Part 8: Image Processing (e.g. with Photoshop)

Steven Beard

Musselburgh Camera Club

Digital Photography and Information

- A digital photograph is made of information.
  - Picture elements = Pixels
- The picture information is described by numbers.
  - Higher numbers mean brighter pixels
- It is important to know how to manage this information.

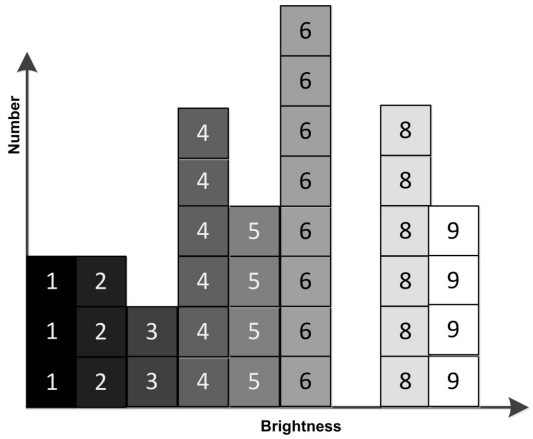
9	9	8	8	9	8
8	4	4	8	6	5
9	6	2	5	5	4
8	4	6	1	2	6
6	6	6	1	5	6
4	3	3	1	2	4

A digital photograph is made of information. Each part of the picture is divided into picture elements, or “pixels” (px). The picture information is in the form of numbers. In this example, higher numbers represent the brightness of each pixel. It is important to know how to manage that information. Photoshop processes that information.

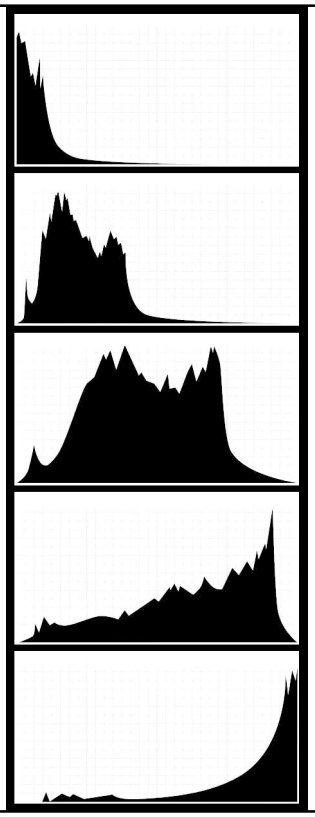
Most of the time, you can’t see what Photoshop is doing because you see the overall effect on a large scale, not what happens to each pixel. With a tiny 6x6 image like this it is easier to see what is happening. This is a 36 pixel image. A 1 megapixel image has approximately 1 million pixels.

The Histogram

9	9	8	8	9	8
8	4	4	8	6	5
9	6	2	5	5	4
8	4	6	1	2	6
6	6	6	1	5	6
4	3	3	1	2	4



Now we have the original image and the histogram. In this case, all brightness levels are well covered (apart from the 7s), so this is a high contrast, well-exposed image. This assumes that there are only 9 possible brightness levels. If the levels actually went from 1 to 16, the lack of any 10, 11, 12,13 14 15 or 16s would indicate underexposure.



Underexposed: Shadow detail will be lost. Dark areas will be noisy.

Peak to the Left: Perfectly ok for low-key scenes, such as night sky or coal shed. Shadows may be noisy.

Neutral exposure: Safest result. There will be detail in shadows and highlights.

Peak to the Right: Expected for high-key scenes, such as snow. Optimum result, as long as highlights not clipped.

Overexposed: Highlights will be clipped. Detail lost in bright areas.

Here again is the advice on how to use the camera histogram.

Move the histogram over as far to the right as you can without blowing out the important highlights. Then use Photoshop to set the exposure level you want. Note that slightly over-exposed exposures are ok. They reduce the noise, and Photoshop can correct the exposure.

Blown highlights are bad, however. Use the “highlight clipping” display on your camera to check for blown highlights.

Image Processing

- Once an image has been saved by your camera, it can be adjusted using a photo editing program.
- Adobe Photoshop is the most popular, but others are available.
- Editing should be minimal. You should aim to capture a good image “in camera”.

- Selecting a portion of your image
  - Cropping
- Exposure correction
  - Brightness / Contrast
  - Shadows / Highlights
- Colour correction
- More complex correction
  - Levels
  - Curves
- Choosing which parts to correct
  - Dodging and Burning
  - Selection
  - Masking

Here are some simple examples of processing to improve your image. One of the simplest techniques to improve an image is to crop it. If your image “jumps out” at you when you zoom in but looks run-of-the-mill at full size, this is a clue it may be improved by cropping.

As far as exposure is concerned, it is much better to get it right “in camera” than rely on Photoshop to correct it for you. Taking a series of bracketed exposures and simply choosing the correct one is better than making a correction in Photoshop. Photoshop helps for difficult scenes (e.g. bright highlights and/or dark shadows) when you can’t expose the whole scene correctly “in camera”.

If you capture an image in RAW mode, Adobe Camera Raw will let you change the white balance setting and improve the colour.

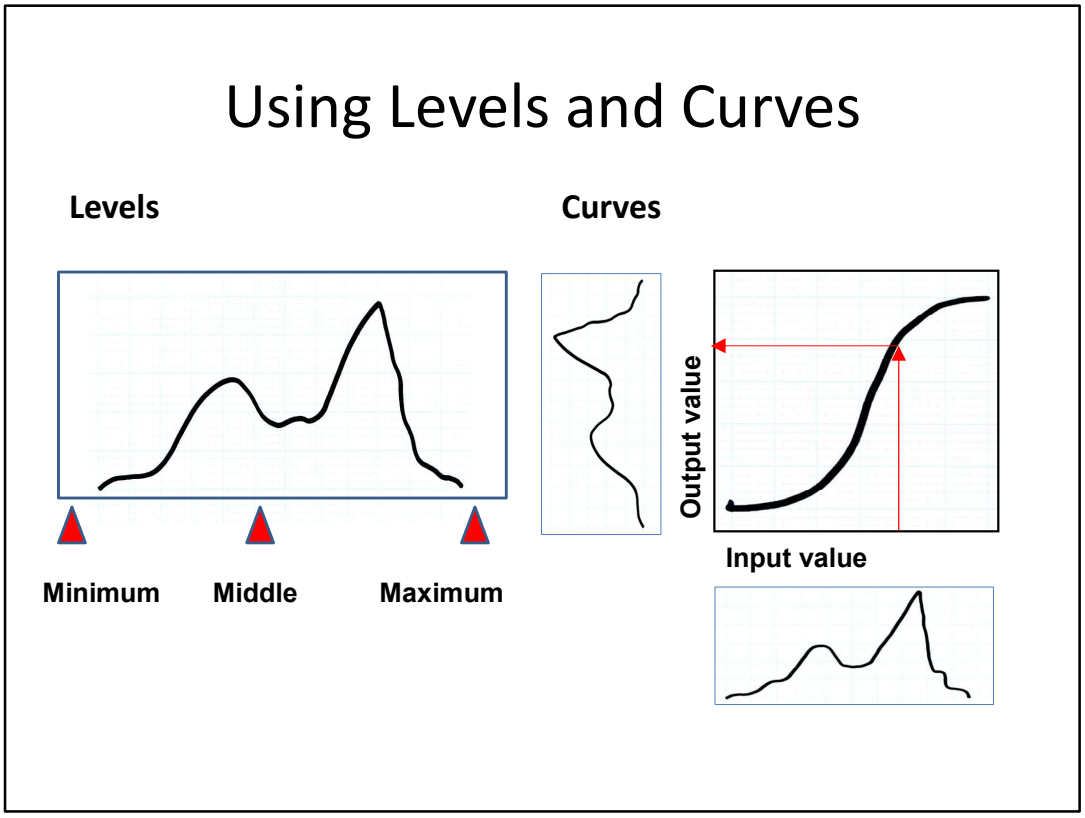
You can find more information about Adobe Photoshop in the user guide: https://helpx.adobe.com/uk/photoshop/user-guide.html

See also the introduction to Adobe Camera Raw https://helpx.adobe.com/uk/camera-raw/using/introduction-camera-raw.html

Image Processing with Photoshop

- Cropping
  - Improve the composition.
- Colour correction
  - Adjust white balance and colour saturation.
- Selection
  - Adjust specific parts of an image.
- Brightness / Levels / Curves
  - Correct exposure and balance tones.
- Shadows / Highlights
  - Improve images with over-bright highlights or deep shadows.

Photoshop can be used to make all these basic adjustments to your images, and more.

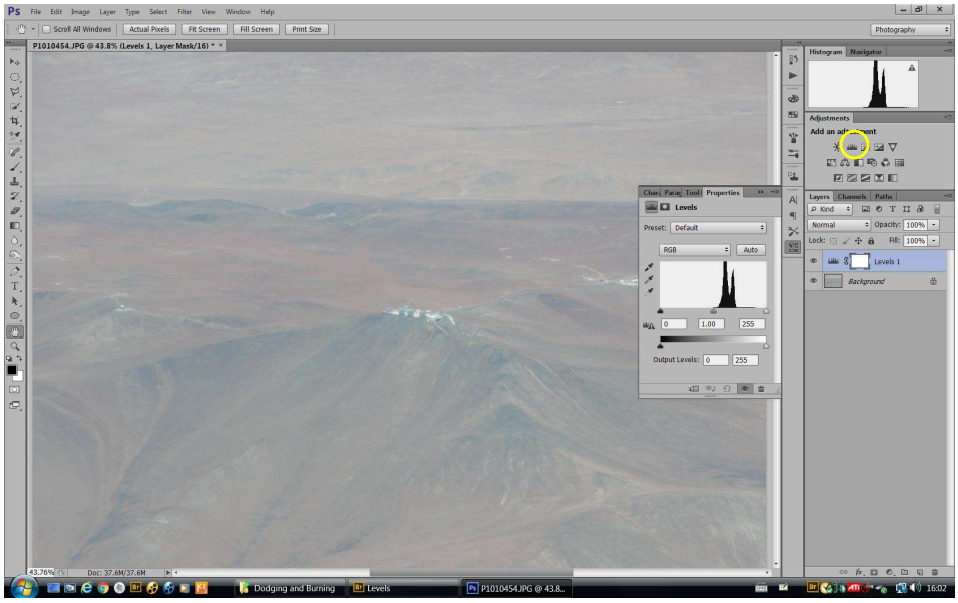


Levels lets you squeeze or stretch the histogram to remap pixels to a different range of brightness levels. Move the minimum and maximum sliders so they just touch the point at each end where the histogram drops to zero. The middle slider can be used to change the middle brightness.

Curves lets you squeeze or stretch the histogram by mapping input values to output values. It is more flexible than levels but is also easier to get wrong. The best way to visualise levels is to imagine the “output” histogram displayed vertically at the left hand side. Push the curve in the direction you want the output histogram to move.

Using Levels and Curves

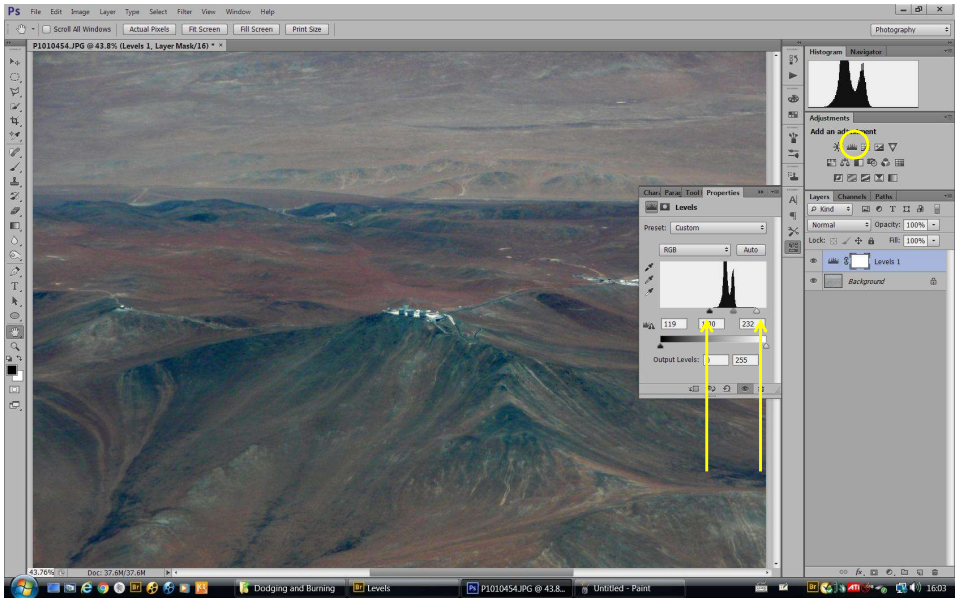
A horrible image before levels adjustment



This is a very bad low contrast image, typical of many photos shot out of an aircraft window. The camera's auto exposure has been unable to distinguish the different tones and has decided to make everything mid grey.

Using Levels and Curves

Move the sliders to meet the ends of the histogram.

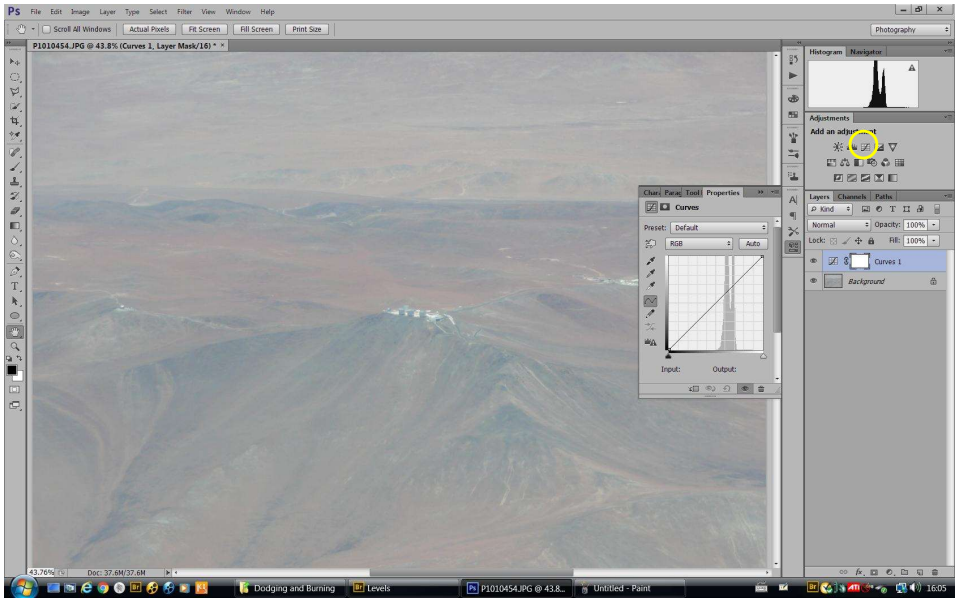


Moving the minimum and maximum sliders makes a huge difference. Move each slider to the left and right edges of the histogram. This rescales the image so the full range of blacks and whites are used. You can move the middle slider to change the brightness of the mid-tones.

Note there is an “auto” button. It’s worth pressing it to see if Photoshop can figure out the best adjustment to make. If you don’t like what you see, adjust the sliders until the image looks right.

Using Levels and Curves

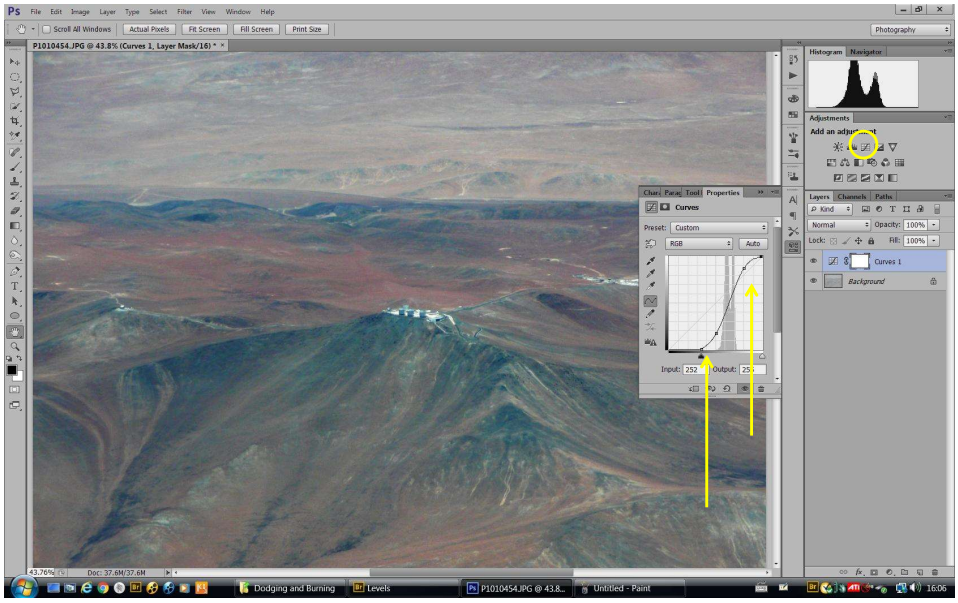
A horrible image before curves adjustment



The same horrible image before making a curves adjustment. Note the thin, spiked histogram.

Using Levels and Curves

Push the curve up on the right of the spike and down on the left.

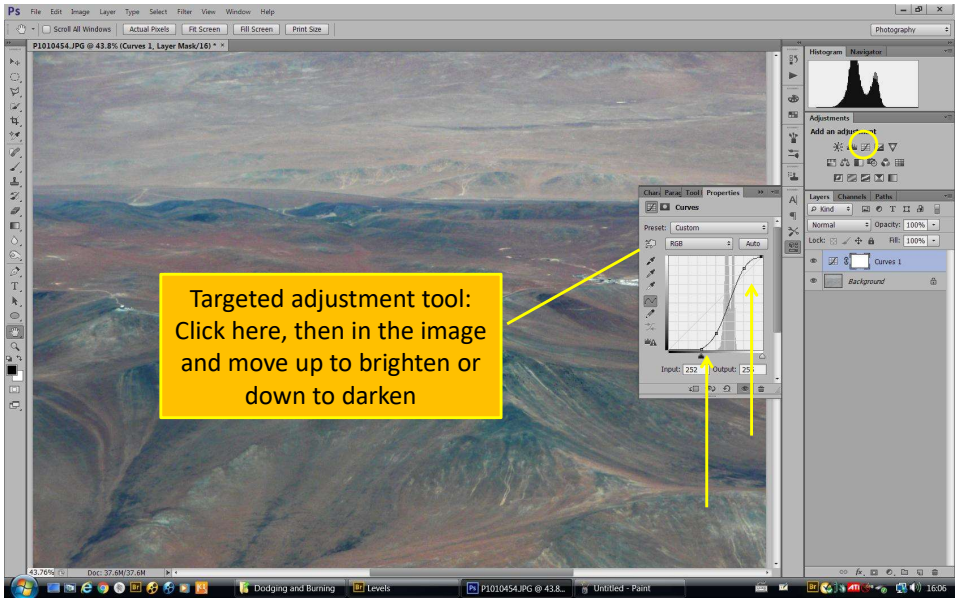


The histogram can be stretched by pushing the curve up on the right hand side of the spike and pushing down on the left hand side of the spike. Curves also has minimum and maximum sliders you can move to the ends of the histogram.

Note that curves also has an “auto” adjustment. Try it out and see what you think. There are also a number of fixed settings, such as “high contrast”. You can reset the settings by selecting “default”.

Using Levels and Curves

Push the curve up on the right of the spike and down on the left.

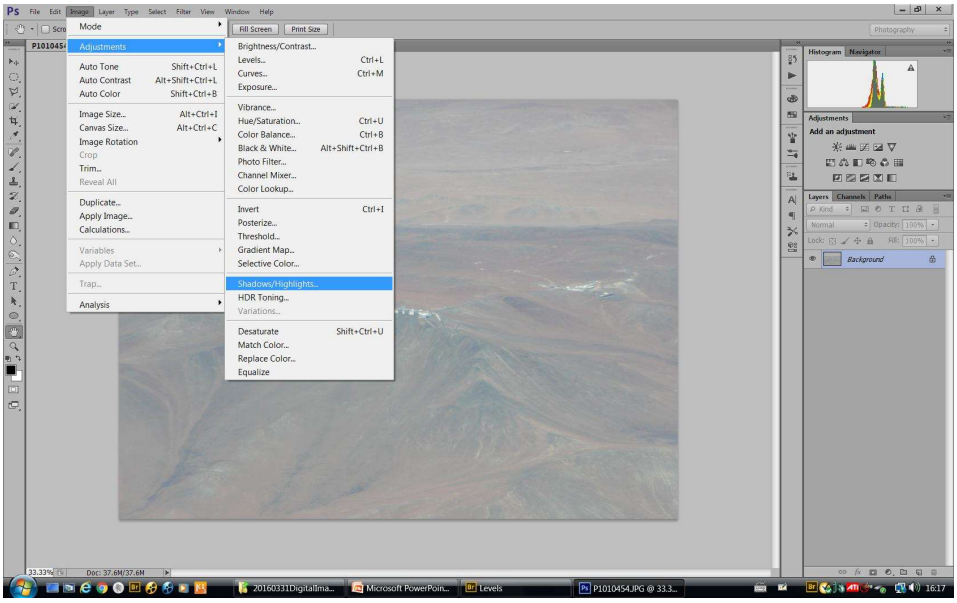


The widget looking like a hand in the curves adjustment tool is the “targeted adjustment tool”. This can be used to brighten or darken specific points in the image.

Note: The same adjustment will be made to the whole image. If you want to confine an adjustment just to a specific area, you can do this by using the selection tool before choosing a “brightness”, “levels” or “curves” adjustment. You can also paint black or white onto the “layer mask” associated with the adjustment (first click on the white rectangle you can see next to the “Curves 1” label). The “dodge and burn” tools can also be used to make adjustments to specific areas.

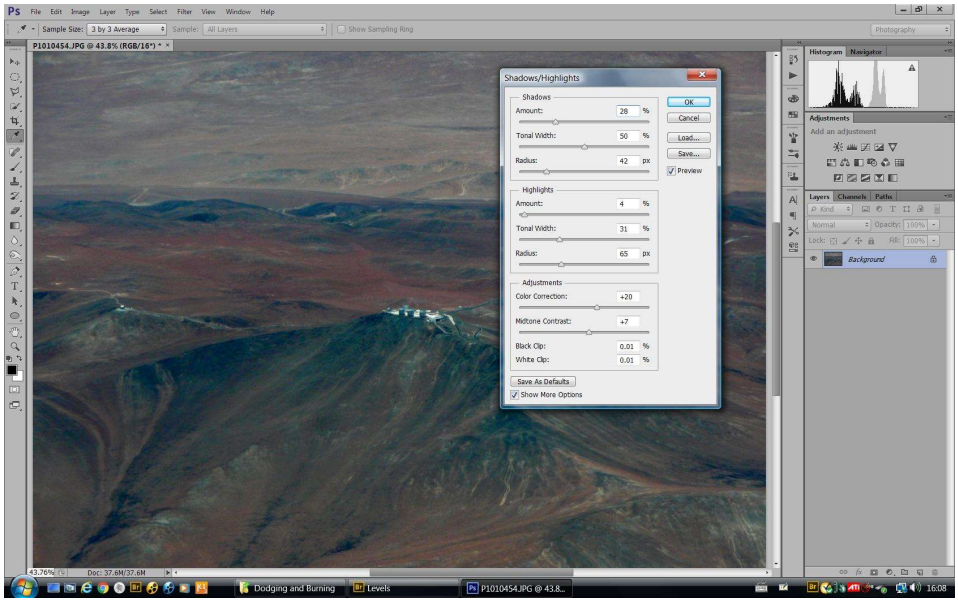
Shadows and Highlights

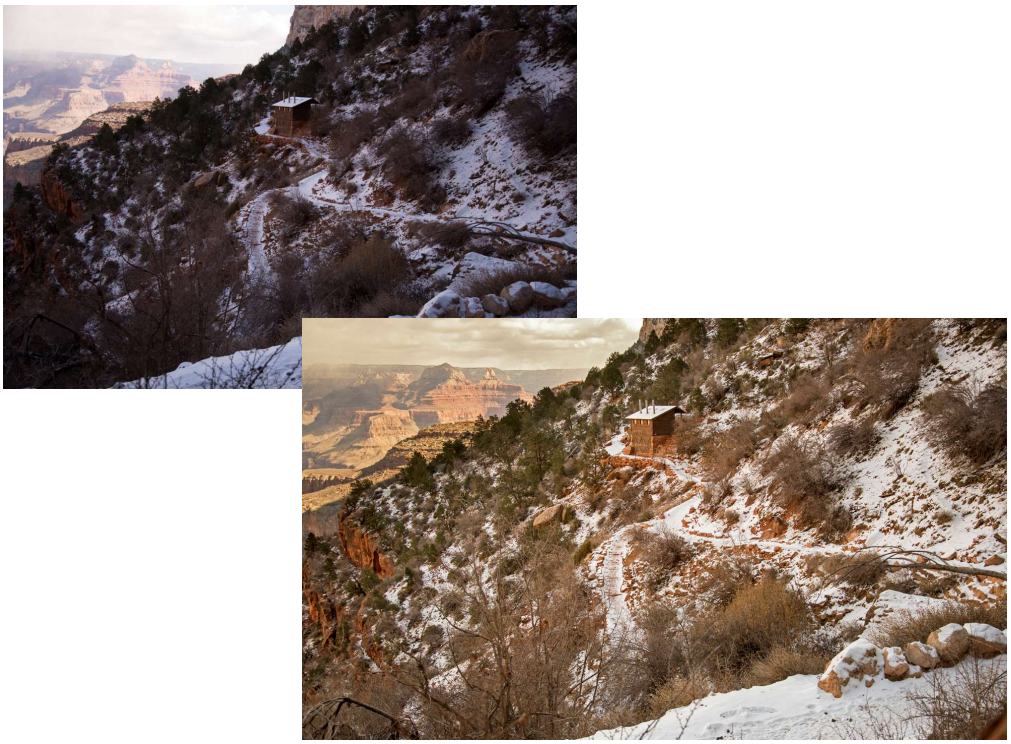
The “shadows and highlights” adjustment can correct dark and light areas



Shadows and Highlights

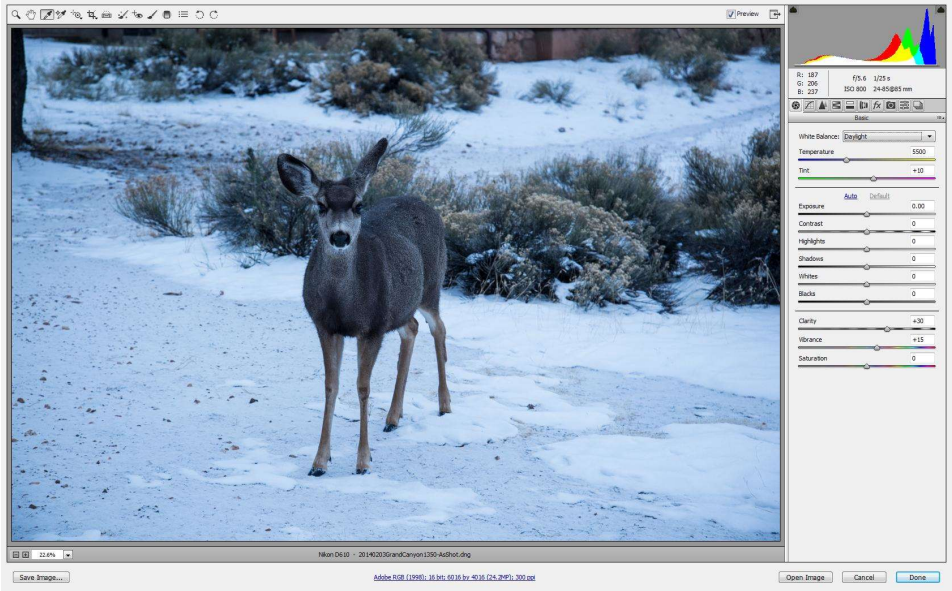
Adjust the “amount”, “tonal width” and “radius” sliders.





Colour Correction

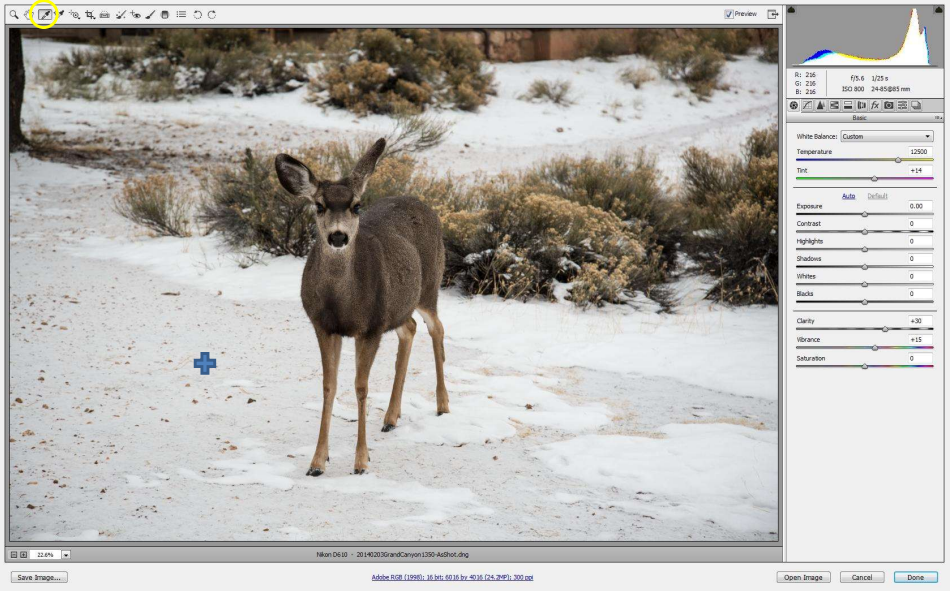
Sometimes images end up with a poor colour balance.



Sometimes images end up with a poor colour balance. Here the deer looks washed out because of all the blue light reflected by the snow.

Colour Correction

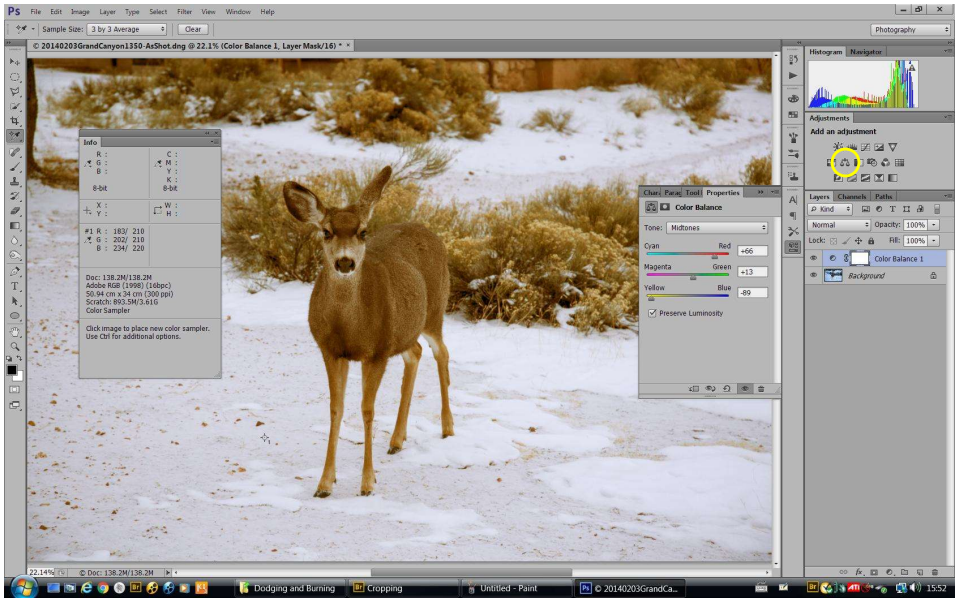
In Camera Raw, select the colour sampler and click on what should be grey.



In Camera Raw, select the colour sampler and click on what should be grey.

Colour Correction

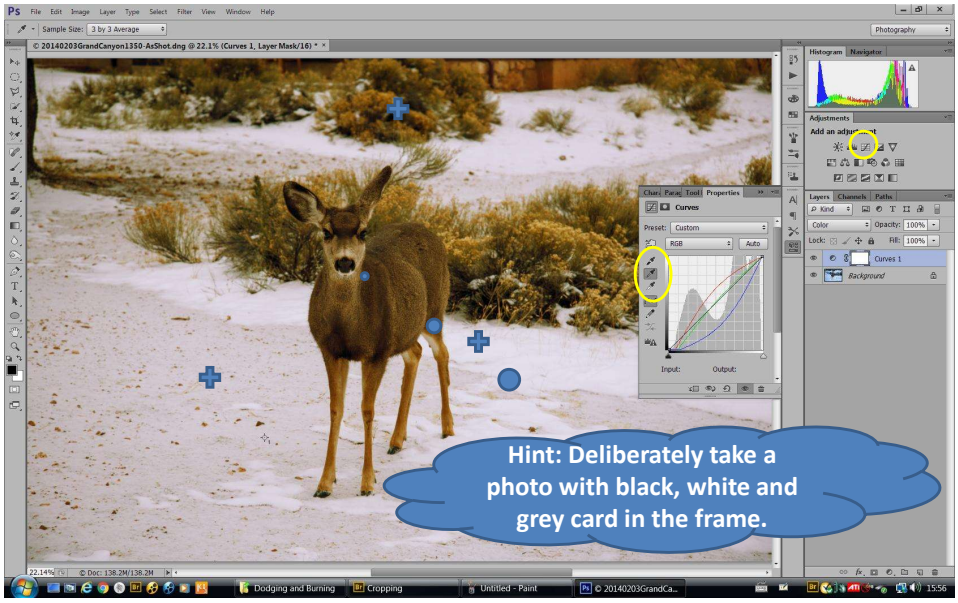
You can make a manual colour balance adjustment in Photoshop.



You can make a manual colour balance adjustment in Photoshop. This takes more practice, but you can monitor your results by placing colour samplers in the image and noting how they change.

Colour Correction

"curves" can do it semi-automatically if you can find white, black and grey points



But "curves" can correct colour semi-automatically if you can find white, black and mid-grey points.

The hardest part is finding those neutral areas, so why not create them yourself by photographing pieces of white, black and grey card before or after your main shot?

Improve the image by cropping.

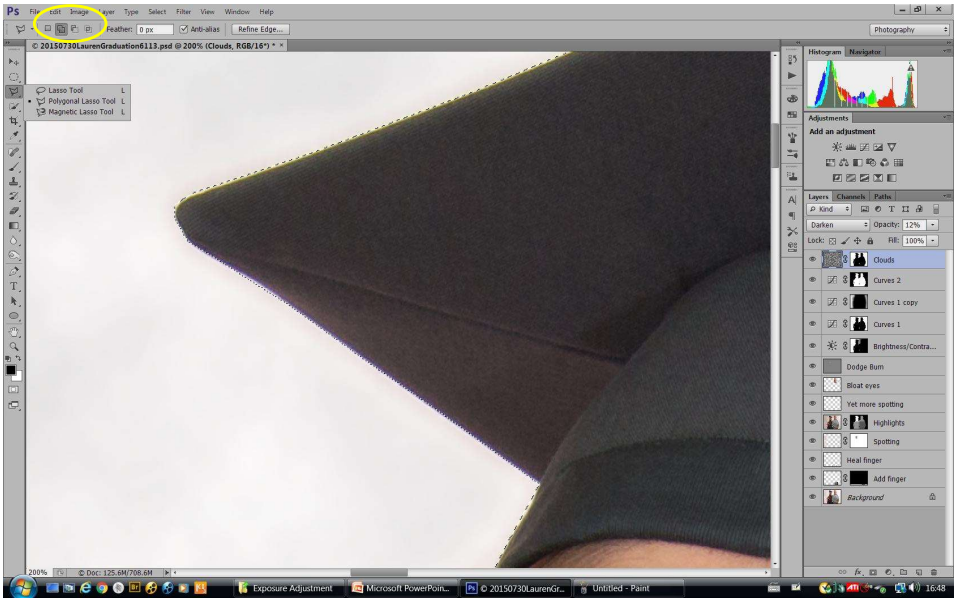
Making a Selection

A simple shape selection. Useful for cut-outs, vignettes and spotlights.

The shape selections are useful for cut-outs, cropping, vignettes and spotlights.

Making a Selection

Polygonal lasso tool. Slow and tedious, but accurate.



The polygonal lasso tool is slow and tedious, but accurate. Don't forget you can edit the selection using the "+" and "-" options.

The most accurate selection tool of all is the "pen tool", which can be used to create a path which you can convert into a selection.

If you have spent a long time creating a selection, save it using "Select/Save selection...". A new channel will be created.

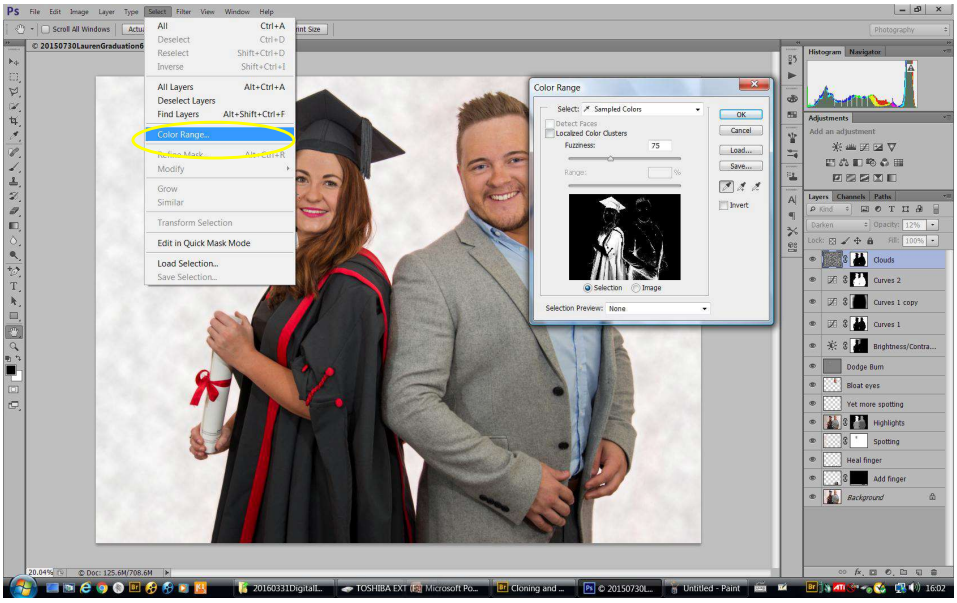
Making a Selection

Quick selection or Magic Wand. Fast but not as accurate.

Quick selection and magic wand can select large areas quickly, but they often find the wrong edges. I normally start with one of these and them edit the edge using “polygonal lasso” in “+” or “-” mode.

Making a Selection

Colour range. Useful for non-contiguous or intricate blocks of colour.



Colour range is also a useful way of selecting areas of a similar colour. Beware that this selection method can create intricate masks with varyin grey levels. If you just want a simple black/white mask, process it with a “threshold” adjustment.

Making a Selection
The Best of Both Worlds

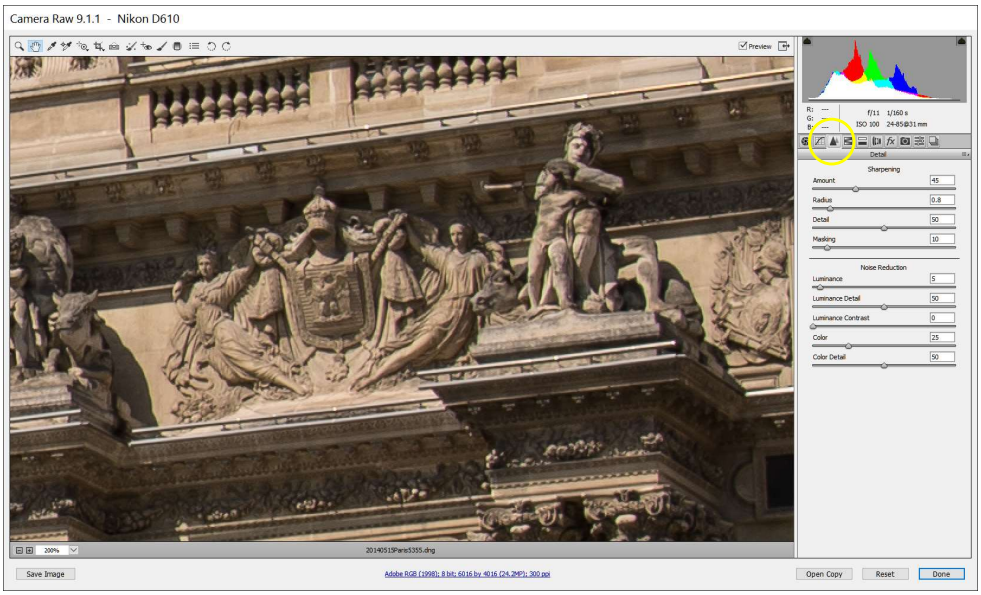
- Time-saving selection method
  - Quick select
  - Magic wand (or colour range)
  - Lasso
  - Adjust using polygonal lasso in + or – mode.

- Slow and tedious, but accurate selections
  - Pen tool → Path → Selection
  - Polygonal lasso
  - Don't use "Magnetic lasso". It will drive you nuts.

This is my usual selection work flow. I try a simple, "quick and dirty" selection first and then edit it with the more accurate tools.

Sharpening

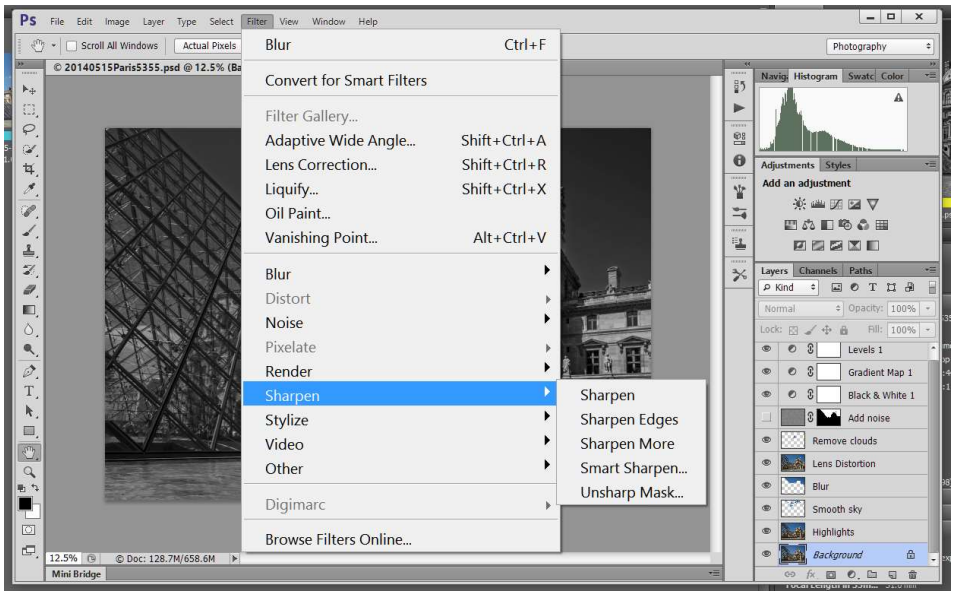
Within Camera Raw using the sharpening menu



A demonstration of sharpening in Camera Raw. It is normally only sensible to sharpen a RAW image.

Sharpening

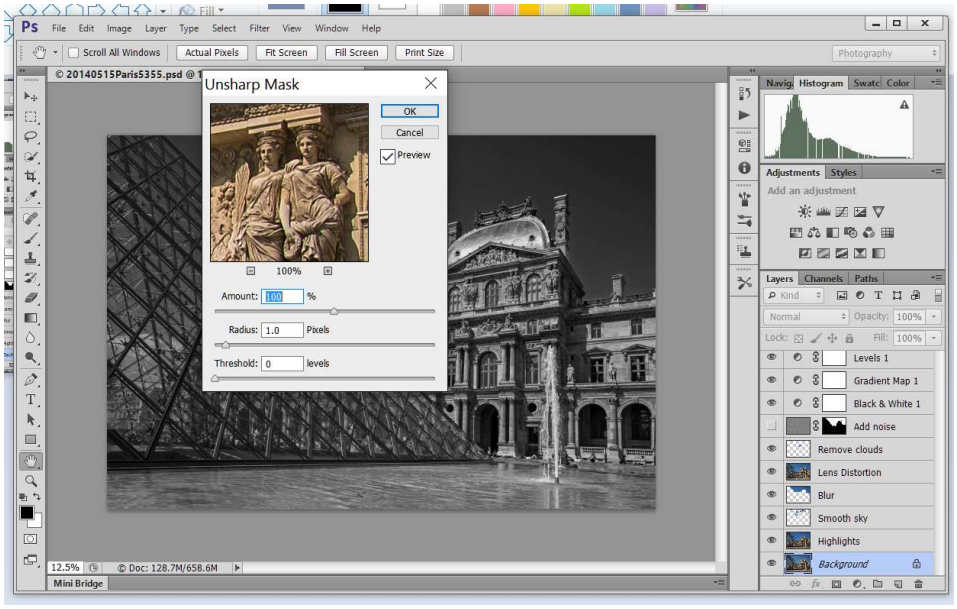
Within Photoshop using a sharpening filter



A demonstration of sharpening in Photoshop.

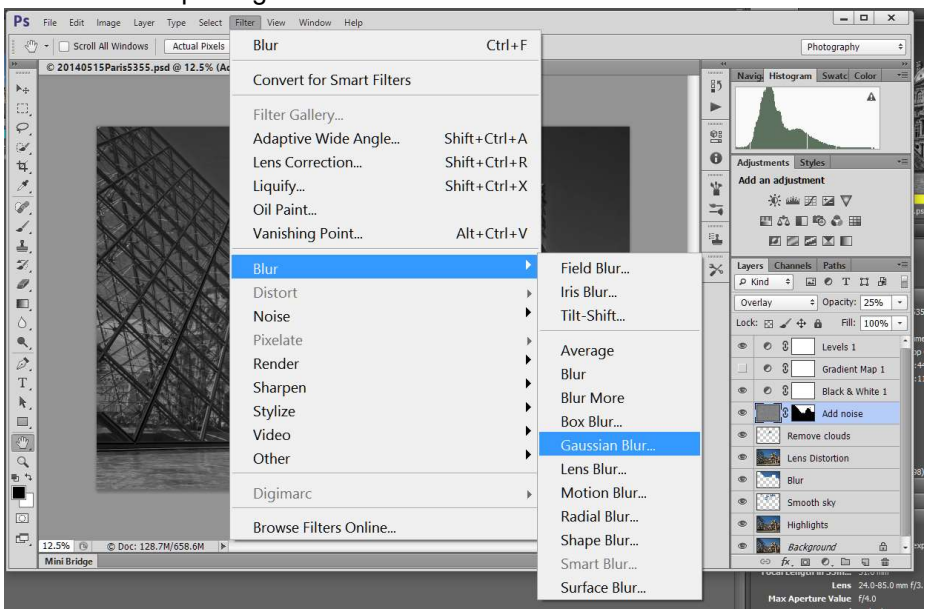
Sharpening

Within Photoshop using a sharpening filter



Blurring

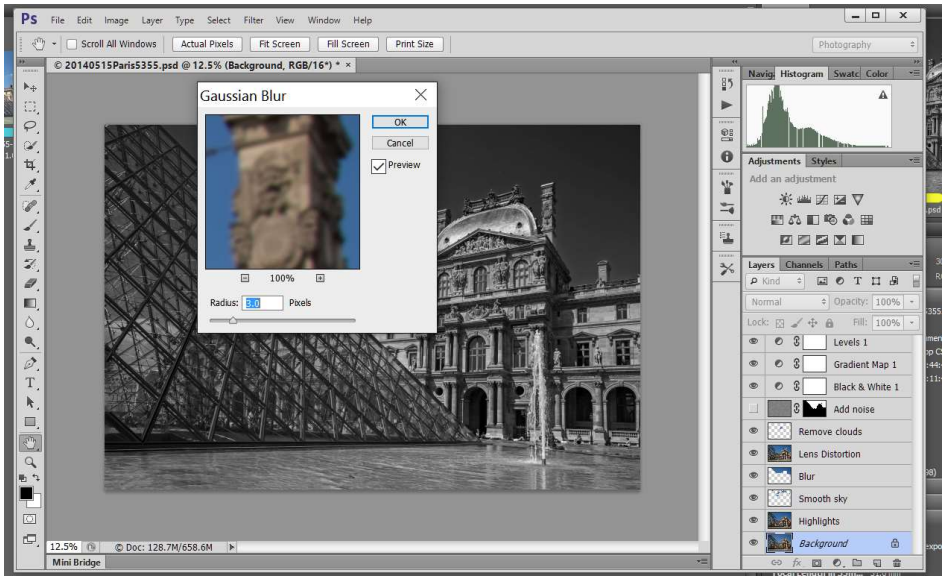
Within Photoshop using a Blur filter



Blurring in Photoshop using a Gaussian Blur.

Blurring

Within Photoshop using a Blur filter



Blurring in Photoshop using a Gaussian Blur.

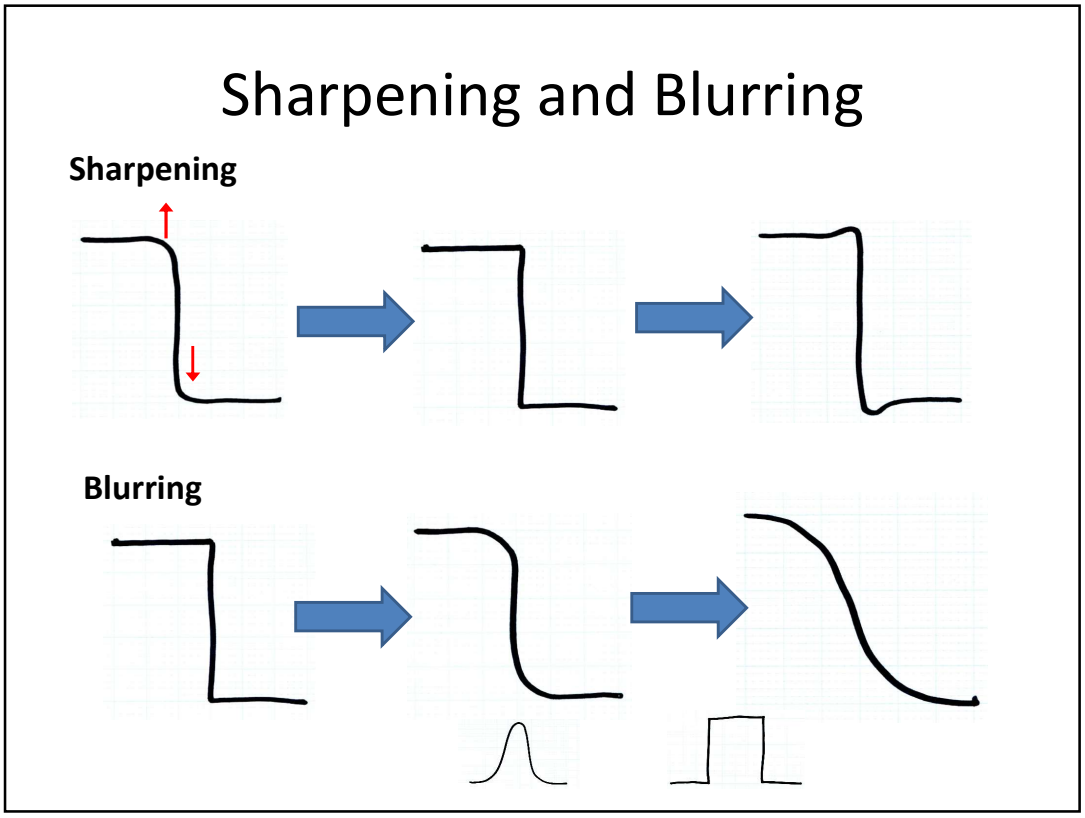
Photoshop Analogies

Sharpening

Blurring

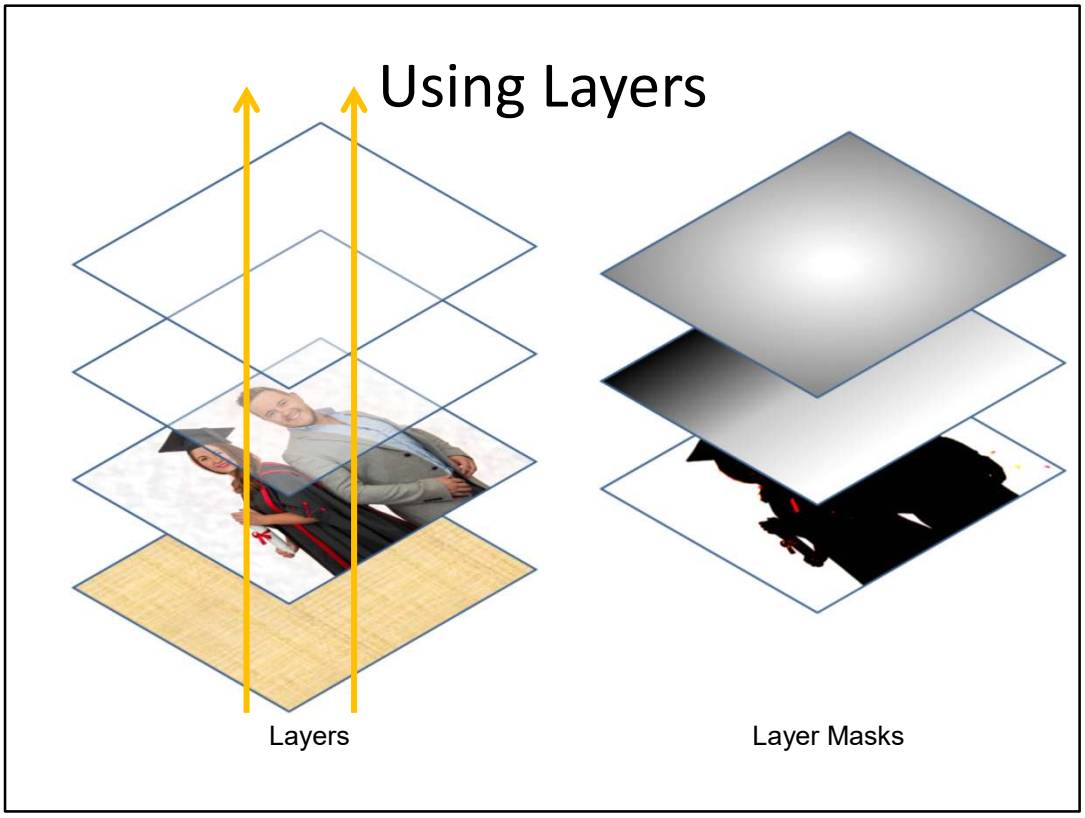
In Photoshop, sharpening a surface is analogous to sharpening up edges in a wooden or plasticine model using a chisel or pallete knife. The plasticine analogy is better because you don't take off any material by sharpening – you just push it around.

Light smoothing is analogous to rubbing a wooden model with fine sandpaper. Heavy smoothing is like taking a blowtorch to a model made of candle wax.



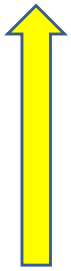
Sharpening emphasises an edge by pulling up the bright side and pushing down the dark side to increase the contrast. But be careful, since over-sharpening can push the edges too far and leave an ugly halo.

Blurring smooths over the edges. Blurring filters apply a “kernel” to each pixel of the image. In a Gaussian blur, the kernel function is a Gaussian, as shown. Other blurs are available, such as Box Blur (also known as Top Hat) and Median.

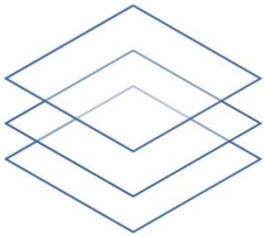


Photoshop treats layers like transparencies on an overhead projector. Just as the light passes through transparencies from bottom to top, Photoshop processes each layer from the bottom to the top. The result is what you would see by looking down on the top-most layer.

Layer Blending



Layers		Channels		
1st and 2nd	3rd	R	G	B
	Result...	196	255	193
	Blend layer	180	255	128
Result →	Base layer	116	42	193
Blend layer		116	89	193
Base layer		128	42	217



- Layer blending combines the R,G,B numbers contained (in each pixel) in two consecutive layers to make a result.
- The 6 numbers are combined together to make 3 new ones.
- If another layer is added, that result is then blended with the new layer.

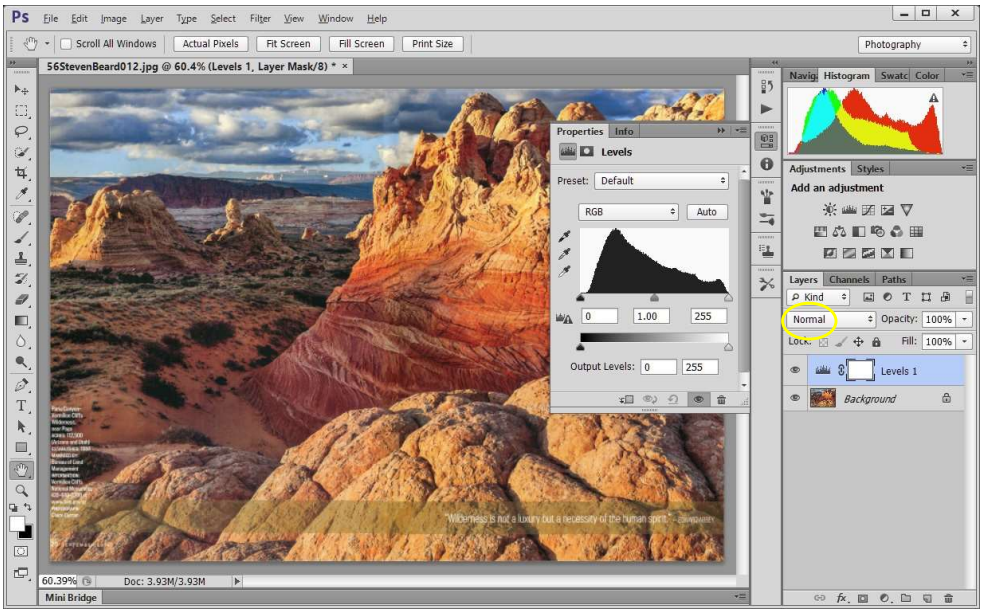
The simplest way to adjust how layers behave is to adjust their opacity. This allows you to see through the top layers and view the layers underneath.

The layer blending modes allow layers to interact with each other in flexible ways. Photoshop processes layers from bottom to top. Each pair of layers is combined using the blending mode of the top-most layer. The 6 R,G,B numbers contained in each pixel in two consecutive layers are combined to make 3 new R,G,B numbers.

Layer Blending and Brightness Levels

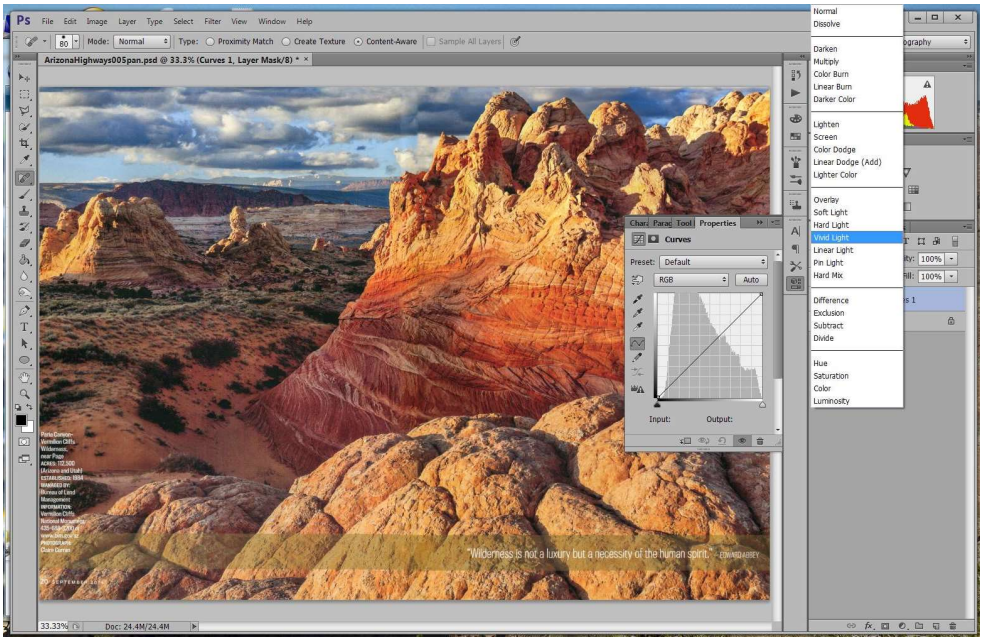
- To better understand how Photoshop blends layers, think of the brightness levels as being in the range 0.0 to 1.0 (not 0 to 255).
  - 0.0 is black and 1.0 is white.
- When layers are multiplied, the brightness level reduces because numbers less than 1 are multiplied.
  - 0.5 x 0.7 = 0.35
- When layers are screened, the multiplication is inverted, and the brightness level increases.
  - 1.0 – ((1.0-0.5) x (1.0-0.7)) = 0.85

Layer Blending Modes



The layer blending mode can be seen here in the layers panel.

Families of Blending Modes



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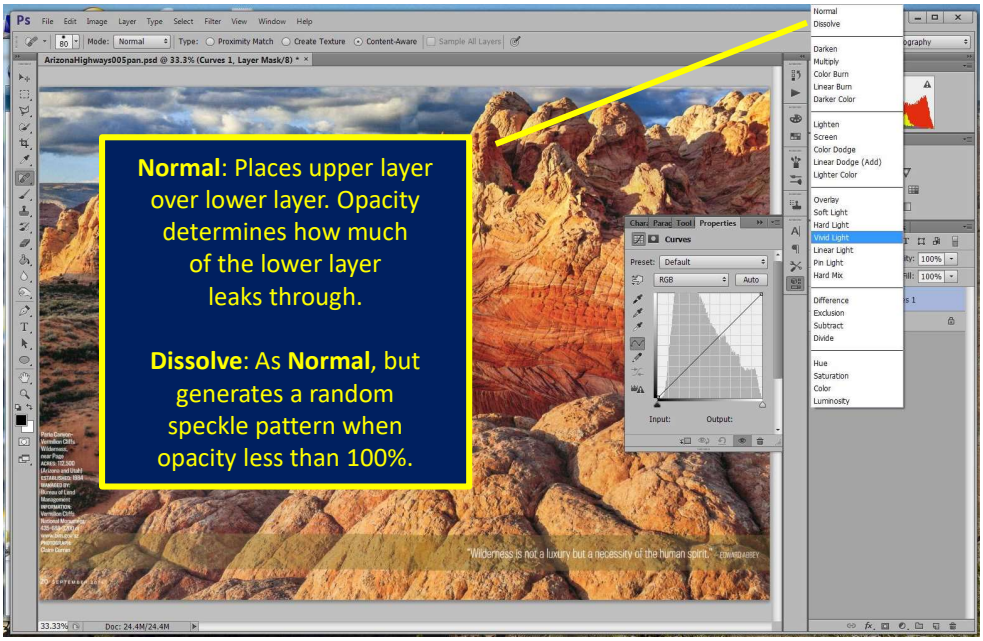

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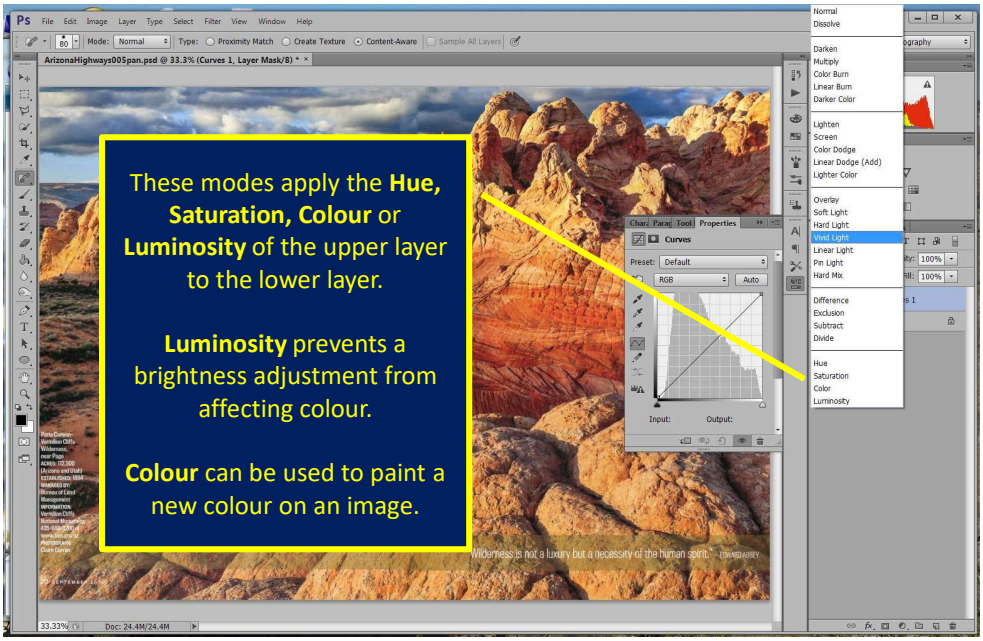

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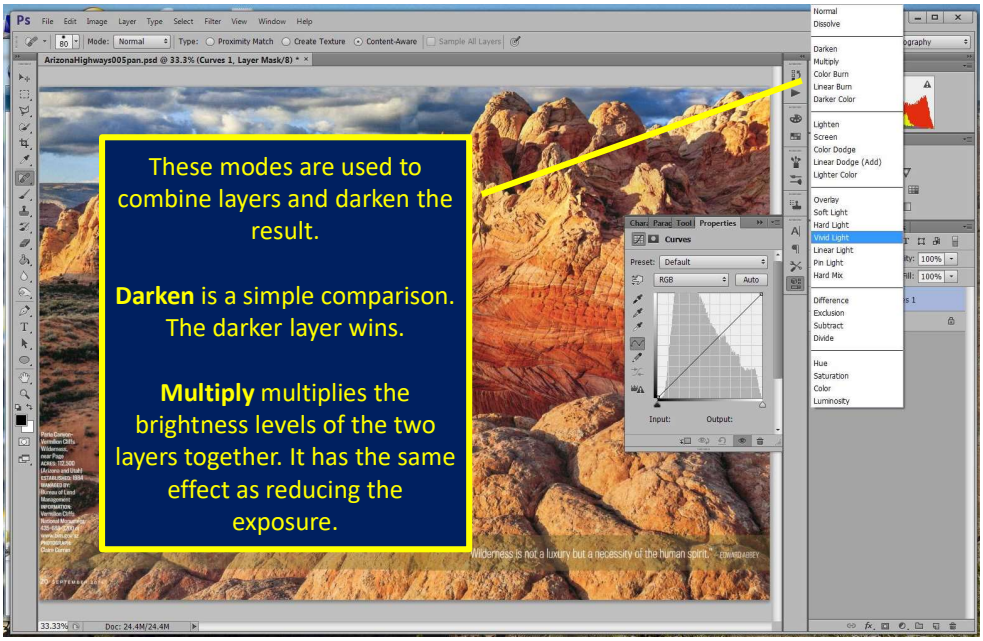

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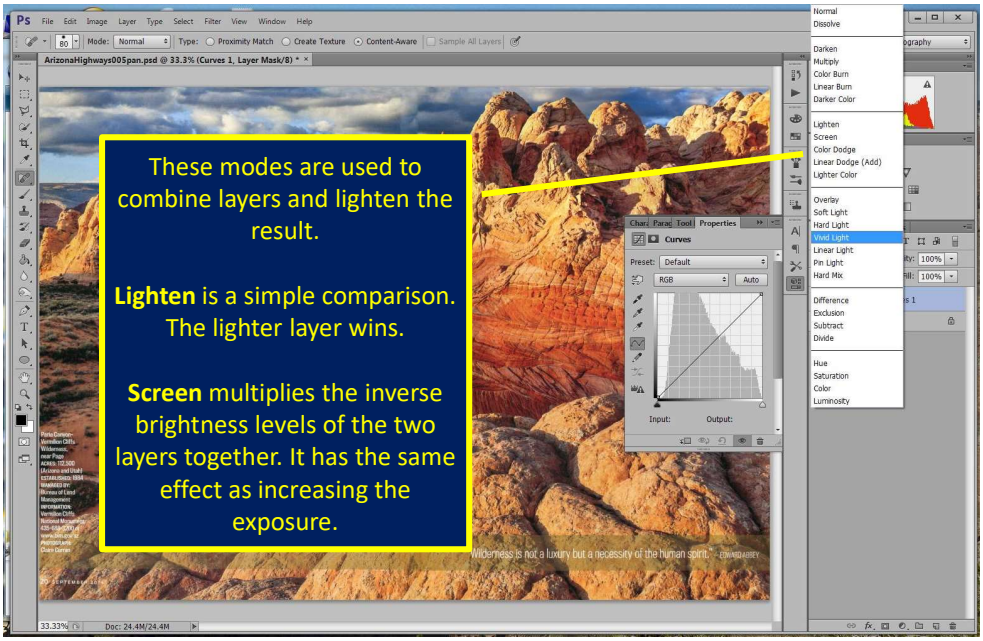

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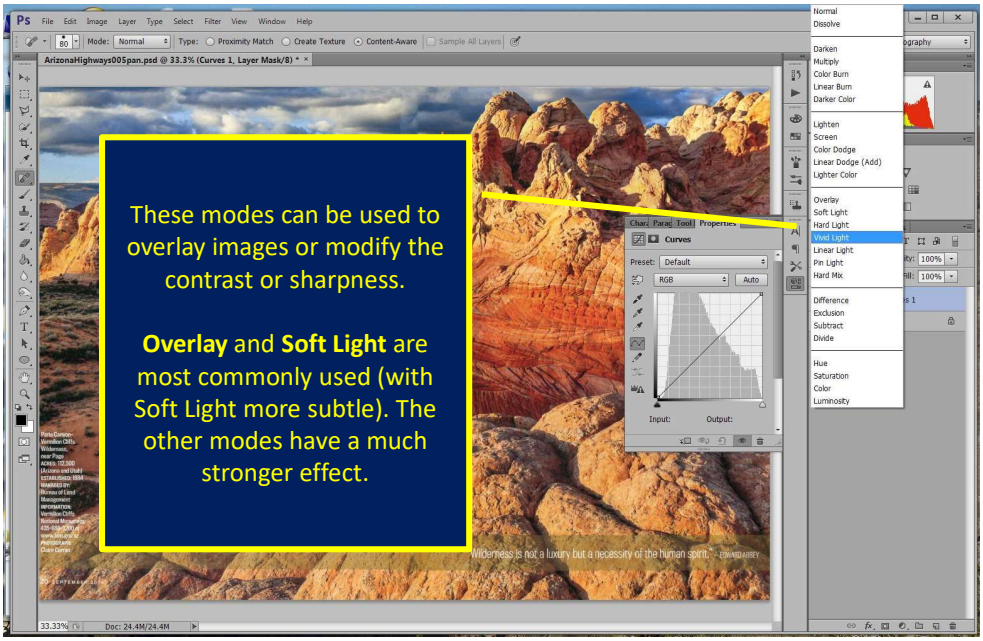
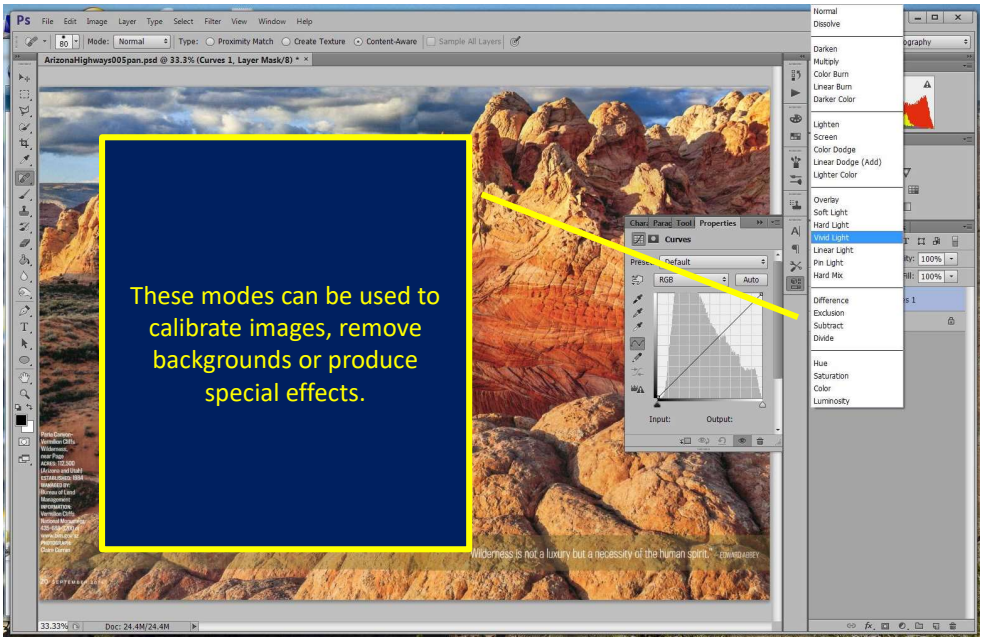


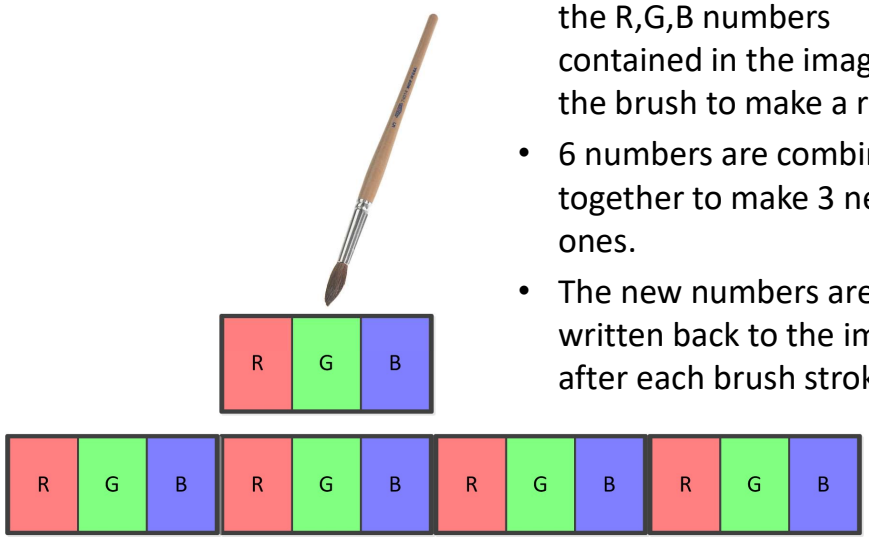
Families of Blending Modes



Brush Controls

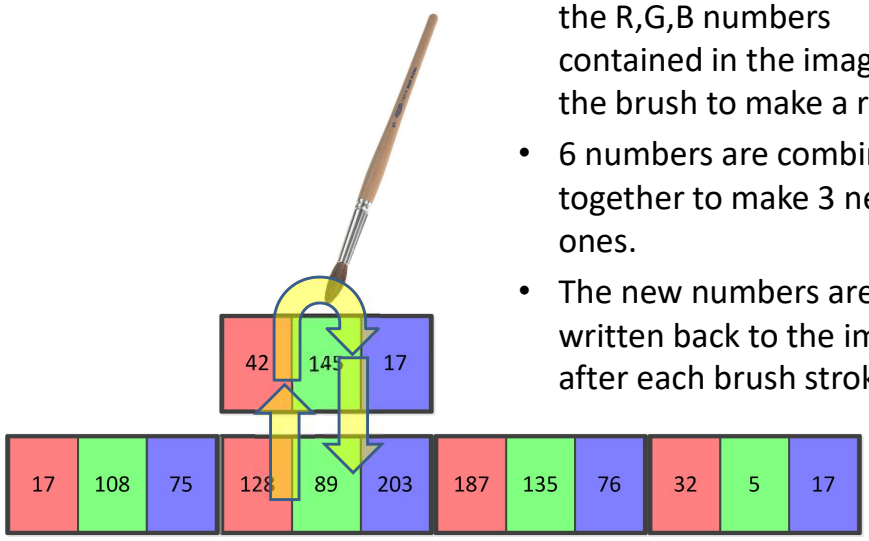
- **Shape**: Brush shape 
- **Size**: Brush size 
- **Hardness:** The sharpness of the edge of the brush.
  
- **Flow:** How much “paint” the brush holds.
  A flow of 20% means 5 brush strokes are needed to build up the full effect.
- **Opacity:** How “see through” is the paint? Sets the maximum effect possible. A black brush at 50% opacity can only paint 50% grey.
- **Mode:** Very similar to layer blending mode.
  See next slide.

Brush Blending Modes



- Brush blending combines the R,G,B numbers contained in the image and the brush to make a result.
- 6 numbers are combined together to make 3 new ones.
- The new numbers are written back to the image after each brush stroke

Brush Blending Modes



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Useful Brush Blending Modes

- **Normal:** Replaces the underlying image with the contents of the brush.
- **Darken:** Only apply the brush where it produces a darker result.
- **Lighten:** Only apply the brush where it produces a lighter result.
- **Luminosity:** Only change the brightness of the underlying image. Makes the brush act like a dodge and burn tool.
- **Colour:** Only change the colour of the underlying image. Useful for colouring an image.

Other blending modes can be used for special purposes. For example “overlay” mode can be used for dodging and burning or for painting “ghostly” patterns over an image.

Dodging and Burning

- The dodge and burn tools only work when you have selected an image layer.
- The dodge tool  lightens an image.
- The burn tool  darkens an image.
- The tools work in a similar way to a brush.
  - "Range" controls whether shadows, midtones or highlights are affected.
  - "Exposure" works like brush "flow", and allows the effect to be built up in several strokes.
  - There is no "opacity" control, but you can reduce the effect with "Edit/Fade Dodge Tool...".

Other ways of Dodging and Burning

- Making selections and adding “Brightness/Contrast” adjustment layers.
- Non-destructive dodging and burning, by painting with white or black onto a 50% grey layer set to “Overlay” blending mode (see later).
- Blending a layer with its own inverse (see later).
- Painting with a grey brush set to “luminosity” or “overlay” mode.