

Back To Basics

Camera Settings

Write up of the main points from Dave Gray's presentation to
Devizes Camera Club on 18th September 2012

Topics Covered :

1. File Format : RAW v JPEG - Quality v Convenience
2. Exposure metering : Automatic/Partial/Spot & coping with extremes
3. Colour Balance : Automatic or Preset
4. ISO : Adjusting the sensitivity of the sensor
5. Aperture : Basic concept and effects on depth of focus
6. Shutter Speed : Setting for subject movement and camera movement
7. Aperture/Shutter Speed/ISO : used in combination to deliver the correct amount of light to the sensor; Aperture Priority v Shutter Priority modes
8. Focusing : targeting the autofocus point; use of Manual Focus with Liveview
9. Summary

With such a list of apparently complex options to master, there is a strong temptation to 'stick it on automatic and hope for the best'. Sometimes this will give good images but it will be inconsistent. However with a little understanding, and concentrating on what is important, your pictures will become consistently good.

1a. File Format : RAW v JPEG

All digital cameras will be able to save pictures in JPEG format, and most will also offer the ability to save in RAW format. This is essentially a choice between using RAW for maximum quality or JPEG for convenience.

RAW pictures :

- contain all the data (light and colour) that was captured by the sensor at the time of shooting
- give the maximum flexibility for editing on the computer
- contain a wider exposure range than can be displayed on a monitor or printed, particularly in the highlights. What initially appears burnt-out on the monitor will reveal detail when darkened during editing

But :

- the files need to be processed on the computer to create a picture that can be shared or printed
- file sizes are larger than JPEG

JPEG pictures :

Editing is done 'in-camera' at the point of shooting, with colour balance, saturation, contrast, sharpening etc applied automatically. The file is then 'compressed' by discarding what the automatic editing regards as redundant data

- because the picture is processed in camera, it is immediately available to use eg to upload to Facebook or to print directly from the camera's memory card
- the compressed file is significantly smaller than the equivalent RAW file

But :

- because the processing discards what it deems to be 'unwanted data', it becomes more difficult to edit on the computer because the data is incomplete.

1b. Different Settings for JPEG pictures

If you choose to shoot in JPEG, there are further options on Size and Compression which trade off quality against file size.

Size :

- you choose between using all of the pixels on the Sensor (Large) or just some of them (Medium and Small)
- Medium and Small settings will produce a smaller file, but the detail will be coarser than a Large setting

Compression

- you choose how much 'redundant' data is discarded by the automatic JPEG processing
- Settings are labelled Superfine (least compression), Fine (more compression) and Normal (most compression)
- Fine and Normal settings will produce smaller files, but will contain less detail than Superfine
- Fine and Normal will compound the difficulties in editing the picture on the computer afterwards

Given the low cost of memory, you would normally only opt for a small size or greater compression if there is a specific application in mind eg loading the picture directly onto a website.

2. Exposure Metering & Coping with Extremes

Exposure Metering means measuring the light falling on the sensor when the picture is taken. The aim is to ensure that the important parts of the picture are well exposed with a good range of tones from light to dark.

The main ways of metering for the exposure are :

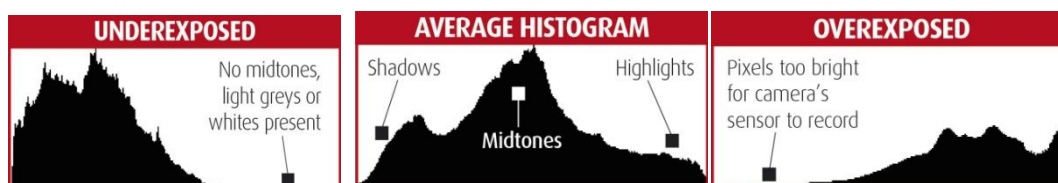
- Using the camera's automatic metering system to calculate an average across the entire scene - either as a simple average, an average biased towards parts of the scene (eg centre weighted), or a more sophisticated 'evaluative' method
- Using the camera's automatic metering system to measure the light falling on a small part of the scene. Spot metering may cover less than 3% of the scene, whereas Partial will cover a slightly wider area of around 10%.
- Using a hand held meter. There is a whole science behind this, which is well beyond a 'Basics' tutorial.

If shooting in RAW file format mode, the latitude inherent in the format will normally allow any small errors in exposure metering to be corrected when editing on the computer. For this reason, methods using a whole scene average will usually give acceptable results. Partial or spot metering will however give better results if the subject is significantly brighter or darker than the majority of the scene - for instance a spot-lit performer on an otherwise dark stage.

JPEG files give less latitude to recover areas of deep shadows or burnt out highlights, and so need more careful attention to exposure metering.

The Histogram

After taking the picture, the exposure can be checked using the Histogram facility.



The histogram gives a quick visual representation of the tones in the picture. Ensure that the 'mountain' is not squashed too much to the left or right of the picture.

2. Exposure Metering (continued)

Coping with Extremes

Sunset/Sunrise

Some scenes such as sunrise/sunset landscapes have such extreme differences between lightest and darkest tones that a single exposure cannot capture both satisfactorily. The solution is to 'bracket' exposures :

- Set the camera on a tripod
- Keep the aperture constant by setting the shooting mode to Aperture Priority (see Section 7 below)
- Take at least 3 photos in quick succession - one exposed normally, one underexposed by 1 or 2 stops, and one overexposed by 1 or 2 stops.
- On the computer, blend the 3 photos into a single image. This can be done manually or automatically using specialist software such as Photomatix.
- This technique is known as 'High Dynamic Range' or HDR processing

Portraits in bright sunlight

Another problem lighting scenario involves photographing people outside in bright sunlight, particularly if they are wearing hats. The difficulty is in balancing the shadow area of the face (which is the most important part of the picture) with the bright sunlit surroundings.

A reasonable way to balance the two is to use 'fill-in flash', so that the flash illuminates the face and lightens the shadows, while sunlight illuminates the surroundings. Modern exposure metering should give good results automatically, though the flash may need to be set to fire at half power (ie under-expose by one stop) to avoid over-lightening the face.

Also beware posing the subject immediately in front of a wall etc to avoid the flash creating an ugly shadow on the wall immediately behind the person being photographed.

3. Colour Balance

The human eye is very good at automatically adjusting to different types of lighting, so that white is always perceived as white. Cameras replicate this by calculating the colour balance in the scene and applying this to the image.

For the photographer, there will be a choice on-camera of

- allowing the camera to calculate the colour balance automatically,
- setting the colour balance using one of many pre-set profiles such as sunlight, cloudy, flash, tungsten, florescent etc.

If shooting in RAW file format, the colour balance used at the time of taking the picture does not matter because it can be corrected later on the computer with no loss of quality. Indeed the computer editing 'RAW convertor' will normally offer the same preset profiles as the camera itself.

Shooting in JPEG file format makes it more difficult to correct errors at the editing stage and hence it is preferable to use the camera built-in pre-set profiles to ensure the correct colour balance is used at the taking stage.

4. ISO - Adjusting the sensitivity of the sensor

[ISO stands for International Standards Organisation, which specifies standards for a huge number of devices and even services. In this context, the ISO standard specifies the sensitivity of the camera's sensor.]

- Camera sensors have a 'native' sensitivity to light, normally set at ISO100
- This sensitivity can be boosted by amplifying the electric signal as it passes from the sensor to the camera's processor. ISO 200 doubles the sensitivity compared with ISO 100, and ISO 400 doubles it again. Some high end DSLR cameras now have an ISO in excess of 100,000.
- The consequence of using increased ISO settings is the introduction of 'noise' into the image. There are 2 types of such noise :
 - luminance noise introduces an overall 'graininess' to the image, especially apparent in areas of smooth tones such as sky
 - colour noise, which typically manifests itself as splodges of random colour in the deepest shadow areas.

Both types of noise can be reduced to a certain extent during editing, though at the expense of fine detail, and a compromise has to be struck between reducing noise and preserving detail.

- However, noise can also be used creatively, for instance to give an impression of grime in an industrial scene or to add character to a portrait.
- Some cameras handle noise much better than others, and typically, the larger the sensor, the better the ability to increase ISO with minimum increase in noise.

5. Setting the Aperture



The Aperture in the lens (also known as the Iris) is a variable size 'hole' which allows light to pass through the lens to the sensor. It is therefore one of the main ways to control the amount of light reaching the sensor to create a well-exposed image.

Apertures are quantified by a numbering system :

- part of the series is quite logical : f2....f4....f8....f16 ie doubling each time
- however, the light allowed through does not double (or halve) between each number, but rather it quadruples (because the aperture has both length and breadth)
- intermediate numbers are therefore required to represent the doubling/halving of light passing through. These intermediate numbers are f2.8...f5.6...f11...f22.
- the full series is therefore : f2...f2.8...f4...f5.6...f8...f11...f16...f22
- it is counter-intuitive, but the larger the number, the smaller the aperture and conversely, the smaller the number, the larger the aperture.

5. Setting the Aperture (continued)

From a photographer's point of view, a much more important function of the Aperture is the effect on Depth of Focus (also known as Depth of Field).

When you focus on an object in the scene, that object will be in sharp focus and everything in front or behind it will, to varying degrees, be less sharply focused. However, to the human eye, there will be a zone in front of the object and also behind it, which appears to be in sharp focus. This is known as the depth of focus.

The Aperture in the lens is crucial to varying the depth of focus. Using a small aperture such as f16 or f22 will maximise the depth of focus, whereas a wide aperture such as f2 or f2.8 will minimise it. Thus :

- for a Landscape, select a small aperture to obtain sharp focus from foreground to horizon. Still Life images can benefit from a similar approach if the aim is to have the whole of the subject acceptably in focus.
- for a portrait, use an aperture which is just wide enough to render the face in focus, leaving the background out of focus. This will make the portrait 'jump out' of the scene, as the eye tends to be drawn to those parts of the image which are in sharp focus. Nature studies can similarly benefit from this approach.

Choice of lens focal length can also accentuate this approach. Although in mathematics, the depth of focus does not change with different focal length lens, the appearance to our human eyes does. Thus :

- a wide angle lens makes further away objects appear smaller and therefore decreases the amount of unsharpness that the human eye can detect. Unsurprisingly, these are popular for Landscape images.
- a telephoto lens magnifies the amount of unsharpness and makes it more apparent to the human eye. A macro lens used very close to the subject has a similar effect.

A final consideration on choice of aperture is that most lenses are at their sharpest when set to a mid-range aperture such as f8 or f11. How much of a difference this makes in practice will vary from lens to lens and camera to camera. It is probably worth trying a few shots of the same image at different apertures, and comparing the quality at wide aperture, mid-range and small aperture. You can then decide whether this should be a factor when deciding what aperture to use.

6. Setting the Shutter Speed

Shutter speed is the other control which, in conjunction with Aperture, regulates the amount of light reaching the sensor.

However, considered on its own, the shutter speed should be used to :

- **Control Subject Movement.** The choice here is between using a short duration shutter speed to freeze any movement in the scene or using a longer speed to blur the movement.
 - Moving water such as a waterfall often benefits from being shown as a blur, using a speed between 1/15th second & 1/4 second
 - A choppy sea can be made much smoother and mirror like by using a shutter speed of several seconds.
 - Nature subjects, especially animals running or birds flying, will need a shutter speed often in excess of 1/1000th second to freeze the movement and capture the detail in fur or feathers.
 - Sports scenes can use either approach, with the action either frozen to capture facial expressions or blurred to give the impression of speed.
- **Control Camera Movement** ie Camera Shake when Hand Holding. The problem of Camera shake is relative to the focal length of the lens, as a telephoto lens will magnify the shake as well as the subject, while a wide angle one will minimise it.

A simple rule of thumb from the days of 35mm film was that the minimum shutter speed should be the reciprocal of the lens focal length. In plain English :

Lens Focal Length	Minimum Shutter Speed
50mm	1/50th second
30mm	1/30th second
100mm	1/100th second
200mm	1/200th second
500mm	1/500th second

This can still be useful providing allowance is made for different sensor sizes and Image Stabilised lenses.

7. Aperture/Shutter Speed/ISO

Sections 4, 5 and 6 looked at the effects different ISO settings, Apertures and Shutter Speeds each had on the appearance of the image. However, they also have to be used in combination to deliver the correct amount of light to the sensor in order to create a well exposed image.

To do it manually, we would be faced with picking one of many possible combinations from a whole series of numbers, all delivering the same amount of light to the sensor. In the following table, moving up and down each column doubles or halves the amount of light reaching the sensor. Poorly lit scenes would tend to move us to the top of the table, whereas in bright sunlight, we would be towards the bottom.

ISO	Aperture	Shutter Speed
12800	f2	1/8th sec
6400	f2.8	1/15th sec
3200	f4	1/30th sec
1600	f5.6	1/60th sec
800	f8	1/125th sec
400	f11	1/250th sec
200	f16	1/500th sec
100	f22	1/1000th sec

Fortunately, the camera can help simplify this complexity. Firstly, we need to decide whether selecting the desired Depth of Focus or the desired Shutter Speed is the more important.

If Depth of Focus is more important :

- select Aperture Priority (Av) mode on the camera
- select the desired Aperture
- check the shutter speed is fast enough - if so, take the picture
- if not :
 - increase the ISO until the shutter speed is fast enough
 - or compromise on the Aperture by selecting a wider setting

If Shutter Speed is more important :

- select Shutter Priority (Tv or sometimes S) mode on the camera
- select the desired Shutter Speed
- check the Aperture is within range - if so, take the picture
- if not
 - increase/decrease the ISO until the Aperture is within range
 - or compromise on the Shutter Speed set.

8. Focusing

Targeting the Autofocus point

Autofocus works by locking on to parts of the picture with significant contrast, but this may not be the main subject of the picture.

DSLRs have a number of visible 'cross hair' focus points in the frame, and if all these focus points are turned on, the camera will select the one with the greatest contrast. This leads to a typical problem eg with portraits, in which the face has relatively little contrast compared with detail in the clothing. The result can be perfectly focused clothing and imperfect focus on the face, particularly the eyes.

A solution for this is :

- turn off all 'cross hair' focus points except the central one
- line up this focus point with the main part of the picture eg the eyes in a portrait
- lock the focus, recompose and then take the picture
- you may need to lock the exposure as well before locking the focus

Using Manual Focus with Liveview

For static subjects (eg Landscape, Still Life), very fine focus accuracy can be achieved using Manual Focus with Liveview.

For this :

- it is essential that a tripod is used so the camera does not move during focusing
- it is also essential that the camera has a stop-down button. The normal view through either the viewfinder or Liveview sees the picture with the lens at maximum aperture. In order to focus correctly, you need to be able to see the depth of focus at the selected taking aperture.
- turn on Liveview and zoom in to 5x magnification
- with the stop-down button engaged, turn the manual focus ring on the lens to achieve crisp focus
- navigate across the frame to ensure the image is sharp from foreground to background

Liveview also has the advantage of locking up the mirror, so avoiding vibration caused by the mirror springing up and back when the shutter is pressed.

9. Summary

This sounds a lot of detail to think about before taking a picture, but in practice, it is very straightforward :

- File Format is rarely changed - select RAW or JPEG when you start according to your way of working, and then forget about it.
- Shoot RAW to give you the latitude to rely on automatic exposure metering in most cases
- Shoot RAW and you can use the automatic colour balance setting in all cases
- Select an ISO appropriate to your subject - eg ISO 100 for Landscapes & Portraits, ISO 400 for Nature. You would rarely change it during the course of a shooting session
- Use Aperture Priority or Shutter Priority as dictated by the subject to achieve the desired 'look' to the image. This is the main aspect you need to concentrate on.
- Make sure you point the autofocus to the most important part of the picture, then recompose.
- Take the shot.