lot of nice texture. The sky was overcast, so scene dynamic range was well within the dynamic range of the sensor. The second image from the left is at the exposure recommended by the camera and the histogram is about as nicely centered as you could hope. The third image is 1 stop brighter and the histogram is properly 'exposed to the right'. The first image is 1 stop less; although dark the histogram is barely clipped. The fourth image is 1 stop more than the third and clearly clipped. These were captured directly from Adobe Bridge.



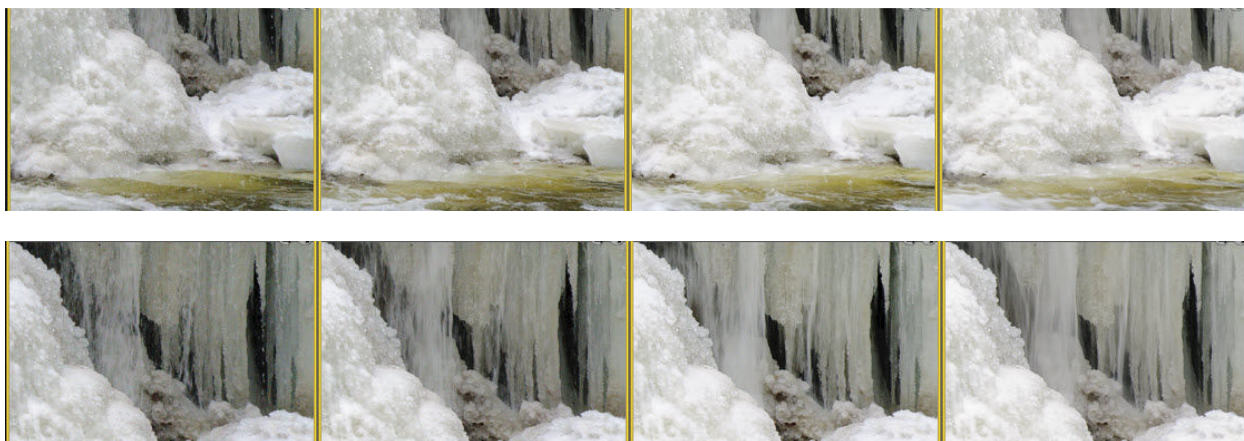
To get this series of images, I had Camera Raw set to *not* apply the default adjustments to the raw images. (This is something I strongly recommend, since the auto adjustments can hide issues of image quality, as we will soon see. How to do this is covered in the Camera Raw chapter.)

After selecting the 'auto' adjustment in Camera Raw, which often provides an excellent starting point in the rendering process, the images seem very similar. All the histograms are nicely centered, although the images generally look dark. Certainly we expect the ice block to be close to white with good texture in the highlights.



I selected each image in Camera Raw and moved the brightness slider to the right to get this brightness value. I also moved the black point slider to the right to fill in the shadow areas. Again, all the images and histograms look similar. Even the fourth image, which was somewhat clipped in the highlights looks pretty good. This is a tribute to the power of Photoshop to recover highlights.

But if we zoom in closer, we see some important differences. The first image shows serious color noise in the shadows; the second has a modest but noticeable amount. The fourth image shows some blocked up highlights; that is, the texture is not as solid as the third image. Even though Camera RAW is exceptionally good at recovering highlight clipping, it's not as good as a properly exposed image. Only the third image, the one 'exposed to the right' looks good in both highlights and shadows.

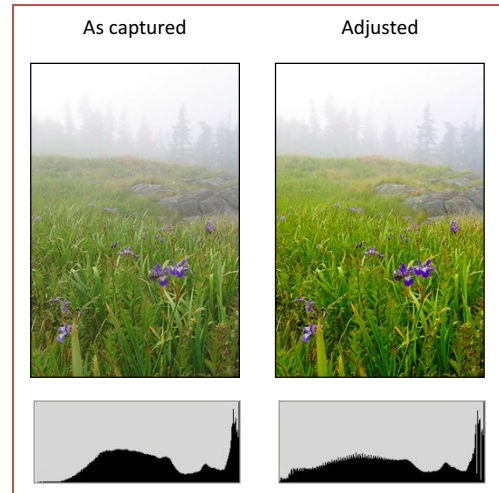


Of course, it is difficult to reproduce these in print. I suggest you do a similar test series yourself. It is worth the time, and you will get to know your camera.

It is important to understand that there is no ideal histogram, *per se*. Clipping may be an important part of your image! Even if you ensure that your original image capture shows no clipping in the luminance or color channels, you are likely to force some clipping in shadow areas in order to get good blacks in the final print. Good blacks can be essential to a dynamic image.

This image was taken on a foggy day on Campobello Island. The image as captured is on the left. The dynamic range is low, as expected, and the histogram does not have any values near black. The sky is clipped, but that does not matter; there is no detail to reveal in the sky. The iris is the key feature that needed to be captured well in the initial image.

After some modest adjustments in Photoshop, the image becomes more dynamic. Some blacks are clipped, but these are very small shadow areas in the foreground. There is more color and contrast in the foreground, which is helped by the deeper blacks. The final image represents my feelings at the time the picture was made. Finding irises in August was unexpected, as was the splash of color in the fog.



EXPOSURE & HISTOGRAM SKILLS

The most common exposure problem a nature photographer faces is a scene dynamic range that exceeds the capability of the sensor. There are number of ways to cope with this, including simply choosing which parts of the image, shadows or highlights, can be sacrificed. However, since we will be rendering all our images in Photoshop, we should take advantage of the possibility of rendering our photographs using multiple exposures of the same scene. Remember that no combination of camera, film or sensor can capture an image in ways that are as capable as the human eye. Ansel Adams' Zone System was designed to enable the film photographer to capture a scene dynamic range that still exceeds the capability of digital sensors. Photoshop allows a different approach for digital images with an equivalent goal.

In addition, making multiple exposures is part of many nature photography techniques. Landscapes, panoramas, and high dynamic range (HDR) images all involve multiple exposures at one time or another. The equipment necessary will be covered in a brief chapter later, as will the work flow in Photoshop necessary to merge multiple images.

When we make multiple exposures of a scene due to dynamic range a tripod is required. We have to be sure that when the images are brought into Photoshop they will align exactly. In addition, exposure changes should be made using shutter speed only, once an f/stop has been selected. This simply because merging an image that is sharp throughout with one that has out of focus areas due to narrower depth-of-field loses quality in those areas. Even though moving parts of the image will be affected by the change in shutter speed, some blur in moving objects is expected. There may be an occasional scene where the required depth-of-field is narrow and differences in f/stop will matter, but in my experience, these are rare.

Most of my photography involves moving water, so I make my exposure adjustments using changes in shutter speed. I will have chosen an f/stop that gives the deep depth-of-field I want, and this almost always results in a shutter speed that is too slow to handhold. So there will always be some motion effects in the water. If you were photographing a landscape where there are clouds moving rapidly across the sky, you may need to select shutter speeds that freeze the clouds. This is an example of the decisions that all photographers must make; depth-of-field vs. shutter speed.

In this case, we set the camera up on a tripod, frame the image, and lock down the head and legs so the tripod is solidly in position. Our first image is made to get a histogram that is as close to perfect as possible. That is, there may be some clipping in both highlights and shadows, but most of the image falls in the middle. I have found that the so called 'matrix metering' option on my camera does a great job of giving a good starting exposure. If the f/stop and shutter speed the camera suggests does not give a centered histogram, I delete the image and adjust as necessary. When I have an image with a good, centered histogram, I make my next exposure to capture shadows. To do this I use a slower shutter speed, which allows light to hit the sensor longer and builds up values in the shadows. Typically, this is a single stop. If the centered image is 1/30 sec, then this one is 1/15 sec. Check the histogram to be sure the shadow clipping gone. If not, delete and use another stop more light. I take images until I get one where there is no clipping in the shadows, with a small area at the left of the histogram where no pixels fall. Each unsuccessful image is deleted.

The third keeper image will be for the highlight areas of the image. Again, I'm looking for no clipping on the right side of the histogram, with a small gap where no pixels fall. Keep in mind that there will often be some highlight clipping that you cannot avoid. In full sun, any reflection of the sun from shiny objects, a wet rock, a dew drop or the shiny exoskeleton of an insect, will always be clipped.

In practice, making these exposures happens fairly quickly. Most of the time, the adjustments are only 1 stop in each direction, and no images are deleted. When I find that more than one stop is required, I begin thinking about using HDR software, which likes a 2 stop interval. There's a chapter on HRD technique to follow.

There are some situations where an exposure sequence needs to be taken quickly. While moving water does not present much of a problem, moving clouds do. The best way to accomplish a quick sequence, is to use the camera's built in exposure sequence automation capability. On my Nikon D200, there's a dedicated button for this. Just hold the button and turn the primary and secondary control wheels. One wheel controls the number of stops between exposures, the other the number of exposures. As these adjustments are made, the exposure display on the top panel changes accordingly. If I want a 5 frame spread at 1 stop intervals, the exposures would be -2, -1, 0, 1, 2. When a bracketing setup has been made the small +/- icon on the upper display panel flashes, and small tick marks appear under the exposure scale at the corresponding locations. As each shot is taken, one of the tick marks is removed. After the last shot all reappear and you are ready to begin a new sequence. Once set, the 5 frames can be taken by merely pressing the shutter button 5 times, if in single shot mode. In continuous shooting mode, holding the shutter button down makes all 5 exposures, then stops. Since your sequence is not interrupted in order to make manual adjustments, the actual amount of time required for the whole spread is minimal.



Be careful though, you have to manually reset the bracketing to 0 frames in order to get out of exposure bracketing mode. From experience, I can tell you it's quite easy to forget!

You may have noted that I had intended to take 3 exposures at -2, 0 and +2. Unfortunately, this Nikon model only allows an exposure bracketing by $\frac{1}{3}$, $\frac{1}{2}$, or 1 stop intervals. Many cameras let you select 2 stop intervals. So I take all 5 and likely use only the 3 I need. Not a big deal.