

## UNDERSTANDING CURVES BY MICHAEL SMYTH

*Most experts advocate using Curves to adjust image tonality, but there are several other tools available that seem to do the same thing, so why is it important to use Curves ?*

### INTRODUCTION

There are only 5 things we do to our image data in the processing and enhancement phase of image making. Adjusting the tonality of the captured data is one of the most important and both Lightroom and Photoshop have a variety of tools to accomplish similar results.

The 5 adjustments we make to our images are:

Does my image (or parts of the image) need to be:

*Lighter or Darker ?* (Tonal Range) – this is the subject of this tutorial

*Warmer or Cooler ?* (Colour Balance = Hue)

*Harder or Softer ?* (Contrast)

*More or Less Colourful ?* (Saturation / Chroma)

*Sharper or Duller ?* (Sharpness and Local Contrast)

The Tonality of a picture is determined by the range of tones from darkest to brightest but does not concern itself with Contrast or Sharpness. When we make adjustments to the Tonal range, we are moving the black and white points to (usually) expand the tones to cover a wider range than captured. By expanding the tonal range, we are also increasing contrast overall, so a benefit of tonality adjustments is an increase on contrast, sometimes called "Presence" (Lightroom and Camera RAW).

### WHY CURVES ?

In Lightroom and Photoshop we have access to a range of adjustments under different names, such as *Levels, Brightness/Contrast* and *Curves* in *Photoshop* and in *Lightroom* we have in the Basic Panel controls for "*Exposure*" (which is really mid tones), *Contrast, Blacks, Whites, Highlights and Shadows*, plus a separate panel for *Curves*.

All these different controls can be confusing, so let's set down some guidelines for working with the Tone Controls:

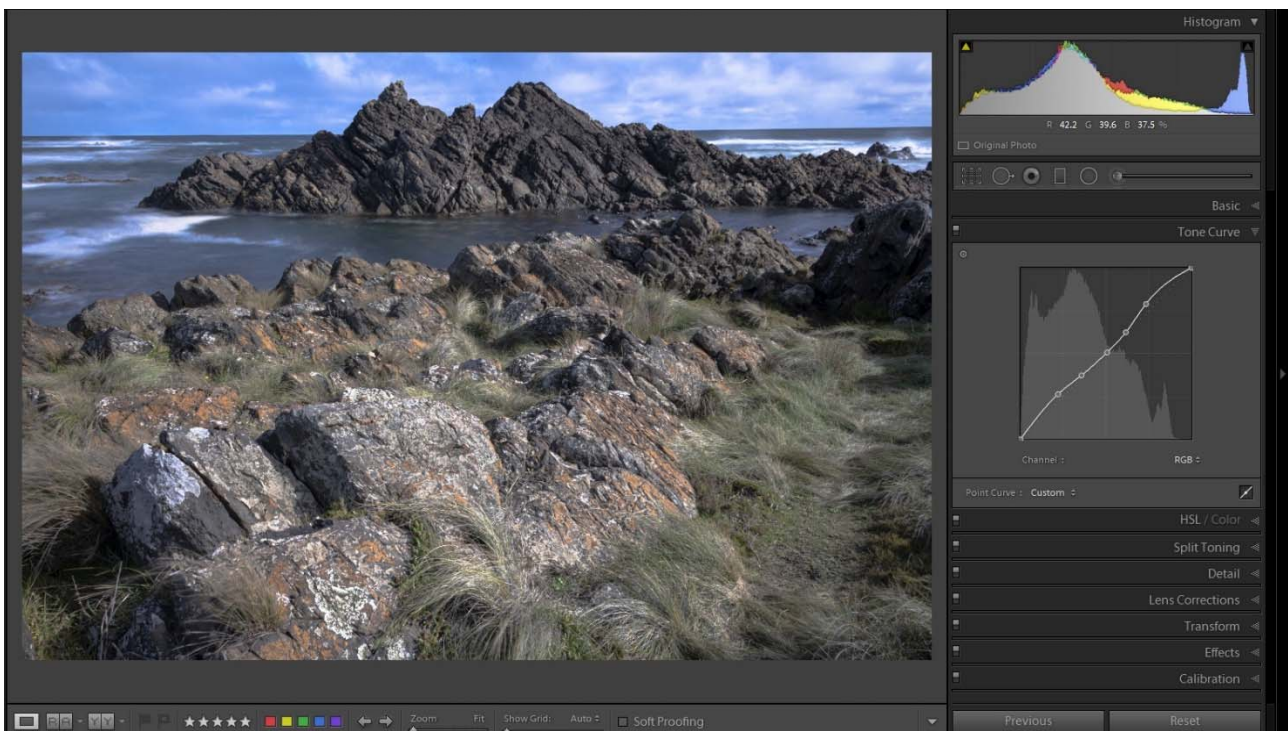
1. ***Make all major tonality adjustments in Lightroom***, before rendering a pixel based image into Photoshop. As with all image editing, most adjustments should be made to the RAW data by adjusting the *parameters* of the data captured by the camera. This yields the best "*Signal to Noise*" treatment from the available information.

2. **Using the Sliders in the Lightroom Basic panel adjusts different parts of the Tonal range in a linear manner.** Moving any of the sliders left or right directly affects a specific range of tones, although there is some effect on adjacent tonal ranges. For example, moving the Whites slider also modifies the Highlights range and to some extent, the mid tones (Exposure).
3. **Using the Curves adjustment panel adjusts the tonality in a nonlinear manner.** Curves also allows for adjustments within a tonal range that does not affect the other tonalities.

Here are some examples of how this works:



**Above:** This image of Coutta Rocks in Tasmania was adjusted using the Basic Panel sliders only.



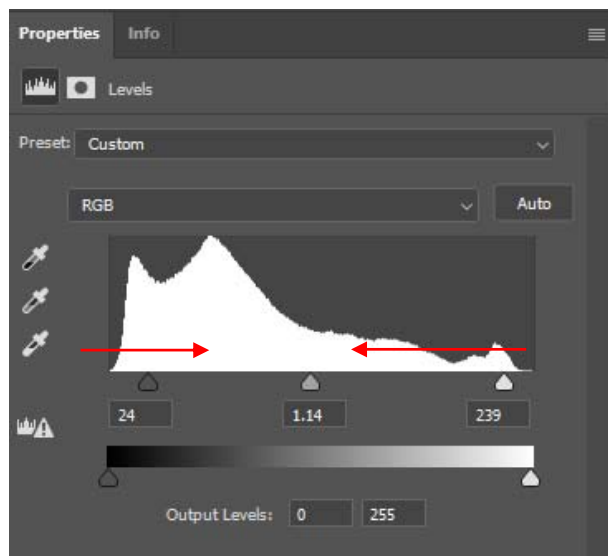
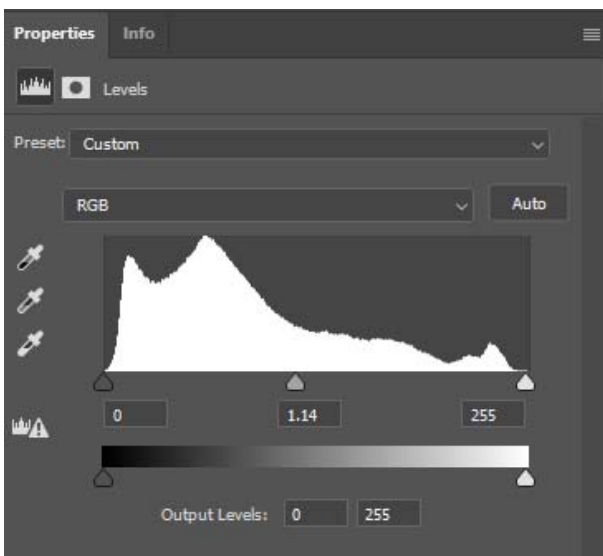
**Above:** The same image adjusted using Curves only. These are essentially the same.

There are differences in the way the shadows have been resolved between the two images, but in Lightroom the differences are not really remarkable, and for most users, using the sliders is a more intuitive way to work than using the Curves panel alone. Often a mix of sliders and a small amount of Curves yields the best result.

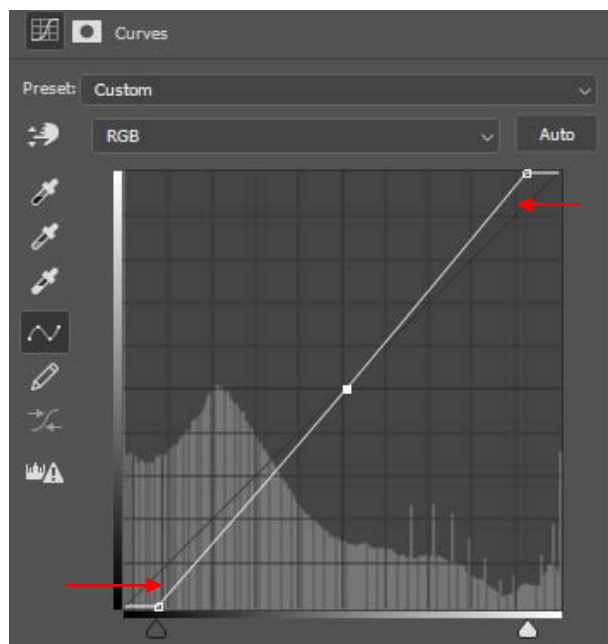
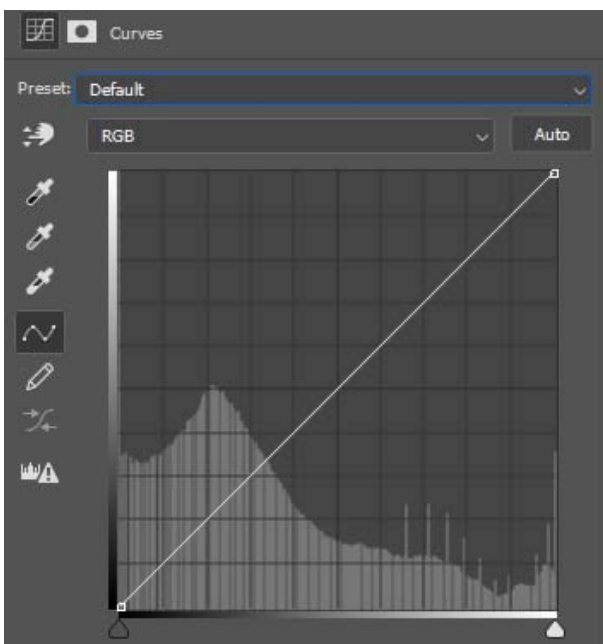
Once we get into Photoshop with a pixel based image, the differences and the issues with Adobe's use of an RGB colour model become more apparent.

First, let's look at how the different tools work in Photoshop. It needs to be said up front that *all of the tonality tools in Photoshop use the same underlying algorithms:*

1. *Levels* is the simplest tool and uses three points to adjust the tonal range.

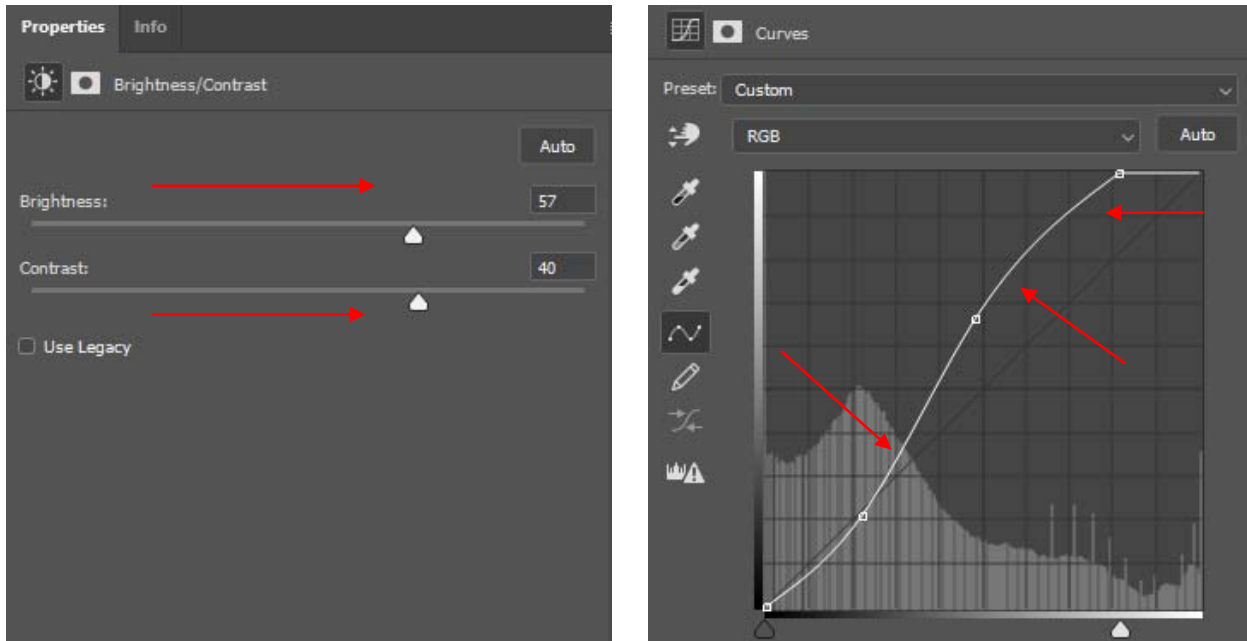


**Above:** The Levels dialogue box. Moving the Black and White point sliders clips the black and white points. The central slider shifts the mid tone only.



**Above:** The curves dialogue box. Moving the black and white points towards the middle is *exactly* the same as the above adjustment in the levels dialogue.

2. **Brightness/Contrast** is also a simple tool to adjust two settings with two sliders.



**Above:** Brightness and Contrast adjustments. At right *exactly* the same adjustment using Curves.

To increase **Brightness**, using Curves we have moved the white point slider to the left. To increase **Contrast**, we have introduced a slight "S" shape to the curve. Pushing the bottom part of the curve down *decreases* the rate at which darker tones are lightened and pushing up the top part of the curves *increases* the rate at which the lighter tones are lightened.

3. **Curves** adjustments offer all of the controls that Levels and Brightness/Contrast offer, with the added advantage of being able to adjust the rate of change between tones.

In addition to adjusting the rate of change between levels of tone, Curves adjustments allow up to 16 points to be placed along the curve (using the point tool to select specific tones), whereas Levels only has 3 options: Highlights, Mid tones and Blacks, Brightness/Contrast does not allow any selection of points at all, so it is considerably "dumbed down".

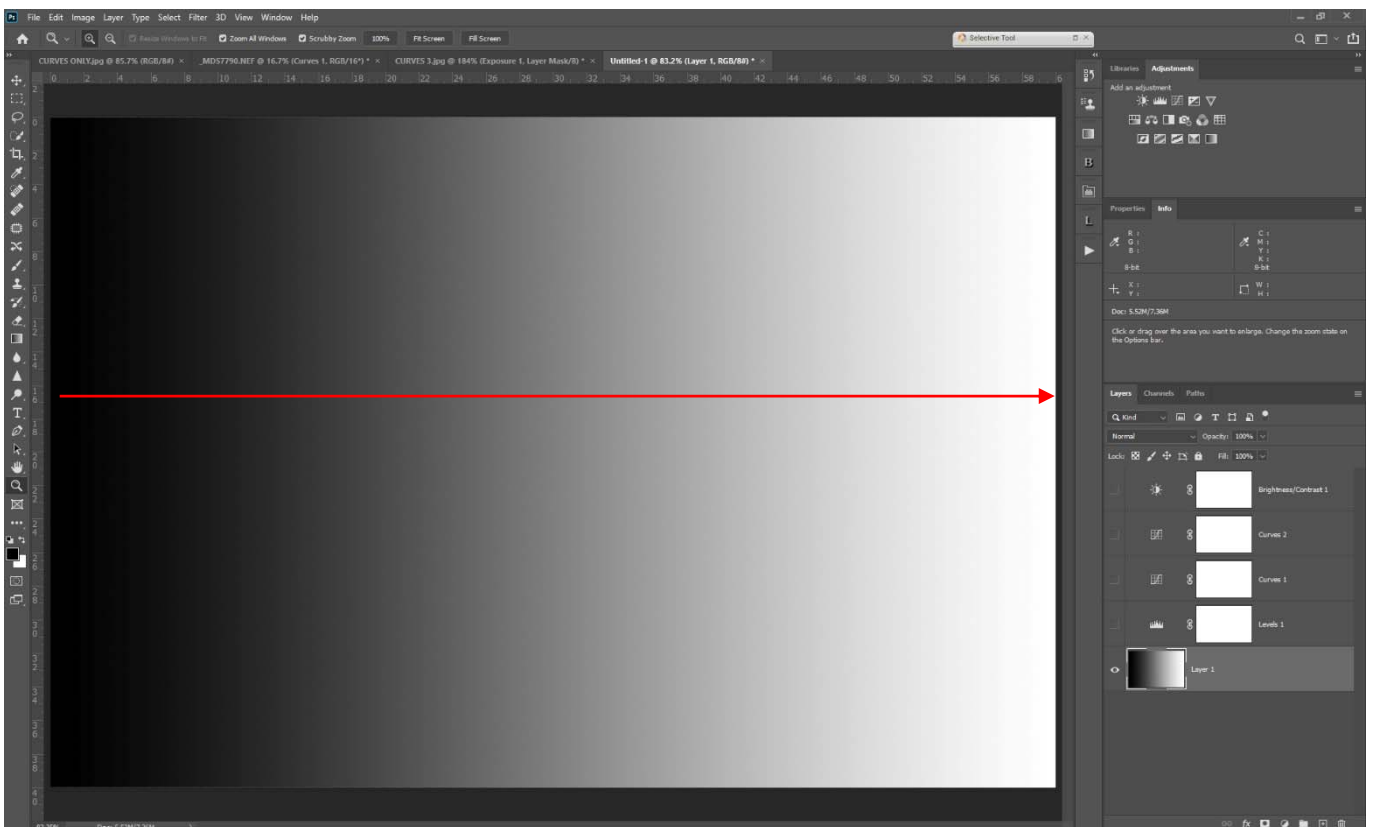
It should also be noted that all of the Tonality adjustment tools display the range of tones as 8 bit data – i.e. 256 possible levels of tone. This is regardless of whether your image is 8 or 16 bit. Photoshop "cheats" with rendering "16 bit" files. 16 bits are actually 15 bits plus one level, which is actually  $(32,768 + 1 =) 32,769$  possible levels of tone. The 16 bit data is being processed, but the information display does not reflect the full range of possible tones.

In any event, the display reflects what is going on with the image adjustments, even if you can't see the fine gradations between tones.

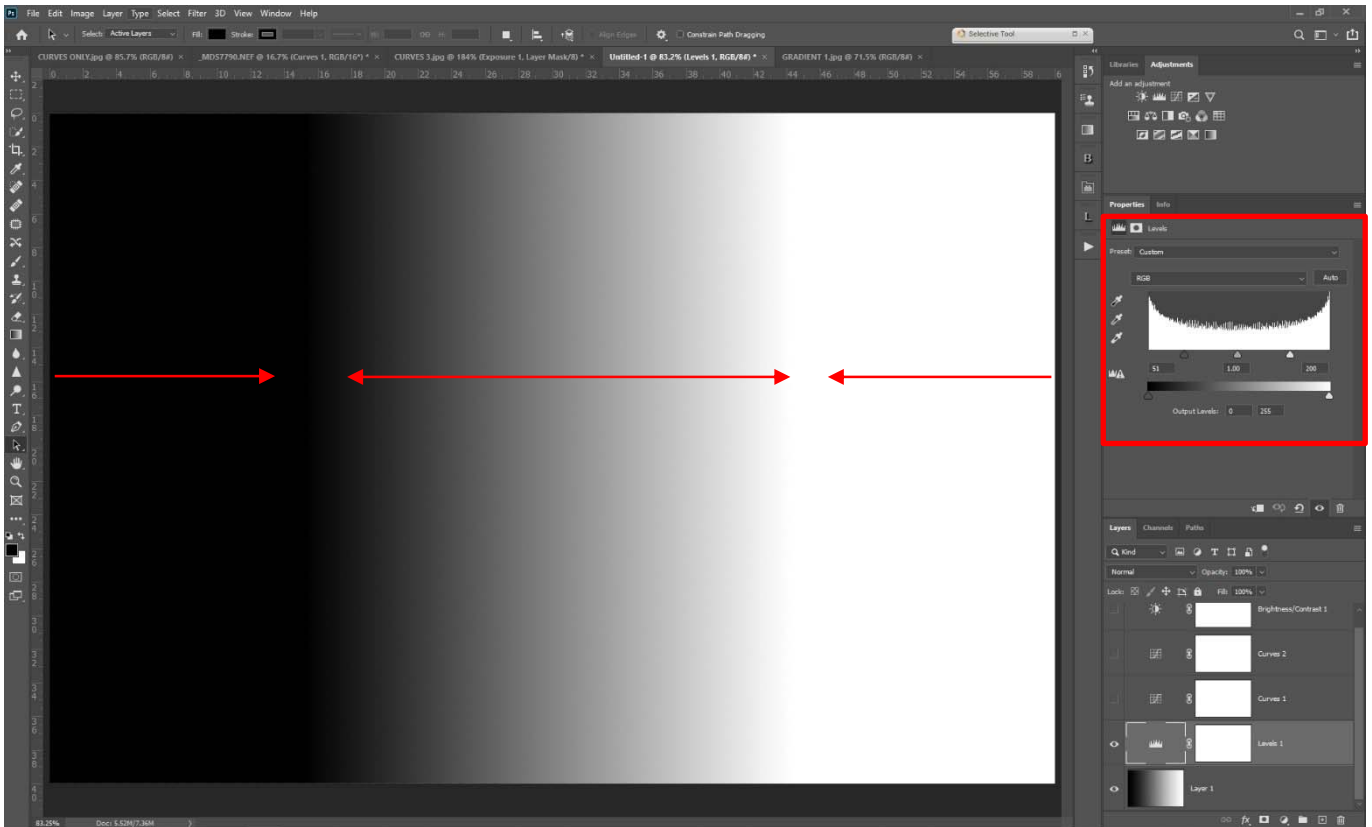


**Above:** An image where the maximum number of points have been added to the Curves Adjustment by selecting the point tool – the one shaped like an “S” curve and clicking on areas of different tonality.

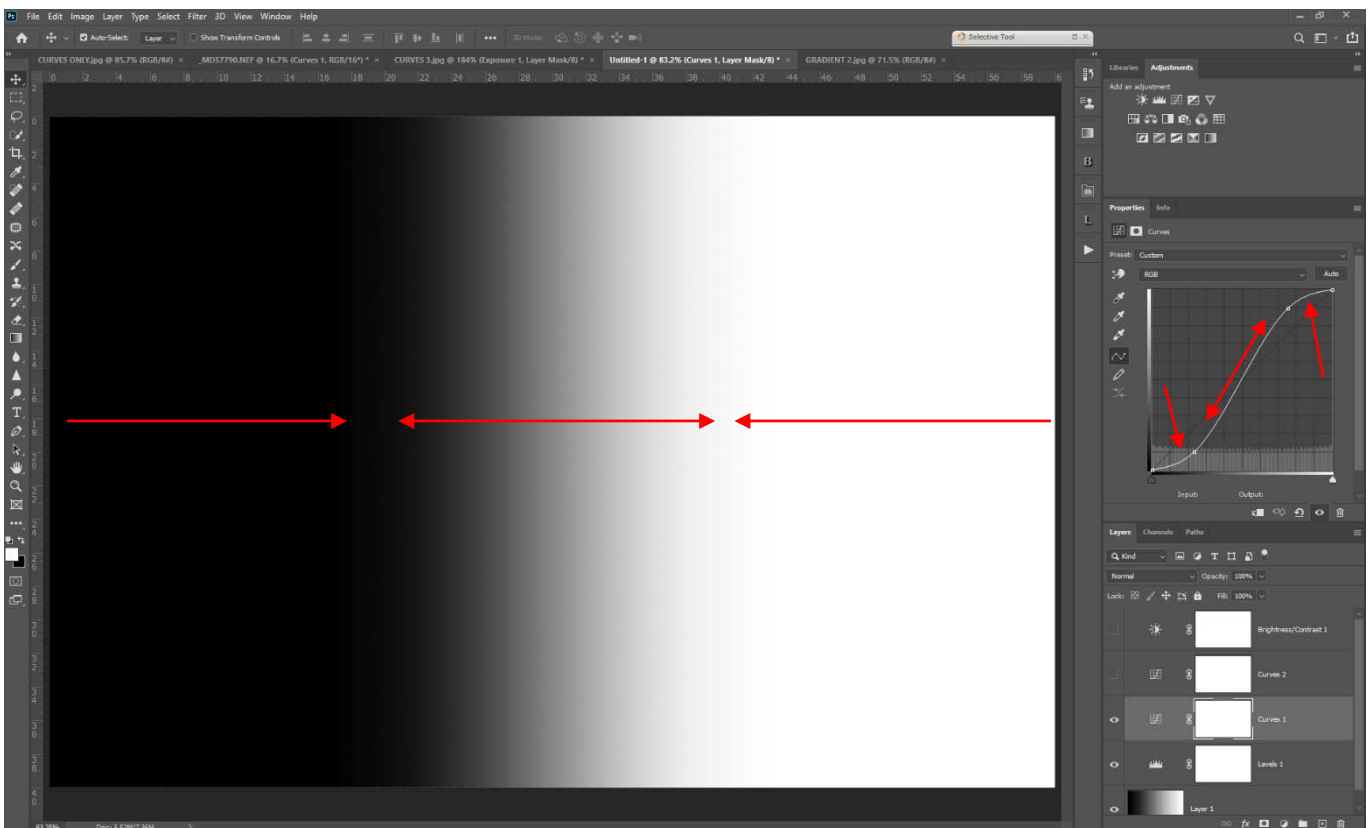
To explain a little more how the different tools affect your image, we can use a simple image of a gradient from Black to White. In this case, an 8 bit image for illustration purposes:



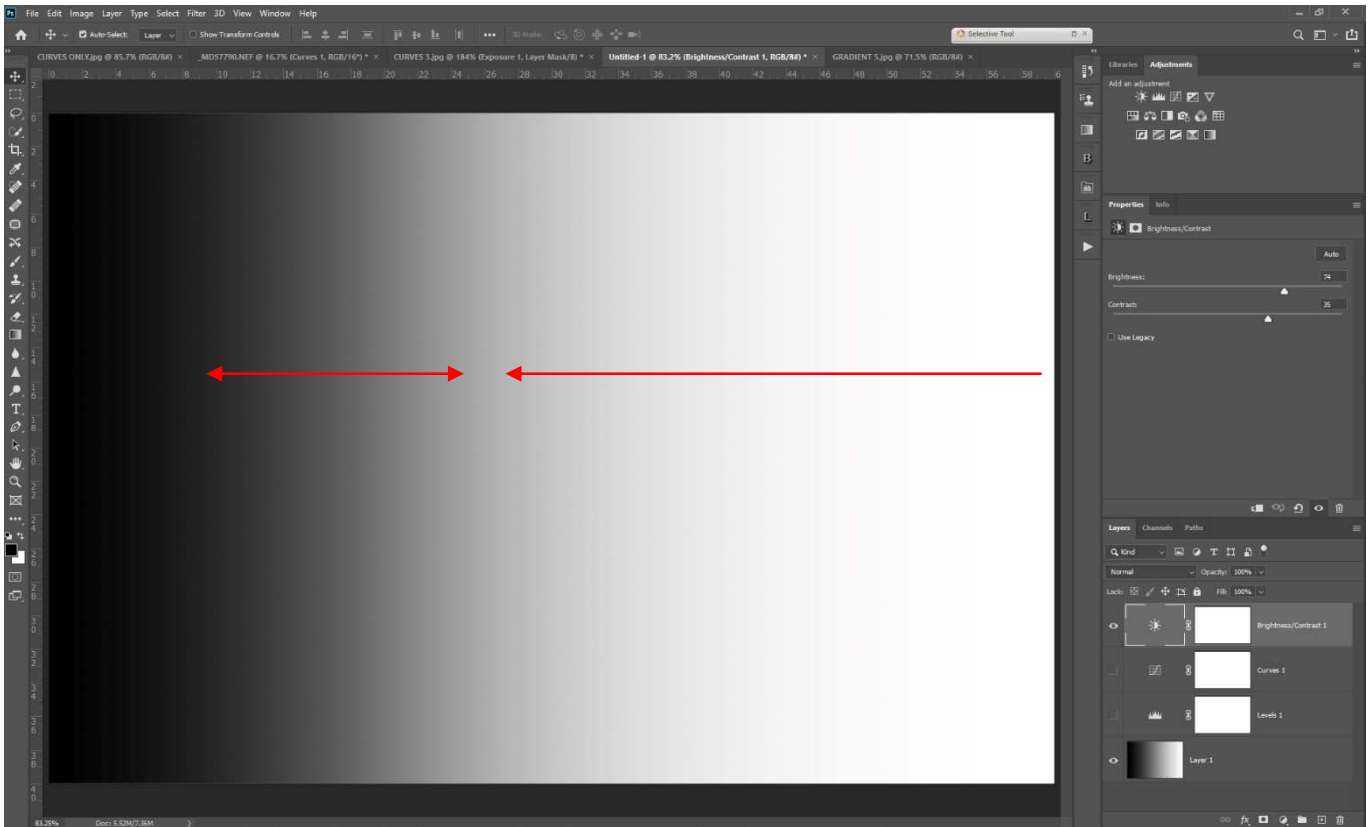
**Above:** A simple Gradient from black to white over 256 steps (8 bit)



**Above:** The gradient after using a Levels adjustment to clip the White and black tones. Everything from the left hand end to Level 58 (the position of the black slider) is pure black and everything from the right hand end to Level 193 is pure white. Between the two sliders is an even gradation from black to white, in this case over 135 levels of tone. The greatest contrast occurs over these middle tones.



**Above:** The gradient with a Curves adjustment added. The gradation from black to white starts at level 0 and finishes at level 255. The rate of change is greatest at either end, with the middle at an even rate.



**Above:** The gradient with a Brightness and Contrast adjustment added. Moving the Brightness slider to the right has compressed the darker tones towards the left. Moving the Contrast slider to the right has also compressed the transition between white and black, now concentrated in the middle tones.

*From the above simple examples, it can be easily seen that using Curves adjustment layers instead of Levels and Brightness/Contrast offers considerably more control over the tonality adjustments to an image. Combining these adjustments with appropriate Blend Modes, Masks and Opacity of the Adjustment layer gives you a great deal of flexibility in your image editing.*

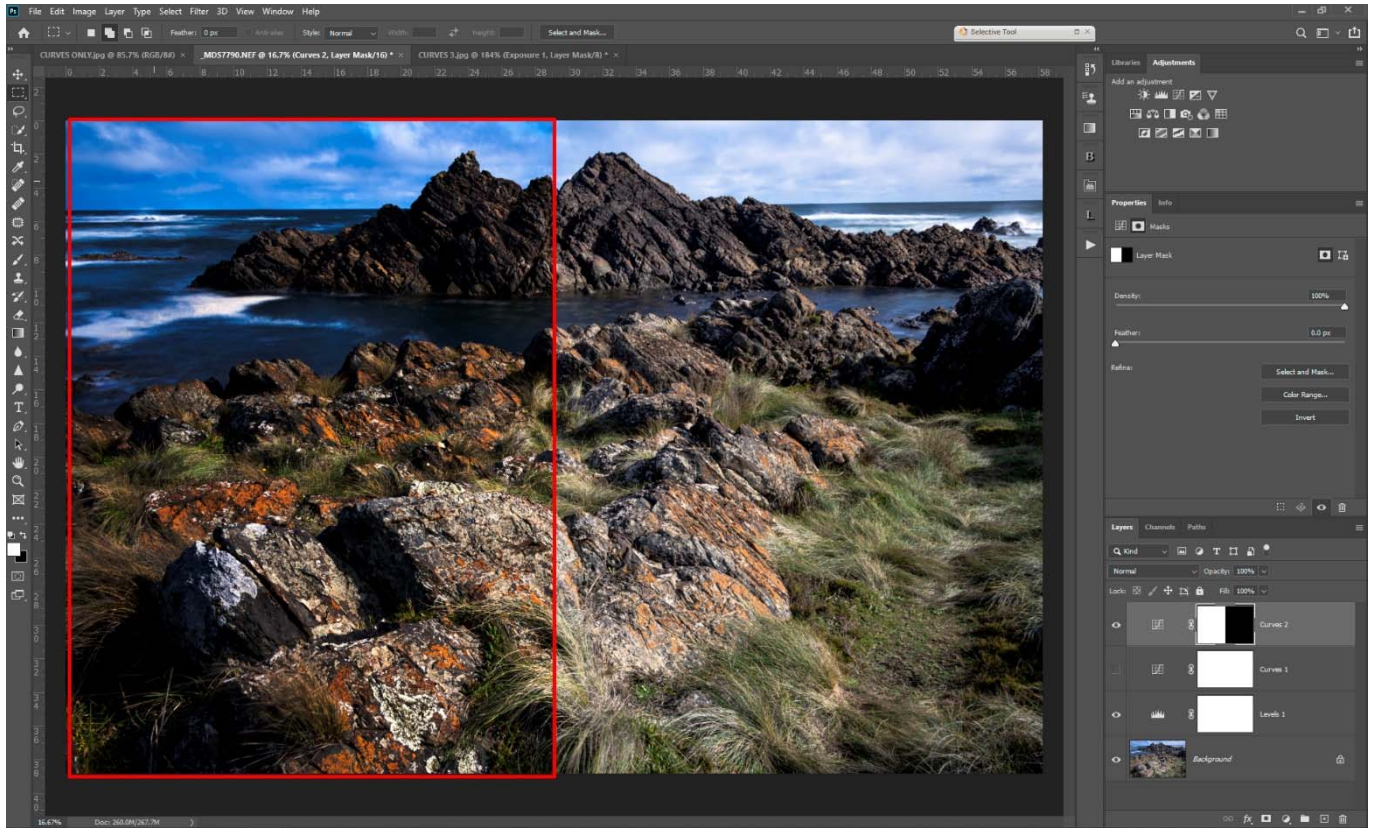
### WHAT ABOUT THE COLOUR SHIFTS ?

The "*Elephant in the Room*" in all of the image processing in Photoshop and Lightroom (and Camera RAW) is the problem of *saturation shifts* when all we want to do is change the tonality (brightness) of parts of the image.

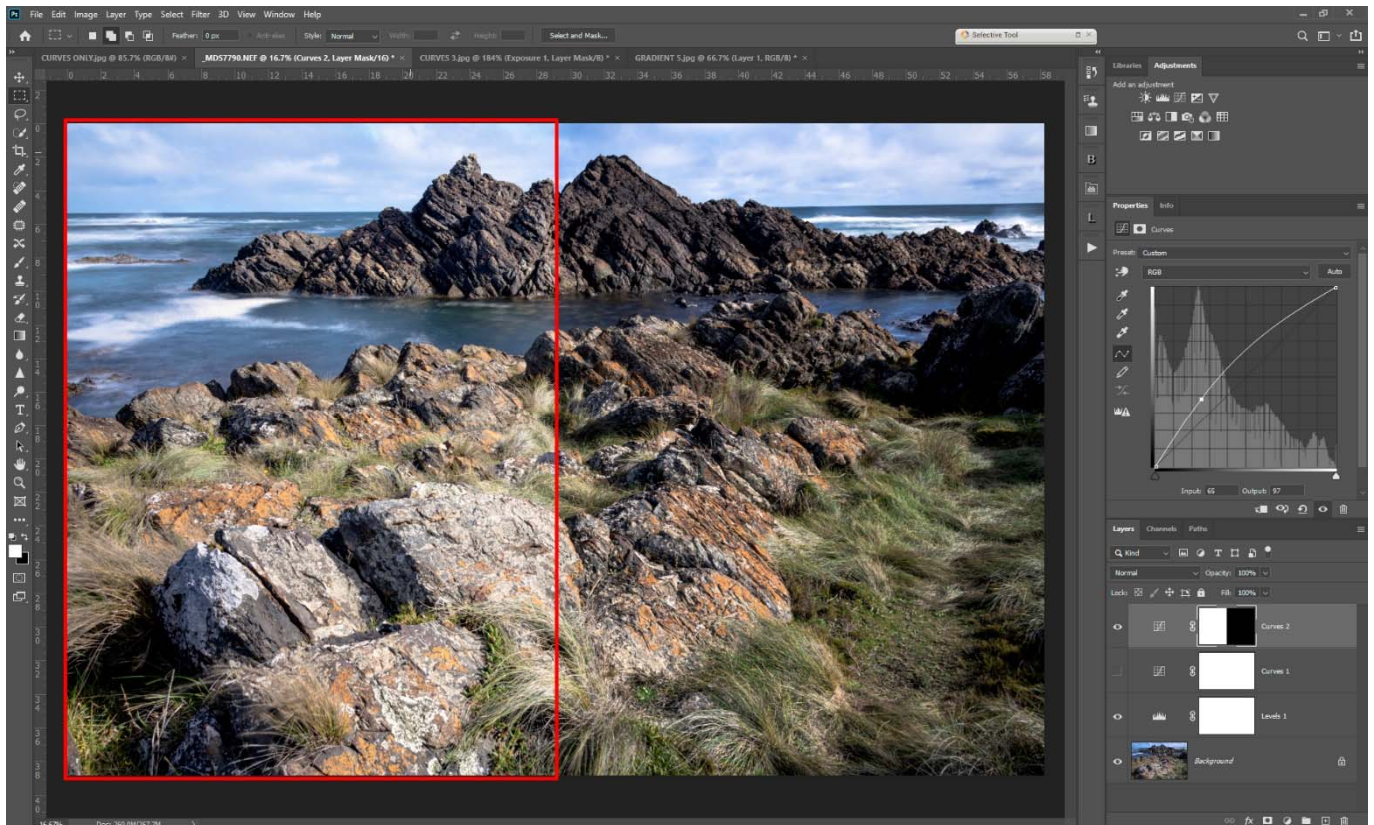
In our natural world, the way our perception works is that as an object becomes darker (is seen in less light) the saturation appears to be lower. The extreme example being in very poor light when pretty much all we see is tonality (monochrome). Conversely, as an object becomes brighter (more highly illuminated) it appears more saturated (this is known as the *Hunt Effect*).

However, as we introduce tonality changes in Photoshop and Lightroom, the opposite happens: *Decreasing brightness Increases saturation* and *Increasing brightness reduces saturation*. This is at odds with perception, so why this utter madness ?

The problem with Photoshop and Lightroom (and every other image editing software) is the way that the RGB colour model responds to tonality changes. There is no simple way around it, but we can take steps to minimise the effect.

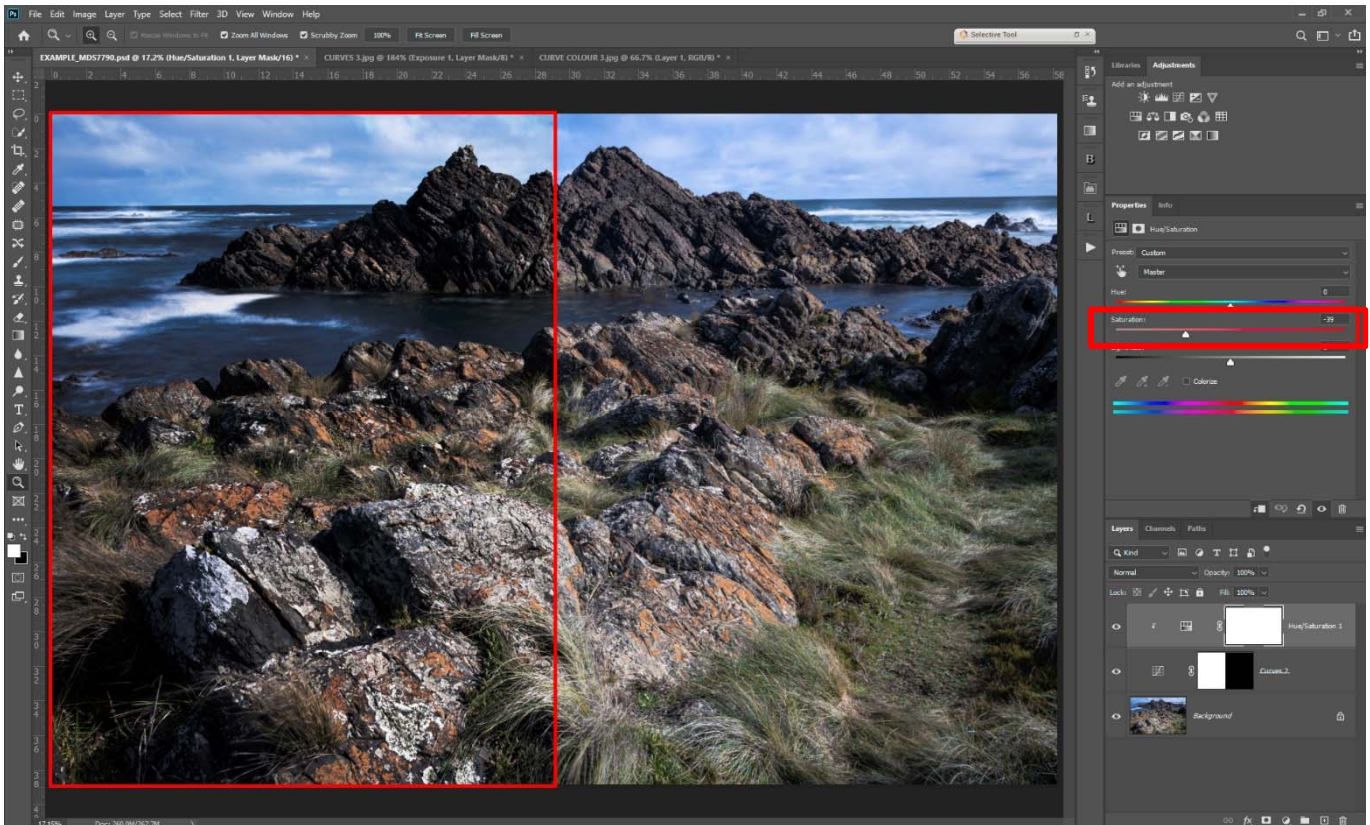


Above: The image with a *darken Curves adjustment layer* applied and masked to show the effect on the left hand side of the image only. Notice the *increase in saturation*.



Above: The same image with a *lighten Curves adjustment layer*. Note the *decrease in saturation*.





**Above:** A darken Curves adjustment with an HSL adjustment layer added and clipped to the curves layer. Saturation has been reduced in the HSL layer to offset the increase in saturation.

The simplest way to minimise the saturation change resulting from a tonality adjustment layer is to add an HSL adjustment layer above it and clip it to the layer below using a **Clipping Mask**.

A **Clipping Mask** is simply a way to make two or more adjustment layers use the same layer mask. Each layer must use the same Blending Mode for this to be effective, however. For example, if the Curves adjustment layer was blended to Luminosity and an HSL adjustment layer clipped to it, the HSL adjustment would have no effect as the layer with the mask only blends luminosity information, not colour or Hue.

Using a Curves or other tonality adjustment layer and blending it to Luminosity should be a way to avoid the change in saturation, but it does not affect the image in a way we would expect.

## SUMMARY

Using Curves as a means to adjust tonality in Photoshop and Lightroom is the most effective tool, because it allows more flexibility and control over how tonality is changed. The pitfalls associated with the RGB colour model need to be catered for in any adjustment however, and here we have shown how to effectively apply an HSL adjustment to minimise the negative effects.