"EXPOSURE FOR ARTISTIC IMAGE MAKING" BY MICHAEL SMYTH

This tutorial discusses how to use exposure as a creative tool in image making and how it is used to convey meaning in our images. Updated 2013

WHAT IS EXPOSURE ?

Exposure in its simplest form is the process of allowing a specific amount of light to fall on the sensor (or film) in our camera. The camera controls that affect the amount of light that reaches the sensor are:

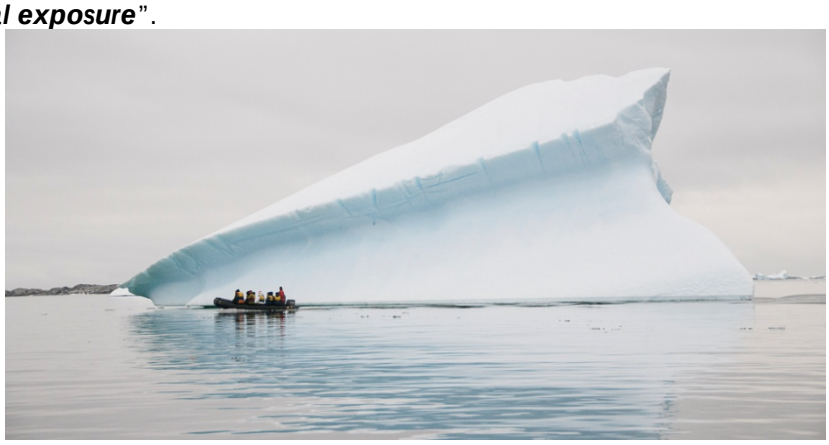
- the ***Aperture*** of the lens being used
- the ***Shutter Speed*** selected, and
- The ***ISO sensitivity*** setting applied.

WHAT IS "CORRECT" EXPOSURE

Wikipedia defines exposure thus: ***"Correct exposure may be defined as an exposure that achieves the effect the photographer intended"***

Therefore the final output image can be "High Key", "Low Key", contain a full tonal range, or have a compressed tonal range, all of which are valid photographic statements.

However, the exposure made at capture ought to provide the maximum information (data) possible to allow for image processing and enhancement in software to achieve any of the outcomes listed above. I call this a "***technical exposure***".



Above: A high Key image has most of the tones in the brighter range, with usually only a small area containing a dark tone. High Key images tend to project a lighter or happy mood.

Above: A Low Key image has most of the tones within the darker range. Images tend to be moody and emotional.

Above Left: An image with compressed tonal range This image displays high contrast and drama

Above right: An image with a full tonal range displays the maximum amount of Information possible

CONTROLLING EXPOSURE

Exposure is a combination of the ***aperture*** and ***shutter speed***, based on the ***ISO sensitivity*** of the sensor.

The Aperture is the size of the hole through the lens that restricts the amount of light that passes through. Aperture settings are expressed as "***f stops***" or "f numbers". The f number is actually a ratio of the size of the aperture divided by the focal length of the lens being used. Somewhat counter intuitively for many people, the larger f numbers (for example f22) equate to smaller apertures, with the small f numbers (for example, f2) equating to a larger aperture. A simple way to imagine this is to think of the f number as a fraction, therefore 1/22 is a small value, 1/2 is a larger value.

Put simply, a large aperture allows a lot of light through the lens, allowing for a shorter time for the shutter to be open (a fast shutter speed). A small aperture allows a small amount of light through the lens, requiring the shutter to be open for a longer period to transmit the same total amount of light.

Aperture size also has a critical effect on the amount of the image that appears to be sharply focussed (known as "***depth of field***"). A small aperture will provide an image with a large depth of field. The type and focal length of the lens being used also has an impact on the zone of sharpness in an image. Wide angle lenses have a greater depth of field than longer focal lengths.

Above: Apertures (courtesy www.engadget.com)

The ***Shutter speed*** is the time that the shutter is held open to allow light onto the sensor. A long shutter speed will show movement in an image, whereas a short shutter speed will "freeze" motion. Slow shutter speeds will also show camera movement, either intentional or unintentional. Generally for landscape photography where the photographer wants a large depth of field a small aperture is used, often resulting in a slow shutter speed. To avoid any unwanted camera movement or "shake" a tripod is recommended.

Above: A fast shutter speed "freezes" action

Above: A slow shutter speed allows for Movement - here both subject and camera have moved during the exposure.

To avoid unwanted camera shake in an image the old "Rule of Thumb" was to use a shutter speed equal to the focal length of the lens, or faster. For example with a 50mm lens, you should use a minimum of 1/60 second. With the arrival of high Megapixel resolution cameras, this "rule" is now thought to be insufficient, so a shutter speed of twice the focal length would be required to avoid noticeable camera shake (in the above example, a shutter speed of 1/100 second would be recommended).

The ***ISO sensitivity*** of the sensor determines how much light is needed for a "technical" exposure. The ISO Sensitivity naming is derived from the old days of film. "ISO" simply refers to the International Standards Organisation which determines the standards for many materials and practices. An ISO setting of 100 is generally accepted as a "Standard" sensitivity for film and sensors. Increasing the ISO setting makes the sensor more sensitive to light, thereby requiring less light to record image data.

Modern cameras can use settings up to and beyond 6400 ISO sensitivity, however the trade off for increased sensitivity is a decrease in image quality and dynamic range (range of brightness captured). High ISO settings display a graininess and colour speckles commonly called "Noise".

For optimum image quality always use the lowest ISO setting possible, given the situation and equipment to hand. For example, in low light situations where you don't have access to a tripod for camera support, use a higher ISO setting rather than introducing unwanted camera shake.

Above: A low light image taken at high ISO showing colour noise (Nikon D100, ISO 6400)

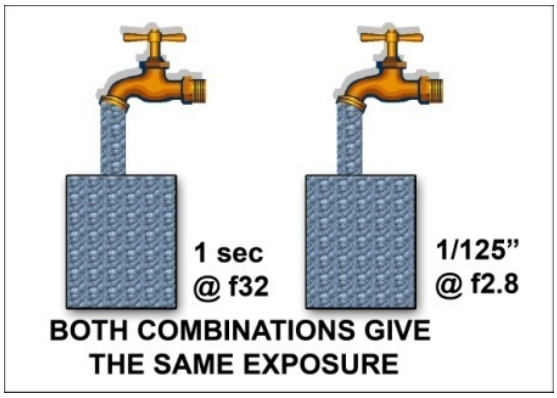
EXPOSURE "STOPS", WHAT ARE THEY ?

Traditionally increments of exposure were changed in "Stops", one stop (or step) in exposure change either doubles or halves the amount of light being let through to the sensor. Modern cameras measure exposure steps in 1/3 steps for greater accuracy, however the principle is the same.

Here is a table showing combinations of shutter speeds and apertures that ***all give the same amount of exposure:***

100 ISO	***Shutter Speed***	**1"**	**1/2"**	**1/4"**	**1/8"**	**1/15"**	**1/30"**	**1/60"**	**1/125"**	**1/250"**	**1/500"**	**1/1000"**
	Aperture	**f 32**	**f 22**	**f 16**	**f 11**	**f 8**	**f 5.6**	**f 4**	**f 2.8**	**f 2**	**f 1.4**	**f 1**
200 ISO		**1/2"**	**1/4"**	**1/8"**	**1/15"**	**1/30"**	**1/60"**	**1/125"**	**1/250"**	**1/500"**	**1/1000"**	**1/2000"**
		f 32	**f 22**	**f 16**	**f 11**	**f 8**	**f 5.6**	**f 4**	**f 2.8**	**f 2**	**f 1.4**	**f 1**
400 ISO		**1/4"**	**1/8"**	**1/15"**	**1/30"**	**1/60"**	**1/125"**	**1/250"**	**1/500"**	**1/1000"**	**1/2000"**	**1/4000"**
		f 32	**f 22**	**f 16**	**f 11**	**f 8**	**f 5.6**	**f 4**	**f 2.8**	**f 2**	**f 1.4**	**f 1**
800 ISO		**1/8"**	**1/15"**	**1/30"**	**1/60"**	**1/125"**	**1/250"**	**1/500"**	**1/1000"**	**1/2000"**	**1/4000"**	**1/8000"**
		f 32	**f 22**	**f 16**	**f 11**	**f 8**	**f 5.6**	**f 4**	**f 2.8**	**f 2**	**f 1.4**	**f 1**

ISO settings increase and decrease in the same steps, so a set exposure at 100 ISO will be halved at 200 ISO and so on.



Above: The combination of aperture and shutter speed can be likened to filling a bucket with a set amount of water:

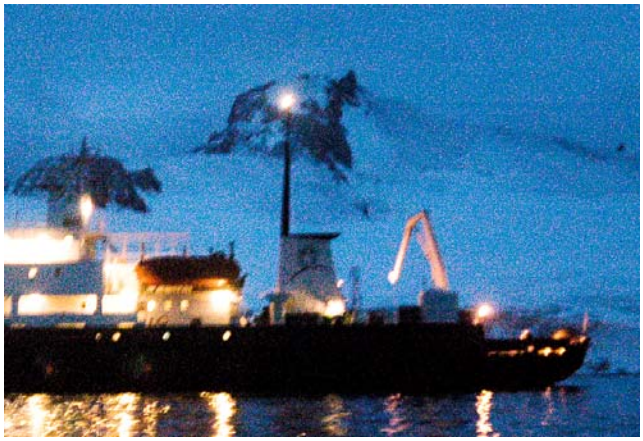
You can turn on the tap fully (wide open aperture) for a short time (short shutter speed) or get the same result with a slow dribble (small aperture) with the tap left open for a longer time. Both methods will provide the same amount of water. Increasing the size of the aperture by one step (or stop - which doubles the size of the hole) will result in a change of the shutter speed by decreasing by one step (halving the time the shutter is open) for the same total exposure.

Making an exposure (recording image data) is the first ***technical*** step in creating an image after the photographer has gone through the process of visualisation and evaluation of the subject at hand.

As we have discussed in earlier tutorials, it is not the end of the image creation process (despite what the "point and shooters" may think) it is the beginning of the ***art and craft*** activities that give rise to a resolved image. (Refer to the ***Creative Image Workflow Graphic*** elsewhere on this site).

Varying the ISO setting or sensitivity of the sensor allows the photographer to use a wider range of exposure combinations in varying situations, usually in low light. The downside of increasing the ISO value of the sensor is that as ISO levels increase, so does noise in the capture. The increased noise can be largely eliminated during the image processing phase, however some loss of detail is inevitable.

Therefore the choice of sensor sensitivity will be a trade off between increased flexibility and a decrease in image quality. As a general rule ISO settings should be kept as close as possible to the optimum or "native" ISO value as stipulated by the camera manufacturer.

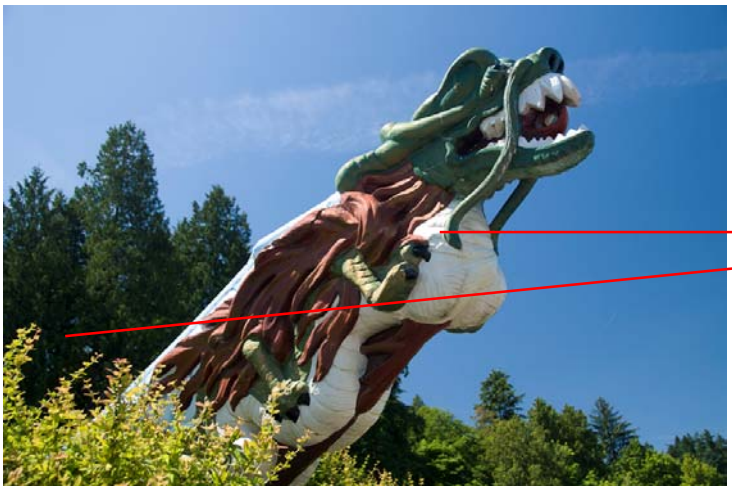


Left: High ISO and low light (JPEG) = very noisy
Above: Low ISO and low light (RAW) = low noise
Images © Michael Smyth 2010

WHAT IS A "TECHNICAL" EXPOSURE

A ***technical"*** exposure records the various levels of brightness in an image within the limitations of the sensor's capabilities without clipping (burning out) of either the highlights or shadows. Camera exposure meters are designed to work with a mid tone approximating 18% grey, which typically is the brightness value of Caucasian skin, grass or heavily printed newspaper.

A bright sunny day may have a brightness range of 15 stops or more, whereas the best digital sensors available (in DSLRs) can record up to 14 stops (RAW capture), or 10-12 stops with JPEG capture (depending on processing options selected).



Real World dynamic range:
Here in this image taken around midday you can see the extreme brightness range. From the deepest blacks to the brightest whites there are at least 10-15 "stops" of brightness range, possibly more
Highlights
Blacks

Some clipping is inevitable, or extreme contrast can be captured with several exposures and blended to form an "HDR (High Dynamic Range) image.

Image © Michael Smyth 2010

Therefore in extreme conditions the photographer will have to make a value choice over recording all of the shadow details or all of the highlights. In most instances, keeping the highlights within the sensor's range is the preferred option as we naturally are drawn to bright areas in an image.

There is of course the option to capture a "High Dynamic Range" (HDR) series of images that can be blended together in Photoshop or other software, however apart from extremely contrasty situations, a carefully controlled capture will usually provide sufficient data for processing.

E.T.T.R. - EXPOSE TO THE RIGHT

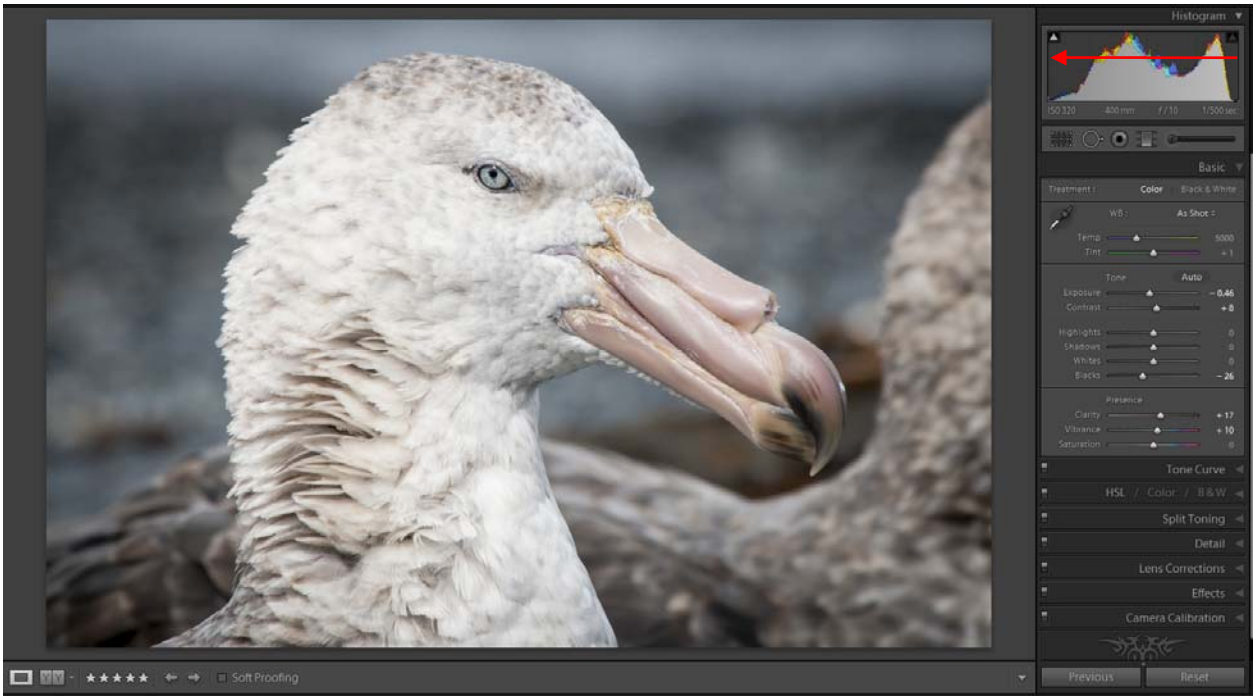
The way our camera sensors record brightness mimics our eyes, in that we do not perceive brightness in a linear fashion. As the brightness levels get higher, our eyes do not respond equally. In the same fashion the brightness values in an image capture has the bright tones compressed. What this means is that the majority of the image information is contained in the brighter tonal range and very little in the darker tones.

For a RAW image file, captured using 12 bits of data (the default for most DSLRs) there are a possible 4096 levels of tone from the darkest to the brightest part of the image. If we assumed that the image covered a 5 stop tonal range (most images do not cover the full tonal range possible) the image data would be captured something like this (based on information published by Michael Reichmann - www.theluminouslandscape.com)

Brightest stop of exposure	2048 possible levels of tone
Second stop	1024 possible levels of tone
Third stop	512 possible levels of tone
Fourth stop	256 possible levels of tone
Fifth stop	128 possible levels of tone

The concept of exposing to the right tries to keep the exposure as far into the bright tones as possible, without clipping (overexposing) the highlights as this is where the most information is recorded. Here is an example:

Above: Original capture without processing - note how the histogram is close to the right hand (brightest tone) end of the graph.



Above: Processed image with the tonal range extended into the darker tones (amongst other processing steps) revealing much more image information.

Note: all images (apart from carefully controlled studio situations) will require some selective lightening and darkening as part of the image processing phase so the most important thing to achieve with the capture is having the most information to work with during the processing steps.

SOME MYTHS 'EXPOSED"

Myth #1 "Get It Right In Camera

In the real world, it is usually not possible to record all parts of an image with their "correct" exposure. For example, in a typical landscape image it is not possible to record both the earth and the sky at their optimum levels of brightness. An exposure that is "correct" for landforms will overexpose the sky and a "correct" sky exposure will render the land under exposed.

Left: Exposed for the Ground

Centre: Exposed for the sky

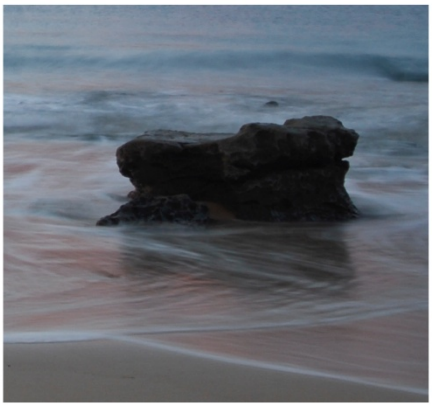
Optimised : "***correct***" exposure

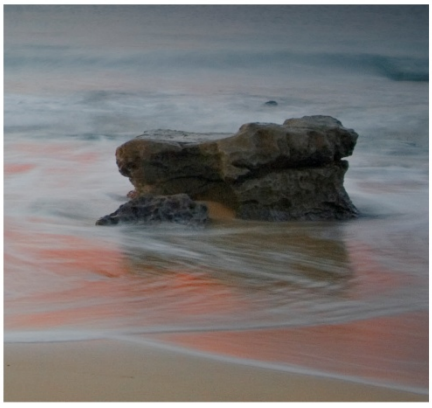
A capture that retains details of both highlights and shadows can then be refined and "optimised" during processing to produce an image that reflects the photographer's vision.

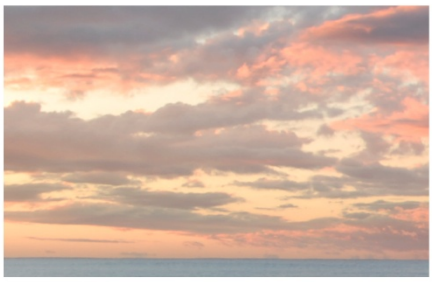
The final image that has been refined by the photographer will have the "Correct" exposure. That is, the image will achieve the result the photographer intended.

Myth #2 "Just Shoot JPEGs so you don't waste time in processing images"

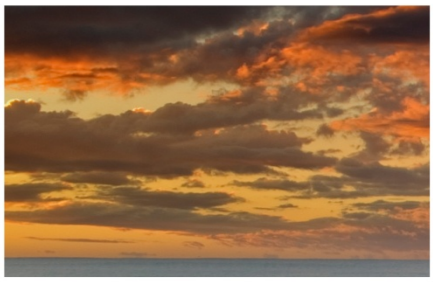
There is a small band of photographers that seem to think that it's all too hard to capture RAW files and then process them in software. The reality is that once a photographer is experienced with the tools available, images can be quickly processed and optimised to give vastly superior results to a JPEG image processed in camera. Here is an example of the differences:



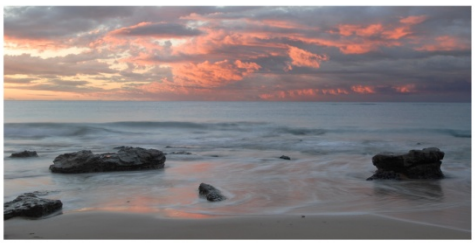




JPEG DETAIL



RAW CONVERSION DETAIL



In camera JPEG conversion from the RAW capture will lock in the colour balance, compress the tones, add contrast, sharpening and saturation. This may be OK for some images, but often it is not what the photographer wants. The other restriction is that once the JPEG has been created by the camera, it is effectively "baked in" and can't be changed significantly.

Myth #3 " Underexpose to avoid burnt out highlights"

There is another school of thought that thinks that the best way to avoid blown out highlights is to deliberately underexpose an image at capture.

As we saw in the section above on ETTR there is very little information captured in the darker tones of an image. Deliberately underexposing will miss out on most of the possible information available and when the file is processed later, there will be little or no information that can be brought out. Here is an example:

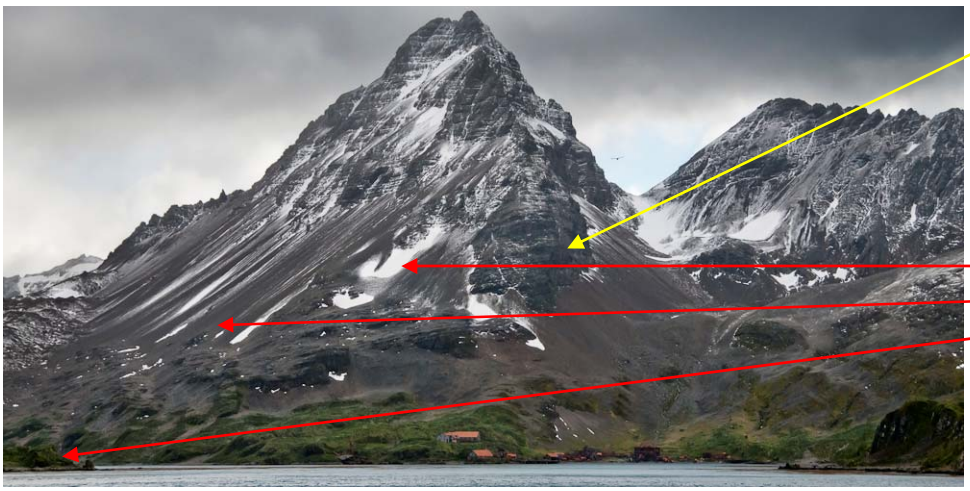
Above: a night time shot underexposed

Above: the processed image - little or no information in the darker areas.

MEASURING EXPOSURE – LIGHT METERS AND THE HISTOGRAM

Using a modern DSLR on Auto or Program mode (also known as "PHD" – Push Here Dummy mode) will not allow the photographer creative control over image capture – the ***Aperture*** and ***Shutter Speed*** combination that will give the desired outcome. It is recommended that either Aperture Priority or Shutter Priority exposure is used to allow for the photographer's input and control of the capture.

Our cameras use an inbuilt light meter that measures the light being ***reflected*** from the subject. Despite the advances in Matrix or segment metering and lots of computing power , unusual subjects that are brighter than average (e.g. snow) or darker than average (e.g. the ocean seen through a polariser) will mislead the exposure meter into giving an inaccurate reading. Using a hand held "***incident***" light meter measures the actual brightness of light falling onto the scene and is not affected by unusual subjects.

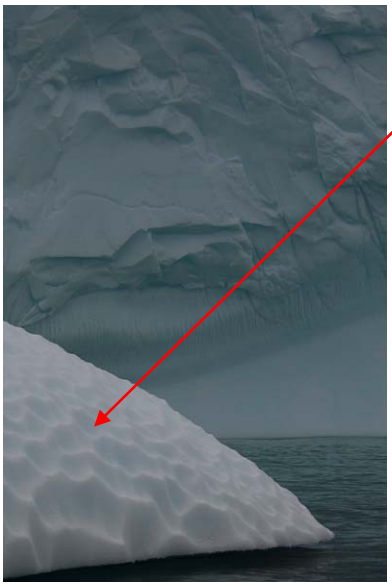


Incident light meters measure the light falling on the subject and give accurate results.

Inbuilt camera light meters measure reflected light.
Highlight
Mid tone
Shadows

Above: Here is a scene that has varying levels of brightness. Note that the sky has been largely framed out of the image as overcast sky is likely to fool the camera's meter.

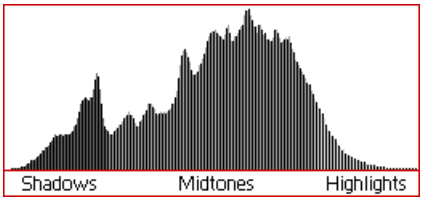
The problem is that the light meter doesn't know we are photographing snow (or any other "non average" scene) and tries to render the middle tone of the scene at (18%) mid grey, giving us grey instead of white. Fortunately we have in our possession the greatest computer yet invented – the human brain ! We can see what we are photographing and can decide how that scene should be recorded and make adjustments as necessary.

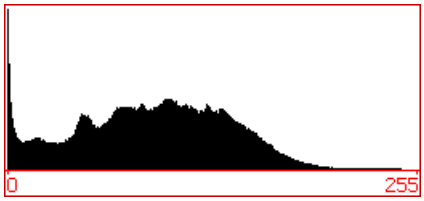


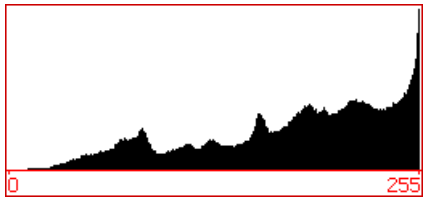
Left: Camera metering has rendered the white ice as grey

Right: By overriding the exposure by adding + exposure compensation, the ice has been exposed "correctly"

We also have the ***histogram*** as a valuable tool in assessing how the image data has been recorded. Using this as a guide we can take a test exposure and evaluate the results. In our hypothetical snow image, the histogram will show that no data has been recorded much above the mid range (centre graph below), when clearly there is a lot of very bright white snow in the image.







Above: A typical histogram, no clipping of highlights or shadows

Centre: Underexposed - shadows clipped

Right: Overexposed - highlights clipped

Clearly we need to make some adjustments to the exposure and can now correct this by increasing the exposure (adding more light). Usually the camera will have an exposure compensation function that will allow us to fine tune the exposure to give us what we want. How much adjustment you need to make and in what circumstances can only be judged by experience with your equipment and close study of the histogram.

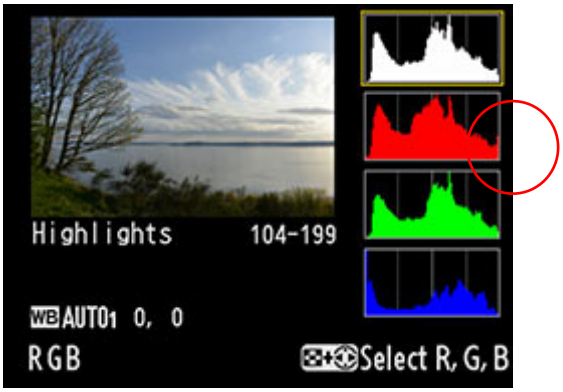
Above: the exposure compensation button - found on almost every digital camera.

Try making an adjustment and making another capture, then re check the histogram to see if you have the desired result. Obsolete test images can be deleted and your "optimal" exposure kept as your working capture for later processing.

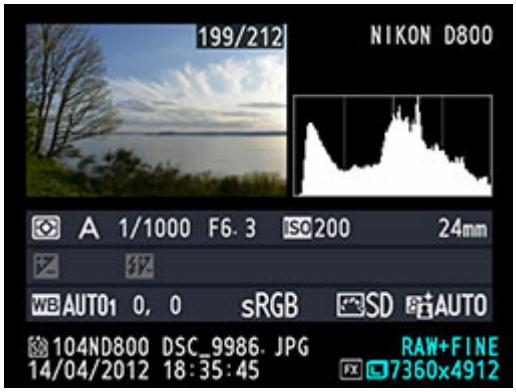
The histogram is your most valuable tool on your camera and you should "***learn to love the histogram***".

Note: There is no such thing as a "***perfect" histogram***. Each histogram is different and the important thing is to look for clipping of either the highlights or shadows.

The Histogram is a graph of the brightness levels in an image file, the height of the graph represents a proportion of the image data recorded at each brightness level. The graph shows brightness with black (or 0 level of brightness) at the left and the maximum brightness at the right hand end. Histograms can show overall brightness (luminosity), or the brightness of each of the three channels (R, G, B) recorded. A three channel histogram is useful to see which channel/s have been clipped (overexposed). If only one channel is clipped, it will be possible to recover most if not all of the information during processing.



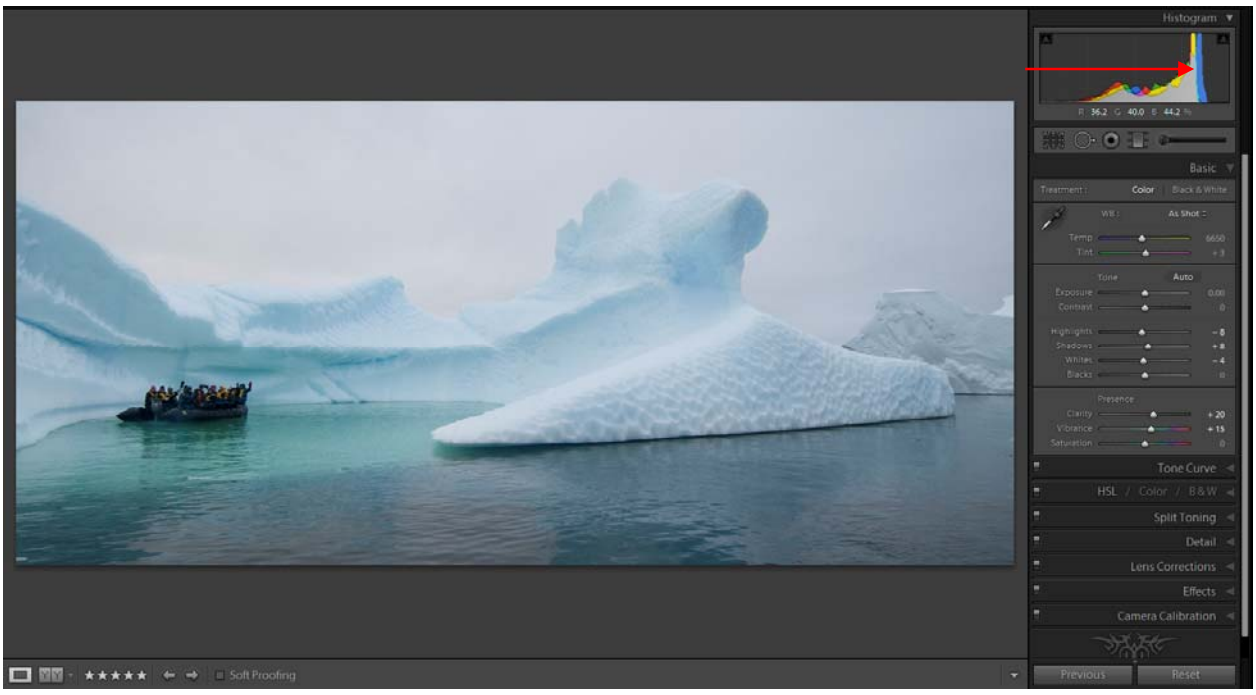
Above: Nikon 3 channel histogram
Note: the red channel shows some clipping.

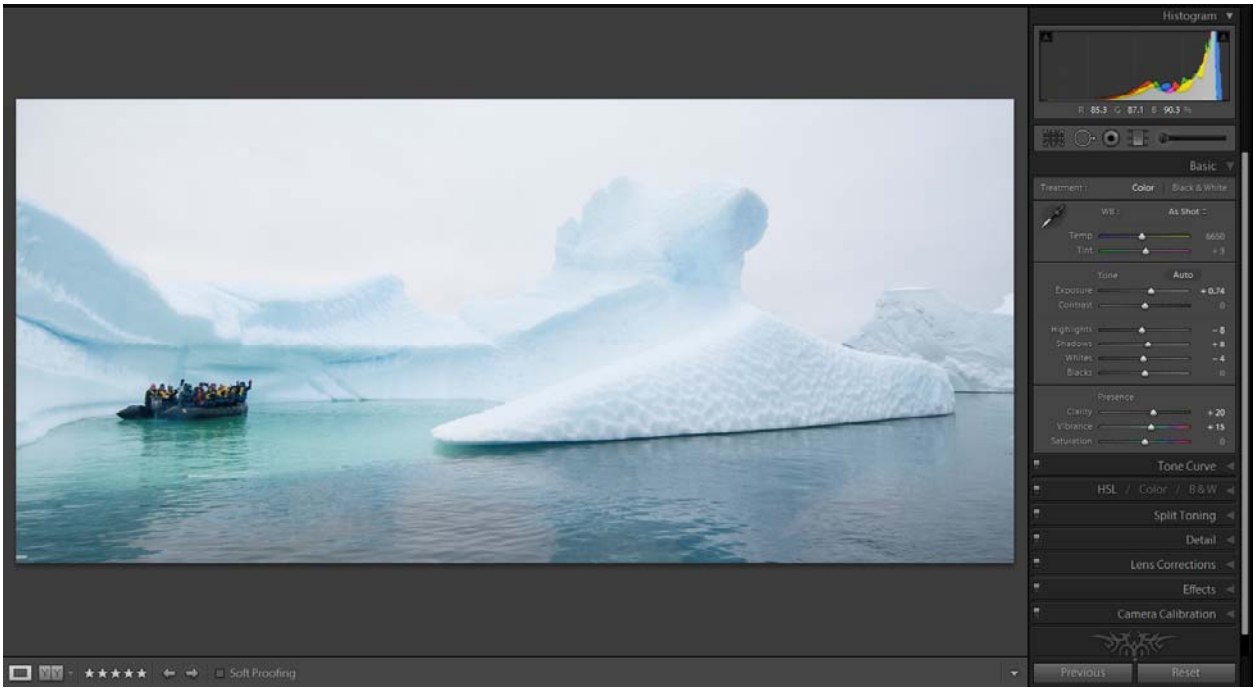


Above: Luminosity histogram.

EXPOSURE COMPENSATION IN ACTION

Below is an image captured without exposure compensation. There is a large area of white sky and iceberg in the image, but the histogram is a long way from the right hand (brightest tones) end of the graph.





Above: The image has had an exposure adjustment (here simulated in processing) of +0.75 stops. The correct "technical" exposure would have had the brightest tones recorded at the right hand end, but not clipped.

CREATIVE EXPOSURE CONTROL

We have seen how to use exposure to capture data that will give us creative control over the final image. We then have a number of options available to us that can help us to produce a "***picture***" rather than a "***document***", or in other words, rather than simply being a photocopier of the world, we can produce our interpretation, an image that convey feelings, emotion and meaning.

Here are a few options for creative use of exposure as a creative tool:

Creative use of Exposure #1: Movement. Creative control over exposure and technique can allow for expressive interpretation of a scene where there are some moving elements.

Movement 1: Using a long exposure to record movement in part of the image – in this case the sea rolling onto the rocks along the coast of Norfolk Island.

Movement 2: Using a relatively long exposure and moving the camera to capture a moving subject adds additional feeling to the image.

Movement 3: Using a relatively long exposure and moving the camera only to capture a stationary subject adds interpretation to the image.

Creative use of Exposure #2: Added or reduced depth of field images. Using a creative approach to exposure, even using multiple exposures blended together can achieve expanded or reduced depth of field (increased or decreased apparent sharpness) in an image.

Depth of Field 1: This image from King Haakon Bay in South Georgia was taken using a very wide angle lens and a small aperture to include sharpness from the nearest point all the way to the mountains in the distance

Depth of Field 2: This image of a fern frond unfolding was taken with a standard lens (50mm) at f1.8 for a very shallow depth of field (and tripod mounted). The narrow range of sharpness focuses the viewer's attention on the uncurling fronds whilst isolating the background.

Creative use of Exposure #3: Expanded Tonal range. Taking an exposure that has been "exposed to the right" you have options to adjust the tonal range during processing.

Expanded tonal range #1: This is the original capture that has been exposed to the right. There is little shadow detail evident.

Expanded tonal range #2: This is the processed image. Note that the sky has been selectively darkened, but the whole image has a broad range of tones. South Georgia Island

Creative use of Exposure #4: Low Key. Using an image that has captured a wide tonal range, all outcomes can be processed to suit the photographer's intent.

Low Key #1: Here an image captured in the middle of the day has been processed to look like a night time photograph and displays a moody, dreamlike appearance.

Low Key #2: Here an image of an old bike tossed into a dam has been processed to give a dark, mysterious mood.
Image © Michael Smyth 2010.

Creative use of Exposure #5: High Key. These images have the majority of the tones in the brighter range, however some part of the image should contain a black or darkest tone. Capturing the maximum image data allows for choices of presentation of the final image. Generally High Key images are uplifting, happy and positive.

High Key #1: Here the image of penguins hitching a ride on an iceberg in Antarctica has been deliberately kept to a high tone to retain the mood and subtle colouring of the scene.

Image © Michael Smyth 2010.

Creative use of Exposure #6: Multiple exposure in camera. Some cameras allow for making two or more images combined at capture to make a montage. This is different from combining images later in Photoshop and requires more forethought and practice. The camera will adjust the overall exposure of the two images automatically if needed.

Multiple exposure #1 & 2: Here two separate but related elements have been combined together at capture to reveal an interpretation of the scene and not simply a "record". Kathmandu and Tibet 2011

IN CONCLUSION

Exposure is a valuable tool in the creative image making process. Knowledge of how to measure, adjust and optimise data capture frees the photographer to process the image data in order to realise their vision.

Remember, "correct" exposure is the exposure that suits your image making requirements.

Use exposure as another tool to realise your personal vision. Experiment with exposure techniques and develop your own way of interpreting your subject. Create a "picture" and don't just photocopy the world.