Histograms II

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In this lesson, we're going to take a deeper look at histograms. Know that there was a previous lesson that covers the basic, essential information about histograms and I highly advise that you visit that one if you have not already. We're going to build on what we covered in that lesson and learn about how we can look at the histogram while adjusting our images to get a better idea of what's happening with our tonal ranges and whether or not there are any issues we'll need to address. We'll also move into RGB histograms, where we can look at and work with individual colors.

Why in-camera histograms cannot be trusted for raw shooters

It's important to know that the histogram on your camera is not an accurate depiction of what you are getting if you're shooting in the raw file format, and this is because the histogram you see on your camera is based on a jpeg file. Let's look at some points related to that.

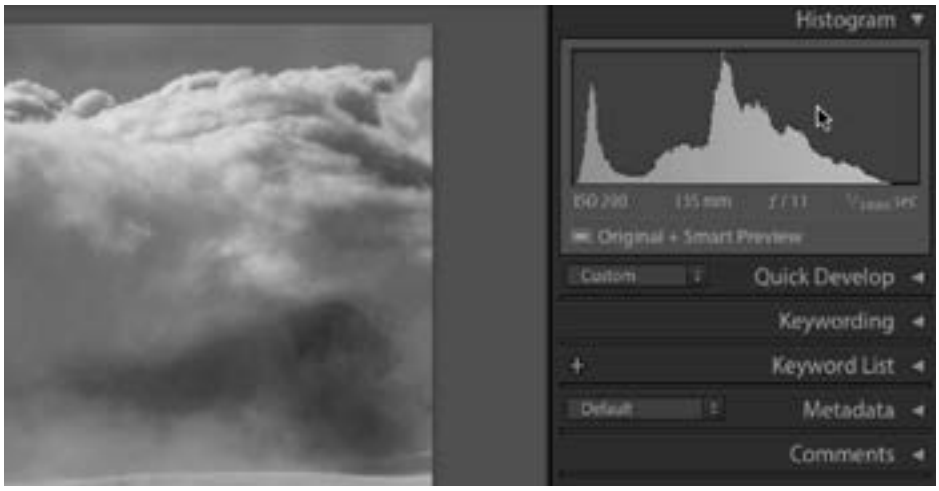
Jpeg-based histograms mess with things. Here's why:

- Most professional cameras capture 4,096 shades (12-bit).
- The brightest and darkest 16 shades are averaged to create right-most and left-most spikes on the histogram in Photoshop. This creates a less-than-accurate result.
- The width of the in-camera histogram is even smaller than Photoshop's, which causes spikes to be even smaller and therefore not an accurate view of raw data.
- Jpeg files only save 256 shades.
- In your camera, there is a setting that changes the jpeg rendering and therefore the histogram, but doesn't affect the raw capture. This setting is called Picture Styles (on Canon), Picture Controls (on Nikon) or Creative Style (on Sony).
- There is no setting available to cause the histogram to reflect the full range captured.

- Jpeg files have a tendency to include solid black in the image, even if your camera sensor was still picking up detail in the darkest area of the scene.
- When any of the individual red, green or blue channels reach saturation, it renders that area as clipped to solid black or white in all three channels (but your raw file still has the usable data from the non-clipped channels).
- The histogram is based on the current white balances setting (not baked into the raw file).
- Tip: Mirrorless cameras allow you to turn on a "zebra stripes" features that shows you where areas will be blown out to white. This may give you a more accurate idea of where you might be losing detail in your images. On non-mirrorless cameras, there is a highlight warning feature (blinkies) that shows you where there are blown-out areas in an image you already shot and are viewing on the screen.

One vs. Three Histograms (or single colorful histogram)

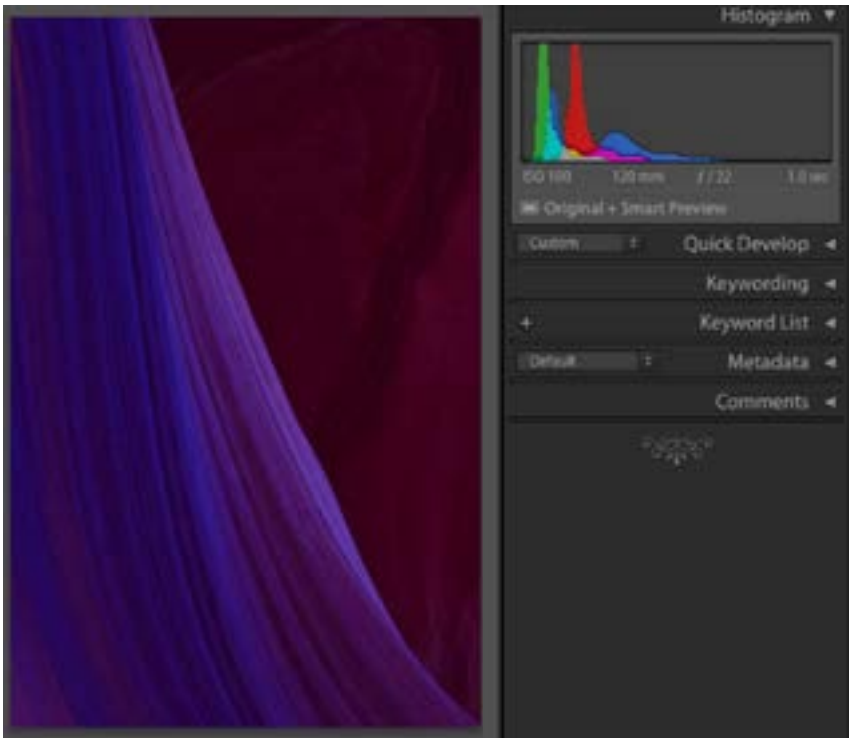
Luminosity vs. RGB Histograms In the last lesson on this subject, we generally covered Luminosity histograms, which represent the tones/brightness of the image. In this lesson, we'll move forward into the histograms that tell us about the color.



When you see a histogram that is completely gray, it means that you're working with a black and white image.

When viewing a black and white image, the histogram will be a shade of gray. If you look at your histogram and don't see any colors, it means you're working with a black and white image. If the histogram is mostly gray with small hints of color peeking out, it means the image

When you see a histogram that is mostly gray with just a little bit of colors peeking out, it means that the image contains a large area that is close to a neutral shade.



This histogram shows very little gray area and that's because the image contains mostly areas of saturated color and not areas that are neutral.

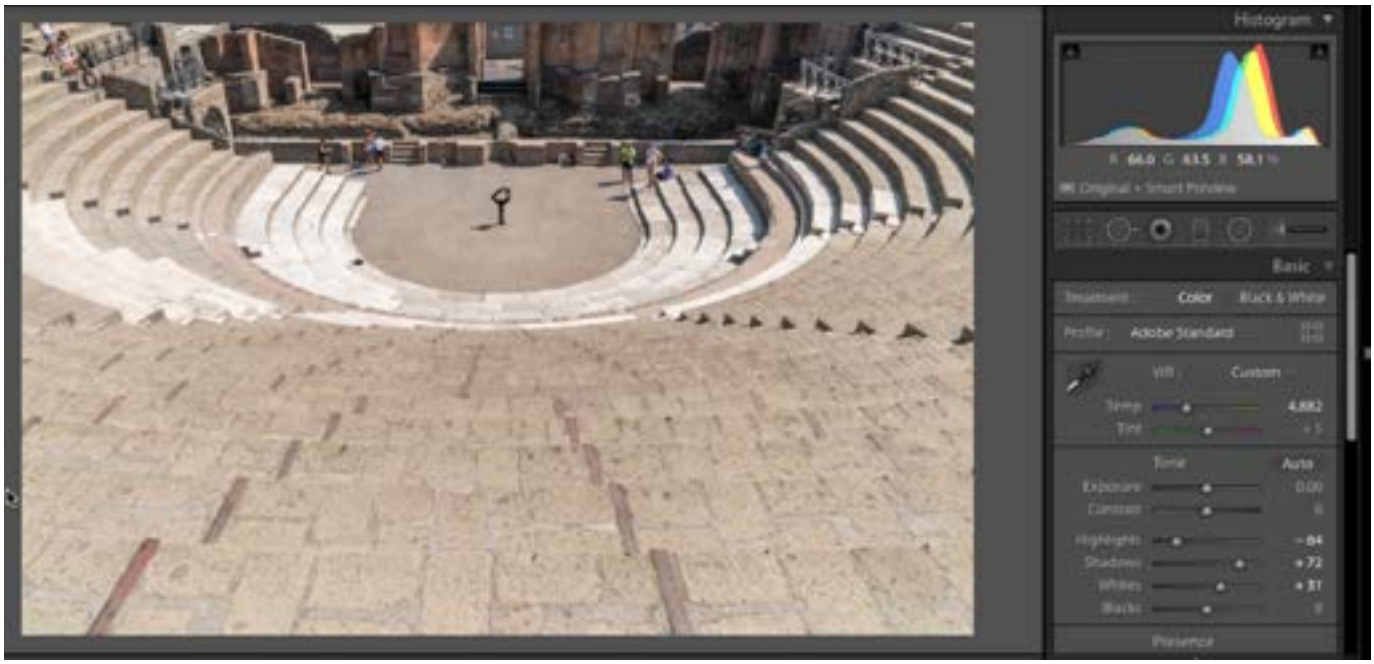
is mostly gray, and only slightly colorful. When you have a really colorful image, there will be very little gray in the histogram. Instead, there will be lots of color in the chart.

We can look at the histogram to get information about what is going on with the colors in our picture. Histograms are made out of three colors that are overlapping in different ways: red, green and blue. It's only in the areas where all three colors overlap where you'll see gray. In a black and

white image, all three of the color histograms are perfectly identical and therefore the colors are overlapping across the entire histogram. That's why it's completely gray.

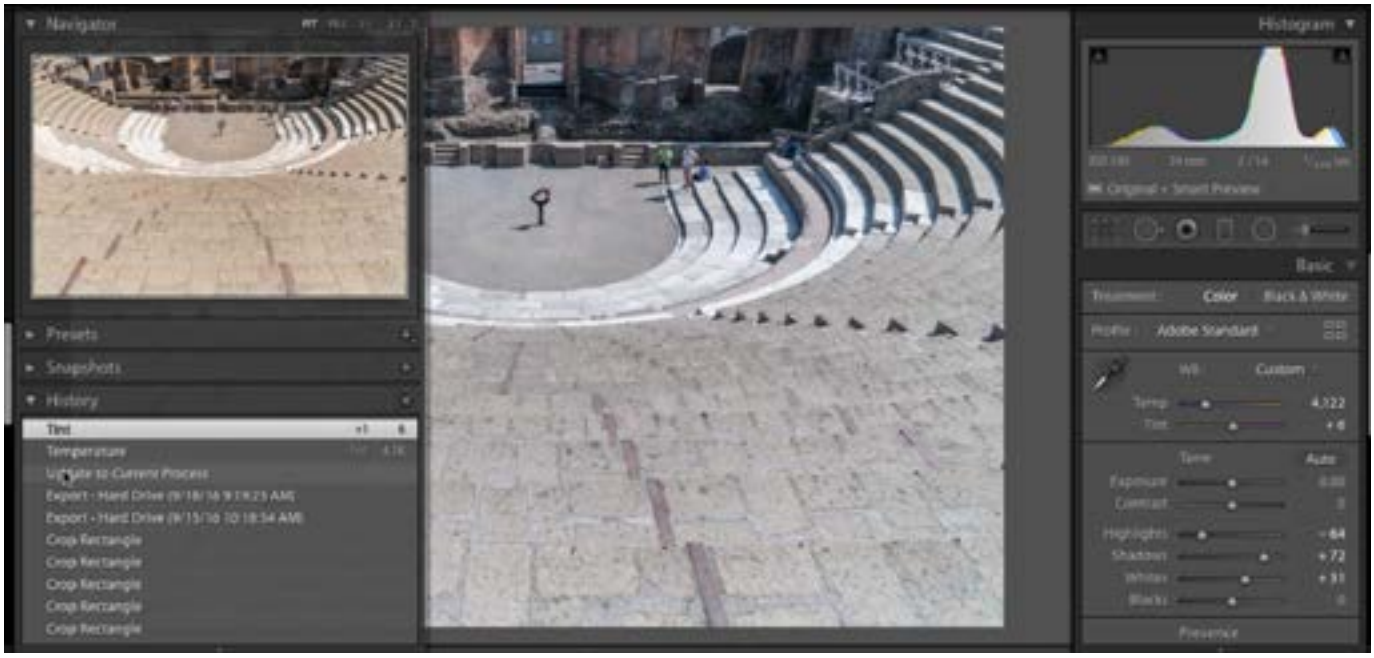
Behind the scenes, our images are made up of three colors: red, green and blue. The histogram shows us where we have a lot of red light, green light and blue light. The histogram also contains three other colors: yellow, cyan and magenta. We see these colors when two of the RGB colors overlap each other. For example, when red and green overlap in the histogram, it displays yellow. When green and blue overlap each other, we get cyan in the histogram. When red and blue overlap, we get magenta.

If you see shapes in the histogram that are similar to each other but don't completely align, it means that the image has a large area that is close to neutral gray. Because the shapes aren't aligned, it means that there is still a small amount of color, but not much. In the video example image, we have a scene that contains a lot of light brown concrete. This histogram displays this area as three humps of equal shape, but because there is a slight hue to the concrete, they don't complete-



In this image, much of the area contains a color that is close to neutral (the concrete) and you can see that it's close to neutral because the three similar histogram humps are very close to matching/overlapping.

ly align. We can change it so that an area like this becomes completely neutral by adding the correct amount of colors so that the area contains an equal amount of red, green and blue. This can be done by adjusting the Temperature and Tint sliders within the Basic panel. These are the settings that control white balance. When you move the Temperature slider back and forth, the colored humps in the histogram will move away from each other. Somewhere in the middle, there will be a sweet spot where the humps align. The same goes for the Tint slider. If you position both sliders so the histogram humps most closely align, it will neutralize the area of the image represented by the hump shape in the histogram. In the video example image, that is the color of the concrete, which takes up most of the image.



Here, we used the Temp and Tint sliders to align the three similarly-shaped humps on the histogram. This made the close-to-neutral area become completely neutral, and you can see the before and after versions in the screen shot above.

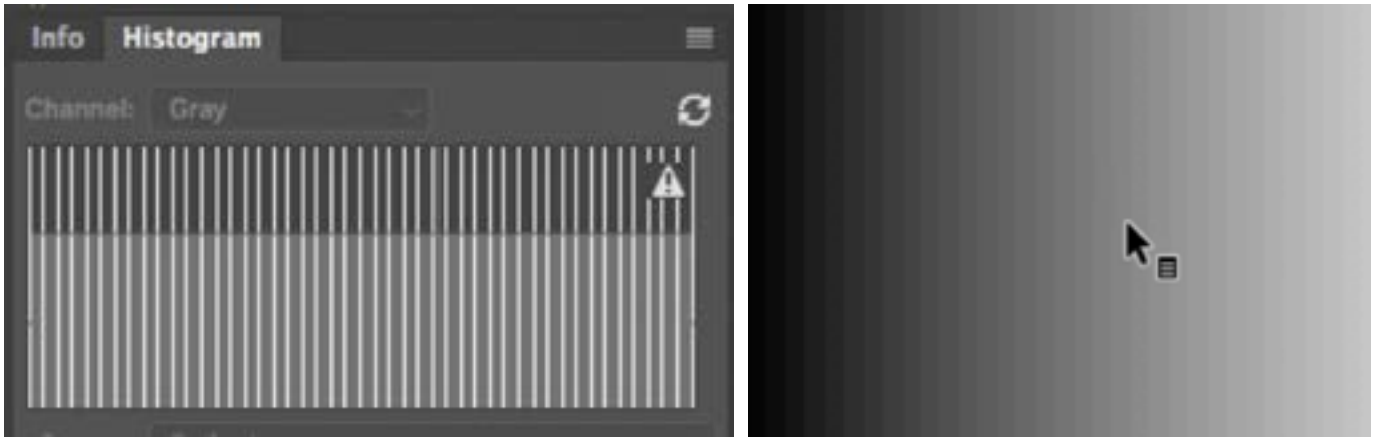
Images with large areas of a particular tone Whenever your image contains a huge area of one particular tone, there will be a large hump in the histogram, and the rest of the histogram may be very short and hard to read. That's because the area that takes up the most space will be represented as a large hump or spike in the histogram, and everything else will be scaled in comparison to that.

Raw vs. jpeg When you shoot raw, your camera takes the raw data from the capture and records that with little to no manipulation. A jpeg takes the raw data and heavily processes it within the camera and then saves only 256 brightness levels. This is a lot less information, so there is a lot less that you can get away with in Lightroom or Photoshop. When the brightest part of the image gets so bright that one of the individual colors (red, green or blue) maxes out at 255, then the jpeg will render that area as solid white, even if the other two colors contain detail. A raw file does not do this. The raw file will still contain information in that area.

Histograms & image processing

Now let's look at how we can use the histogram while adjusting our images. We can also use it to determine whether we're doing something bad to the picture in the process of adjusting it.

Bit depth An 8-bit image can contain 256 shades, or brightness levels, which is the same as a jpeg file. A 16-bit image can contain thousands and thousands of brightness levels. If you ever look at the histogram and the spikes resemble the teeth of a comb, where there are gaps in between them, it means that there are areas in the image that are not smooth. If you look closely at those areas, you will be able to see a banding effect in the image. These gaps also indicate that the image has been processed in some way. When we make an adjustment that might create these gaps in the histogram, know that the gaps will be much wider in an



If the bars in the histogram ever resemble the teeth of a comb (with gaps between them), it means that there is banding in the image.

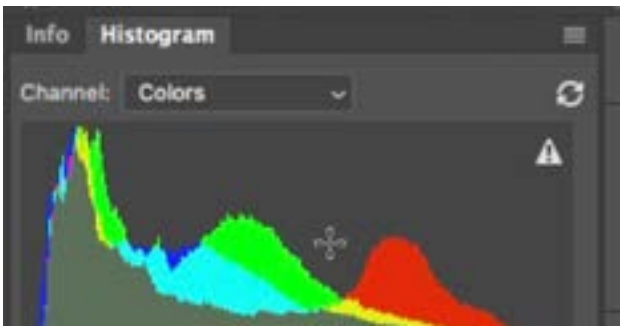
8-bit image than they would be in a 16-bit image. With the 8-bit image, there will be more space between each bar and therefore more brightness ranges that are not represented. We mentioned earlier that the 8-bit image contains the equivalent number of brightness levels to a jpeg file. Therefore, if we are going to make radical changes to the brightness of the image, it's best that the file is not in jpeg format and that it be in 16-bit mode.

At left is the histogram for an image in 8-bit mode. At right is the histogram for the same image in 16-bit mode. You can see that the gaps in the histogram are smaller when the image is in 16-bit mode.

At the moment you open a raw file from Lightroom to Photoshop, it determines how much information is sent over, and we can specify that within the External Editing section of Lightroom's Preferences. Here, there will be a bit-depth option. In Camera Raw, click on the line of text that runs along the bottom center bar in the interface and you will get the options for how the image should be opened in Photoshop.

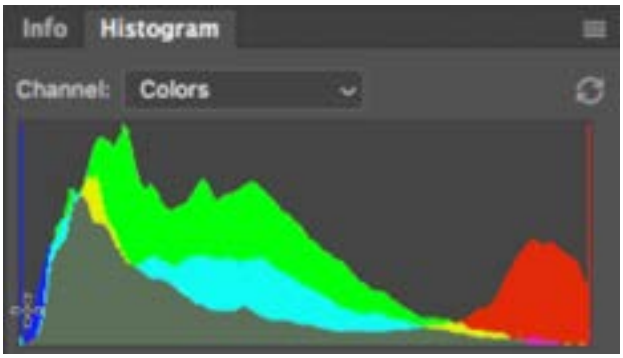
Photoshop's histogram In Photoshop, if the Histogram panel is not already visible on your screen, you can access it by going to the Window menu and choosing Histogram. The Channel menu above the histogram chart will allow you to choose what type of histogram you'll see. If this menu does not appear, click on the little hamburger menu in the top right corner of the panel and choose to see the Expanded View. You can also use this menu to toggle the visibility of the Statistics that can be displayed beneath the histogram.

If you ever see a triangular exclamation point icon, it means that the histogram was displayed very quickly and it may not be a precise description of your picture. Click on the icon to update the histogram so that it becomes precise. Any time you make a change to your picture, that icon will show up again and that's because it's trying not to slow down Photoshop.



The triangular icon indicates that the histogram is not updated to be most precise. Click on the icon so that it updates to accurately represent the image.

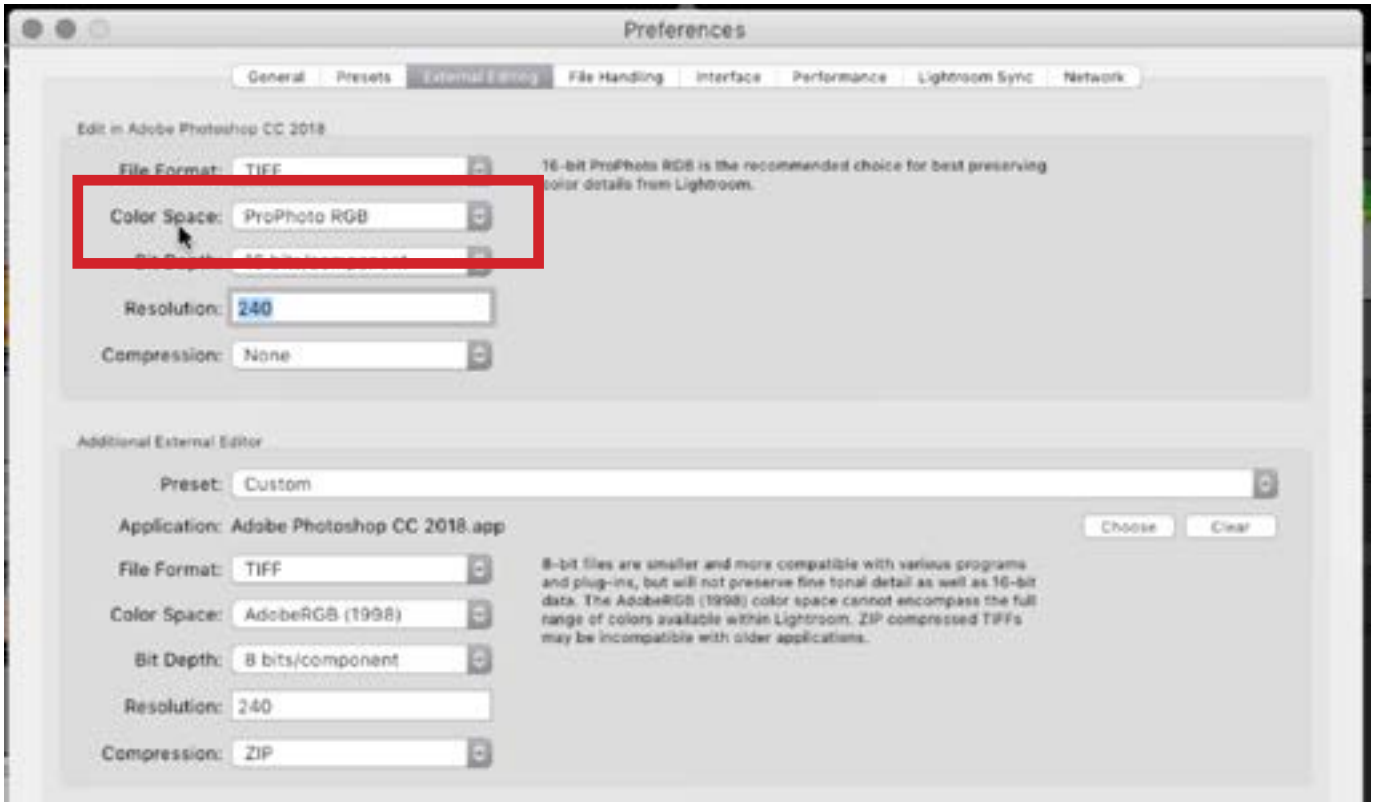
Saturation clipping When we oversaturate a picture, we get saturation clipping, which can be described as a loss of detail in the saturated areas in the image. Note that there is an entire Masters Academy video dedicated to the topic of saturation clipping, and it's a good idea to watch that if you like to really push the colors in your images.



The tall, colored spikes on either end of this histogram indicate that the image is so saturated that it is losing color detail in some areas.

If you ever see colored spikes on the far ends of your histogram, it means that you might have colors in your picture that are out of gamut. This means that the colors are so saturated that they are losing detail.

How the color space affects the histogram When you're in Lightroom or Camera Raw, there is a setting that determines what color space the image will used when an image is opened in Photoshop. In Lightroom, this setting can be found under the External Edition section of the Preferences dialog. In ACR, this setting can be accessed by clicking on the line of text at the very bottom of the interface.

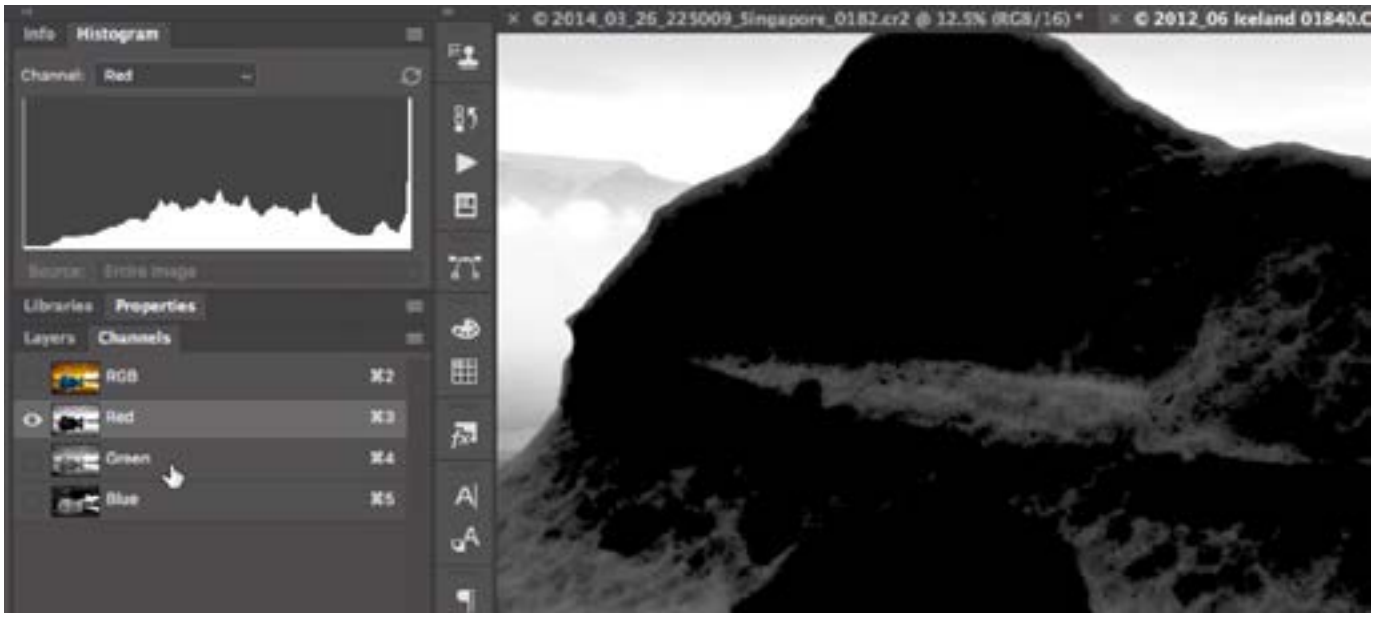


The Color Space option can be found within the External Editing section of Lightroom's preferences.

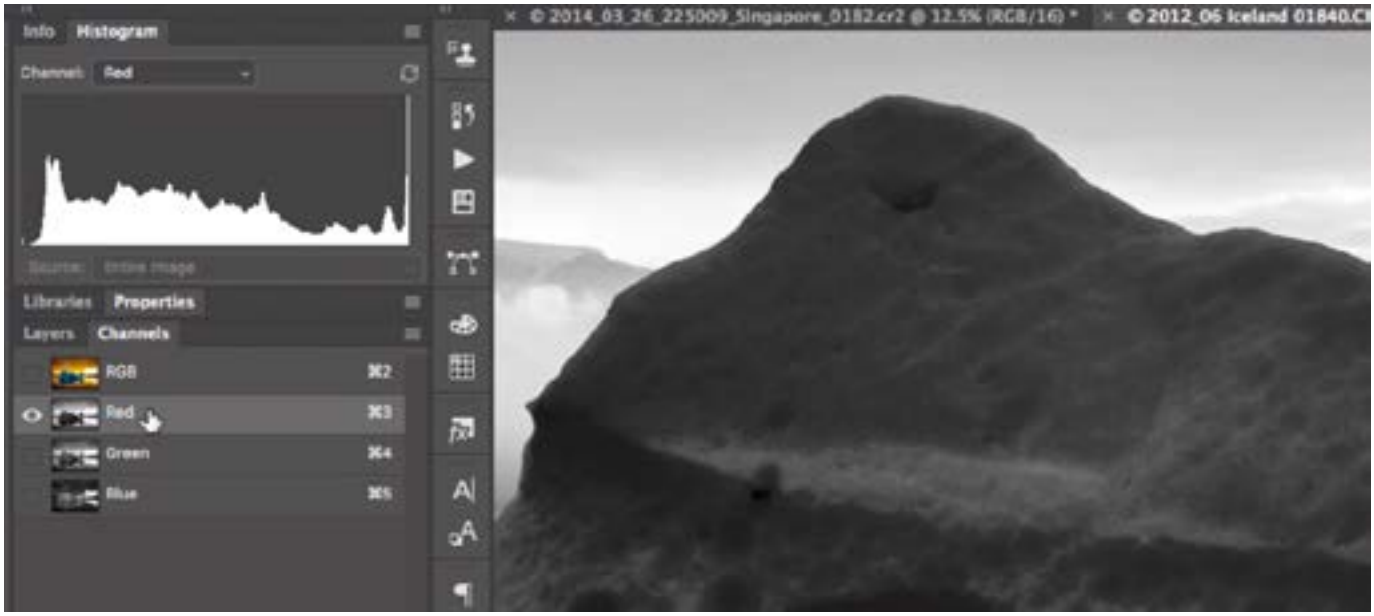
The choice of color space determines how vivid the colors can become within your picture. The one that can produce the most limited range of colors is sRGB and it's easiest to lose color detail when working in this space. As you move higher and higher in the Color Space list, the choices will allow for more and more saturated colors before you lose detail. The ProPhoto RGB color space will allow for the most saturated colors of all the color spaces. If you find that you get the colored spikes on the ends of your histogram after processing your images (indicating saturation clipping), you may want to consider using a color space that allows for more saturated colors.

What the spikes really indicate is that one of the channels in the image is losing detail and is being blown out to solid white or solid black. The larger the spike is, the larger the area that's losing detail. You can see this by clicking though the different channels within the Channels panel. If there is a colored spike in the histogram, one or more of the channels contains an area that is solid white or solid

black. In a video example image, we have a picture of an iceberg. When working in the Adobe RGB color space, part of the red channel was completely black, which meant that we were losing color detail in that channel. We re-opened the same image, using the ProPhoto color space, and there WAS detail in the red channel, which meant that there was no saturation clipping when using this color space.



This is a view of the red channel using the Adobe RGB color space. You can see that it's completely black, indicating a lack of detail.



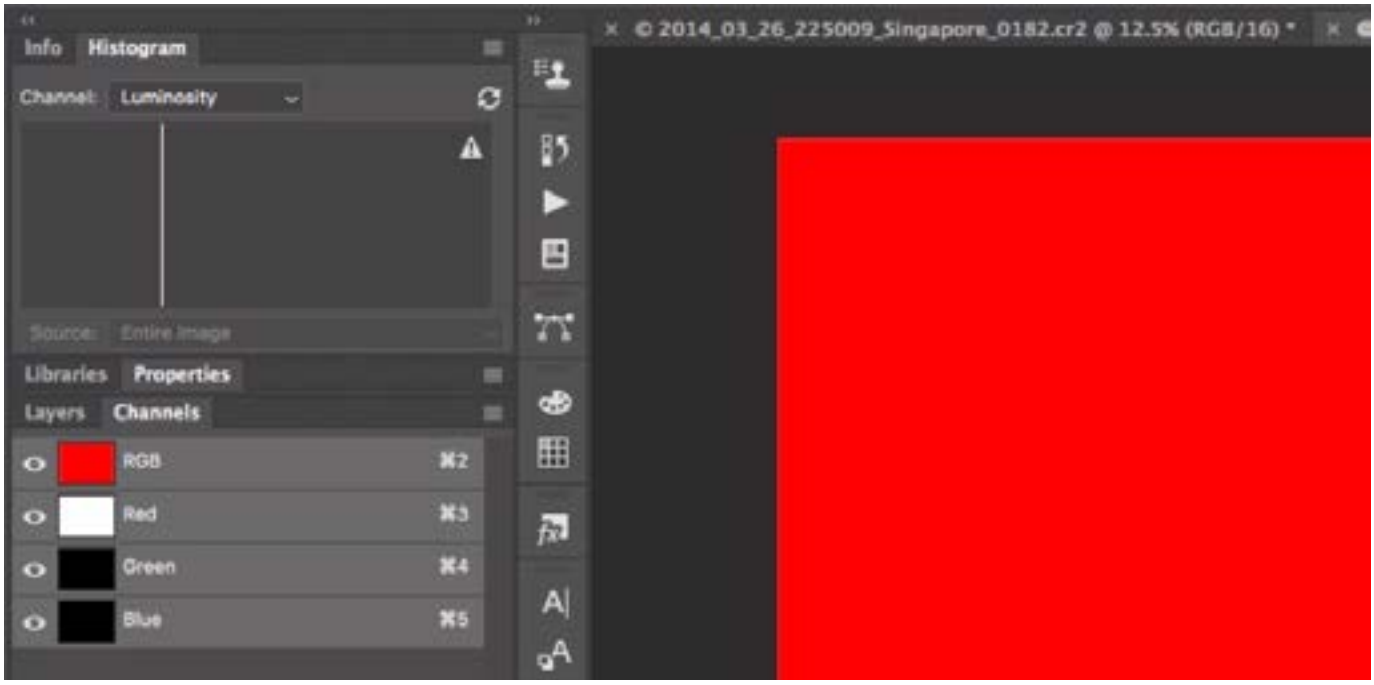
This is a view of the red channel in the same image using the ProPhoto RGB color space. As you can see, there is no loss of detail.

Luminosity vs. RGB Histograms Now we're going to return to this topic and learn about how the various histograms in different areas of Photoshop are different.

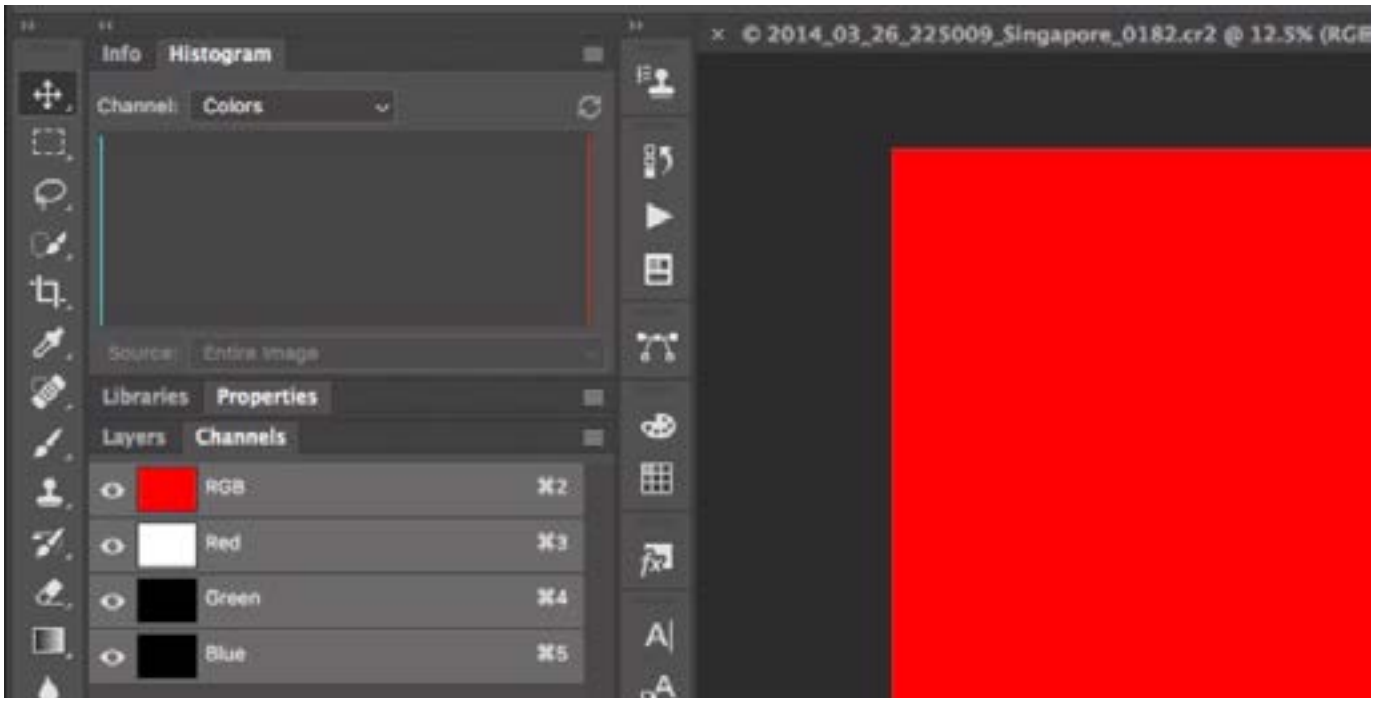
- Luminosity histograms may not be accurate. (They reflect how we perceive brightness/color in a grayscale image, not how color is actually captured.)
- All images are captured as red, green & blue light (RGB)
- Clipping in one channel won't show up in the Luminosity histogram.
- The histograms in Levels/Curves adjustments are not Luminosity histograms. They are RGB histograms displayed in gray and they can show where you're losing color detail.
- If there are equal amounts of red, green and blue, then you have a grayscale image.
- The more the colors diverge, the more colorful/vivid a region is.

Saturation clipping differences

- The in-camera histogram is based on sRGB or AdobeRGB even though raw data is not limited to the range in those spaces.
- This histogram in Lightroom is based on a variation of ProPhoto RGB so it rarely shows clipping. Use soft proofing to preview what the image will look like in its final destination. (Remember: Export and External Editing settings might not match.)
- ACR Saturation clipping is accurate because it is based on the output profile in the workflow options at the bottom of the window.
- In Photoshop, the histogram is based on the color profile of active document, which means any saturation clipping spikes are accurate.
- Note: Set the white balance before evaluating saturation clipping.



In this document, we purposefully created an image where there was total saturation clipping. Looking at the channels, we can see that there is no detail in any of them. When we look at the luminosity histogram, however, we don't get any spikes on the far sides of the chart. This means that the luminosity histogram is not accurate in depicting saturation clipping.



When we switch to a color histogram, we do in fact see the colored spikes on either side of the chart, indicating that there is saturation clipping.