



Understanding Histograms

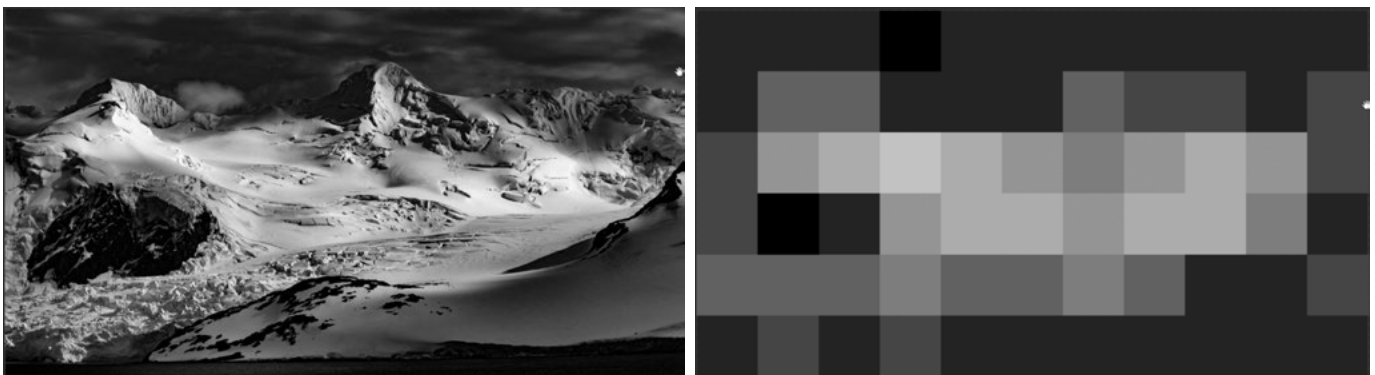
Understanding Histograms

In this lesson, we're going to cover the basics of histograms. The topics we cover here will build the foundation for future lessons that will get more in depth on the subject.

What is a Histogram?

Whenever a histogram is made, your computer is basically creating a simplified version of your image. If it were to work on a full resolution image, it would take a good amount of processing time to create the bar chart based on the image. Because of this, your computer will scale your image down, working on a very low resolution version. This will quicken up the processing time while still retaining enough information to pick up the tones in the image. A normal image captured by a digital camera has thousands of brightness levels. A histogram usually reduces the number of shades down to 256.

In the example image, we manually created a histogram and limited the number of brightness levels down to 11, just for demonstration purposes. We took each of the perfectly black pixels and stacked them on the left. Then we took all of the 90% gray pixels and stacked them to the right of the black ones. We continued this process with all of the same-toned pixels until we formed a bar chart. The chart was then scaled down to an appropriate height. This is essentially what happens every time you view an image's histogram.



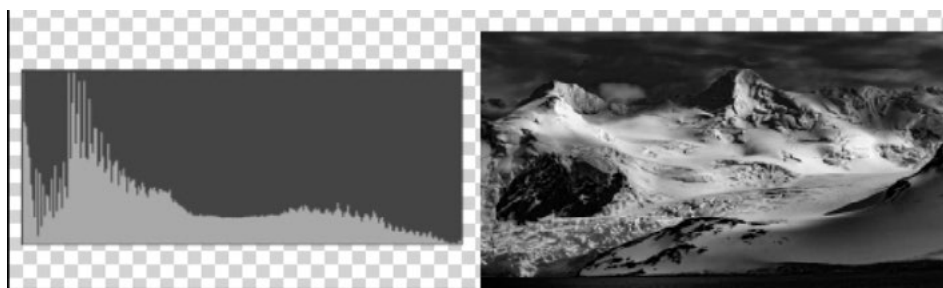
When your computer creates a histogram, it first simplifies the image and then creates the bar chart based on that simplified version. Above is an image and an overly simplified version of the image that we used for demonstration purposes to create the histogram.

Knowing this, we can see that a histogram is a simple description of the brightness levels of your picture. Black is always on the left. If there is a bar on the far left side of your histogram, that indicates how much black is in the picture. White is always on the right. If there is any solid white in your image, there will be a bar on the far right side of the chart. Because a histogram is created by using a simplified version of the image, it may not be as precise as you need it to be. For example, the histogram on your camera may show that there are no white pixels when, in reality, there were a small amount of white pixels. They were just eliminated when the image was simplified in

order to create the histogram. In the example image, you can see that the super simplified version showed no white pixels, while the version that was created using a less simplified version of the image revealed that there were a few small areas of white. This is just something you should be aware of when referring to histograms.



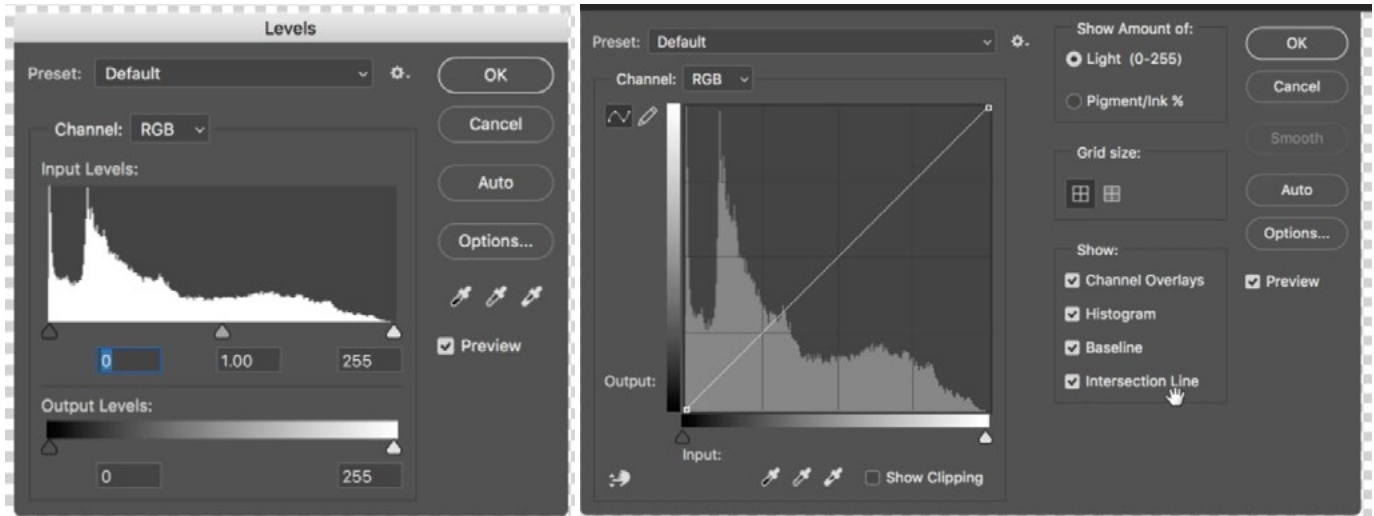
Here we have our oversimplified version of the image (to 11 brightness levels) along with the resulting histogram chart.



Here we have the image that was simplified by the computer (to 256 brightness levels) and the resulting histogram.

Histograms in Photoshop

In Photoshop, there are many different areas where you'll find a histogram. The Histogram panel is one of them. If it's not already visible in your interface, you can access it by going to the Window menu and choosing Histogram. The Levels and Curves dialogs also display a version of the histogram. With these, I like that there



You can see the histogram chart within the Levels dialog (left) and the Curves dialog (right).

is a gradient bar underneath the histogram chart and you can think of that as a key to the histogram. The bars on the chart show you how much of the image is taken up by the tone directly beneath the chart. For example, if there is a spike in the chart directly over the part of the gradient that represents 50% gray, that means a good portion of the image contains a 50% gray tone.

A histogram can show multiple sets of information. When that's the case, there will be more than one set of bars overlapping on the chart and they will be different colors. Often times, these bars will be red, green and blue.

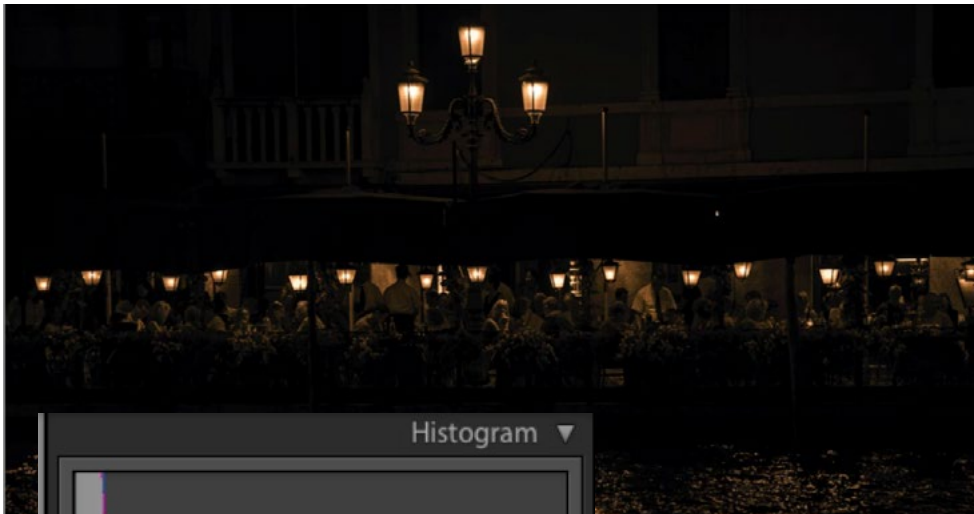
Dynamic Range

Dynamic range is the brightness range that a camera or your eyes are able to see. If there is part of a scene that is darker than the range of light you're able to see, it will appear solid black. If there is part of a scene that is brighter than the range of light you're able to see, it will appear as solid white.

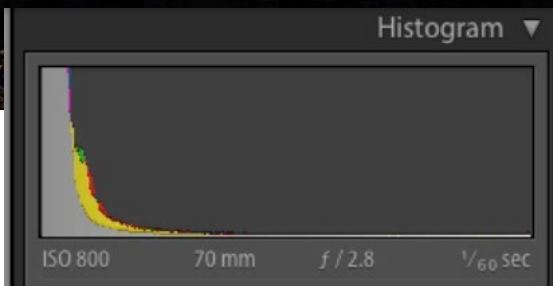
Know that your eyes have a much wider dynamic range than a camera. When looking at a scene with your eyes, you'll be able to see more of what's in the dark shadows or bright highlights than the camera. When you're shooting a scene with

a wide brightness range, the camera will either expose properly for the highlights, leaving the shadows in complete darkness, or it will expose properly for the shadows, leaving the highlights completely blown out. Changing the Exposure Compensation setting on your camera will determine what slice of dynamic range your camera will capture.

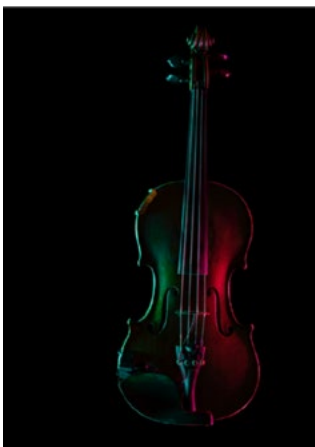
Image Examples



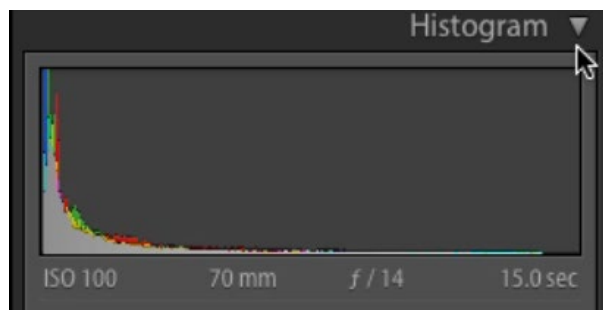
Venice at night In this scene, I intended to highlight the diners while allowing the rest of the scene to fall into blackness. Because of this, the histogram mainly contains higher bars on the left side of the chart, which is the



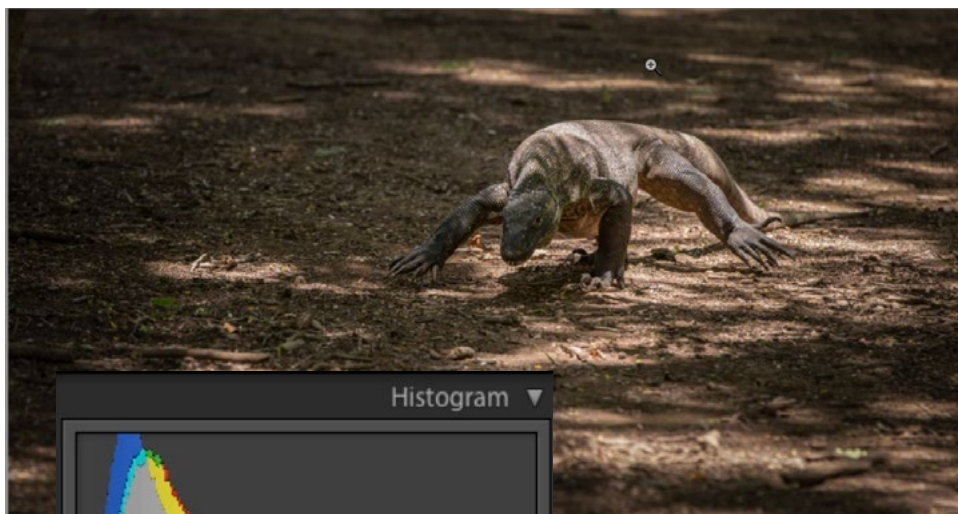
side that represents all of the dark shades. The bars in the center and right side of the chart are either super low or nonexistent.



Violin light paint This image is similar to the Venice image in that it's extremely dark and moody. There are not many

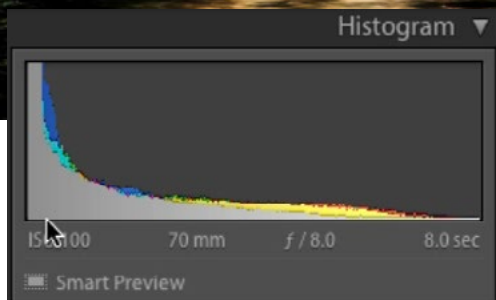
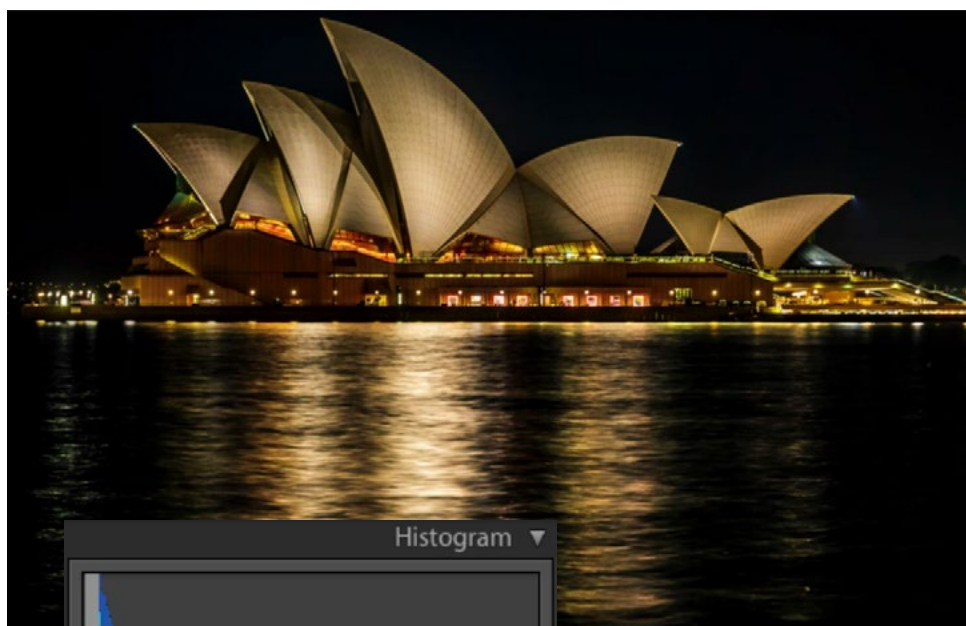


bright areas in the image and therefore the main hump on the histogram is on the left side, which is the side that represents the dark tones.



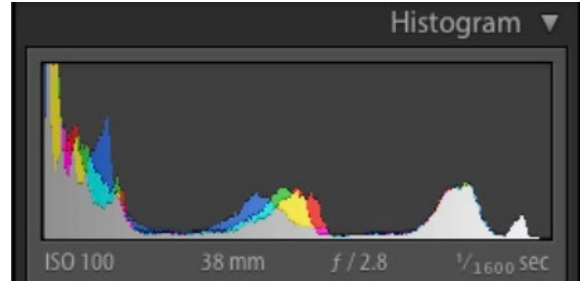
Komodo Dragon This image has a lot of dark in it, but it doesn't have many areas of solid black. Because of this, the dominant part of the histogram is around 75% gray. There is no white in the picture, so there is a gap on the right side

of the histogram, which is the area that would represent the white tones.

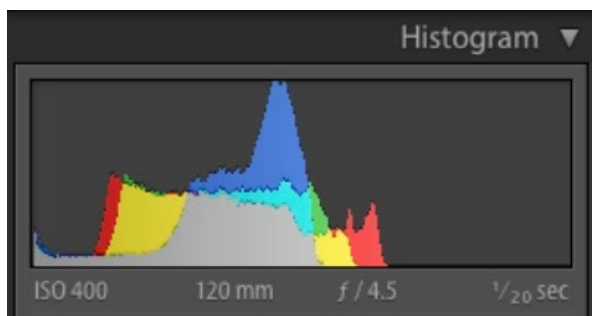
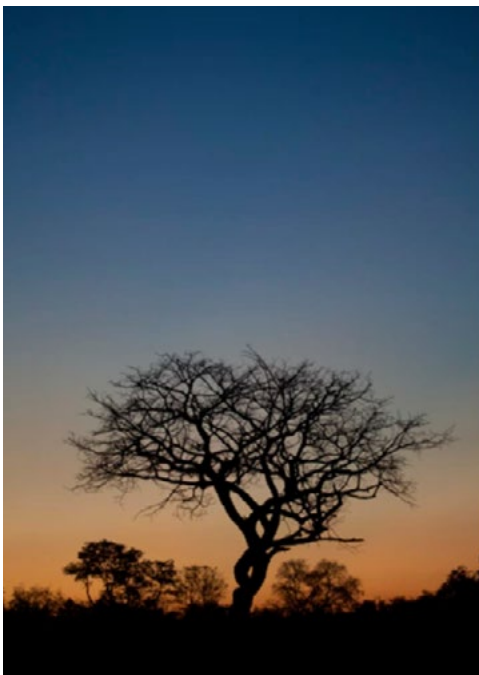


Opera House In this image of the Sydney Opera House, the sky is rendered solid black and you can see that in the really tall part of the histogram. There are many different medium shades and those extend to a lower degree across the entirety of the histogram. Looking at the

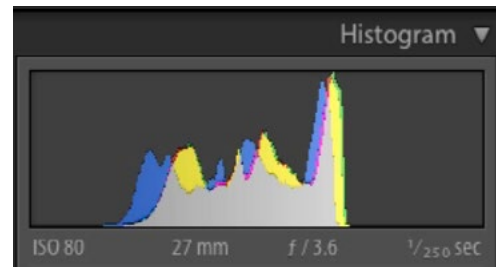
far right side of the chart, you can see that there is a small bar, which means that the image does contain a very small portion of solid white.



Window with car cutout This image contains large areas of dark as well as a large area of light. We also have some smaller portions of color that is of medium brightness. Because of this, the histogram has a hump on the left (representing the dark areas), a hump on the right (representing the light areas) and a bump in the middle (representing the colorful areas around 50% gray).



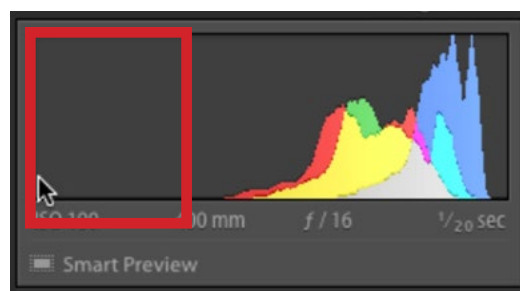
Tree silhouette The main portion of the histogram for this image is located in the center of the chart. That's because the sky takes up the majority of the image and it contains medium tones. There is also a spike on the left, representing the black silhouette of the tree.



Foggy scene Whenever you have a really foggy scene, there will be little to no bars on the left and right sides of the histogram and that's because the fog creates a lack of contrast. Everything becomes a hazy 50% gray (or something close to it).

Predicting noise

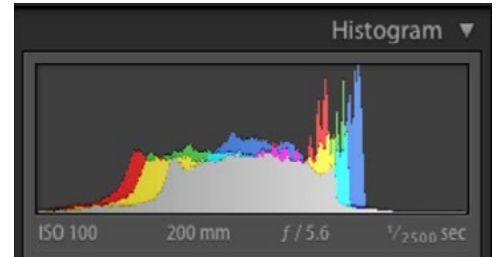
When looking at the histogram on your camera, you can use it to determine how much noise the image might have. The camera captures more and more noise as you get into the darker and darker tones in an image. The most noise will be contained within the left third portion of the histogram. If the majority of your image is contained within this left third part of the histogram and you don't think it should be, you might want to readjust your settings so that the main content on the histogram is farther to the right.



The content within the left third of the histogram chart is the area that could potentially contain noise.

Solid white

Some people say that you should expose so that you don't have anything solid white in your histogram. When you have a solid white spike, it means there is an area that has been blown out to white. This, however, is not always a bad thing. There are some instances where there should be



Here is an example where it's appropriate to have areas of solid white. The highlights on the water would appear white to your eyes, and therefore should appear white in the image.

solid white in your image and those are instances where the area would be solid white to look at with your eyes as well. An example would be the sun reflecting off of something shiny or the highlights in water. These are referred to as specular highlights.

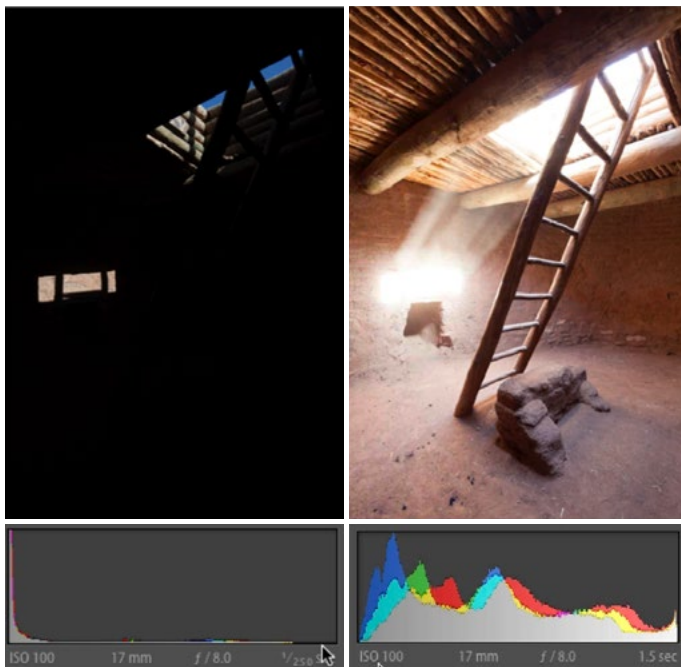
Use the histogram as a guide

Any time you see a histogram where the dominant portion is on the left, it means you have an image that was either shot at night or where the subject is predominantly dark. Whenever you see a gap on the left side of the histogram, it means that the image has shadow detail and whenever you see a gap on the right side of the histogram, it means that the image has highlight detail. When the histogram extends all the way to one or both sides, it means that there's a part of the image that contains no detail. It's either completely black or is blown out to white. This isn't necessarily a bad thing, as long as you intended to have an area that was perfectly black and/or white.

When shooting, use the histogram in your camera as a reference to see if you're getting the results you want. If you know you want the shadows to be perfectly black, make sure that the histogram extends all the way to the left side of the chart. If you know you want to capture the entire brightness range, without losing any detail, look at the camera's histogram and make sure that there are gaps on the far left and right sides. The gaps can be very small, but they must be there in order to ensure that the darks have not gone completely black and that there are no blown-out highlights.

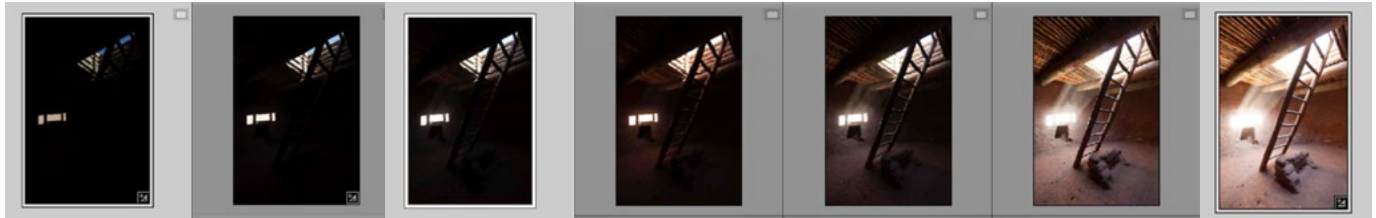
Histograms and HDR

The HDR shooting technique is used when there is a scene that has an extreme brightness range. In an instance like this, the camera will be unable to capture the entire range of light. You'll get a shot where the highlights are exposed correctly and the shadows have gone to black, or where there is shadow detail but the highlights are completely blown out, or something in between. In order to



In shooting for HDR, we made sure that we had one image that contained highlight detail (left) and one image that contained shadow detail (right).

capture the entire brightness range in the scene (so you have both highlight and shadow detail), you will need to take more than one exposure and then merge them together. The histogram can be a useful guide when doing this to ensure that you have exposures that end up capturing the entire range. Make sure that you have an exposure that contains a gap on the right side of the histogram. This indicates that the brightest part of the picture is not rendered as white and there is detail in the highlights. To achieve this, you'll need to use the exposure compensation setting on your camera to darken the im-



Above: All of the exposures that were shot to create a final, merged HDR image. Right: The merged HDR image contains detail in both the shadows and the highlights.

age. After you've got this exposure, you can start increasing the exposure compensation setting, little by little, capturing images with more and more light. It no longer matters if the highlights are blown out because you know you have at least one exposure with detail in this area. You'll want to continue increasing the exposure until you get an image that contains a gap on the left side of the histogram. This indicates that there is detail in the darkest part of the image. Now that you have a series of images that incorporate detail in both the shadows and the highlights, you can merge these together into an HDR image that contains the entire brightness range.

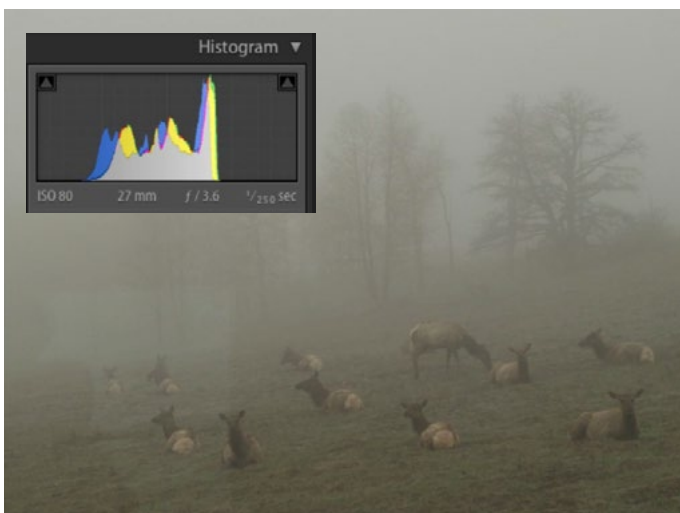


Adjusting images

The histogram can be found in the top right corner of the interface when working in Lightroom's Develop Module and it will update as you adjust your picture. If you have gaps on the ends of the histogram, the sliders that will affect it the most are the Whites and Blacks sliders. The Blacks slider controls how dark the darkest portion of the picture is. As you drag the Blacks slider to the left, you will see the bars on the histogram being pulled to the left as well, introducing more and more

dark tones into the darkest part of the image. If you drag the Blacks slider until a spike appears on the left side of the histogram, you know that part of the image has gone to solid black.

The Whites slider controls how light the brightest portion of the picture is. If you move the Whites slider to the left, you'll darken the brightest part of the picture. If you move it to the right, you'll lighten the brightest part of the picture and the bars on the right side of the histogram will be pulled more and more to the right side of the chart. If you drag the Whites slider until there is a spike on the far right side of the histogram, you know that part of the image has become solid white.



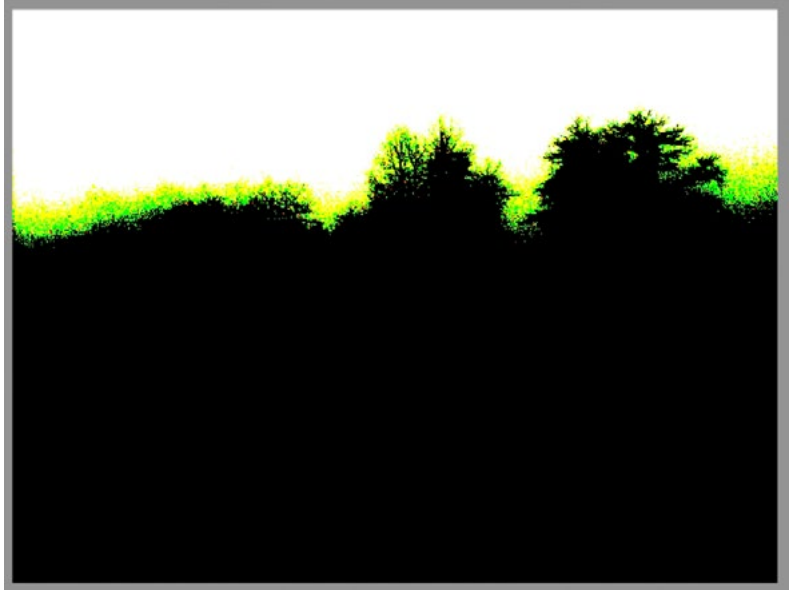
Above Left: The original image. Because of the heavy fog, there are large gaps on the left and right sides of the histogram, indicating lack of contrast.

Above Right: We dragged the blacks slider to the left, shifting the left bars of the histogram farther to the left.

Left: We dragged the Whites slider to the right, shifting the right bars of the histogram farther to the right.

In Lightroom, there is a way to see what parts of the image have been pushed to solid black or solid white. Hold down the Option key (Alt on Win) and click on the Whites slider to get a view of your image that shows you what part of the scene is solid white. Hold down the Option key (Alt on Win) and click on the Blacks slider to get a view of your image that shows you what part of the scene is solid black. Note that you can get the same view while making a Levels adjustment in Photoshop. Use the same technique with the upper right and upper left sliders in Levels to achieve the same view.

The Exposure slider affects your image as a whole, so it will take the entire histogram and shift it to the left or the right.



In Lightroom, we are holding down the Option key while clicking on the Whites slider. This is giving us a view of the image that shows where the white areas are (the sky in this case).