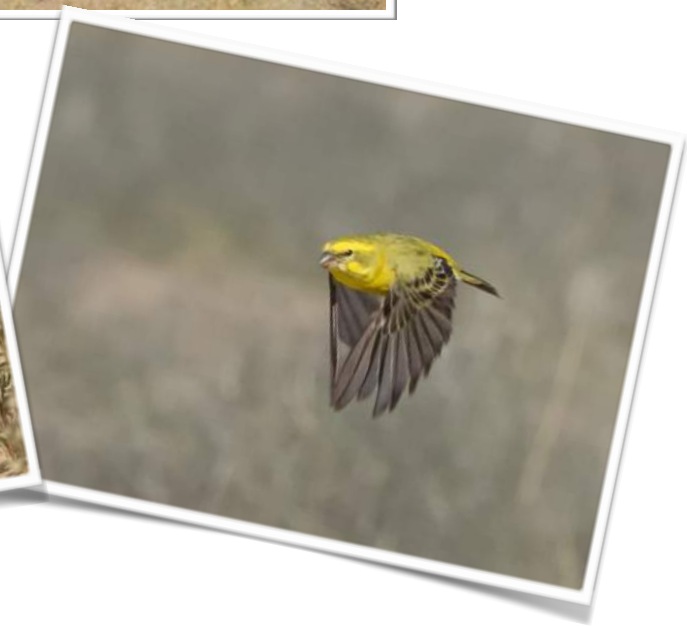
Basic Camera Craft



Roy Killen, GMAPS, EFIAP, MPSA

Basic Camera Craft

Whether you use a camera that cost $100 or one that cost $10,000, you need to be able to use it in ways that will give you the best results possible from *that* camera. To do this, you need to understand some basic principles of photography and you need or understand how to apply those principles when using *your* camera.

When you understand the capabilities of your camera, and how to control them, you can be ready to take advantage of whatever photographic opportunities present themselves. Consider, for example, the three different situations that have been captured in the following three images. How would you go about capturing each of them?

Those images, and every image that you want to capture, have one thing in common - the most basic aspect of photography, correct

exposure. If the captured image is not correctly exposed you will have lost some of the important information that your camera was capable of capturing.

Under exposure will result in details being lost in the shadows.

Over-exposure will result in details being lost in the highlights.

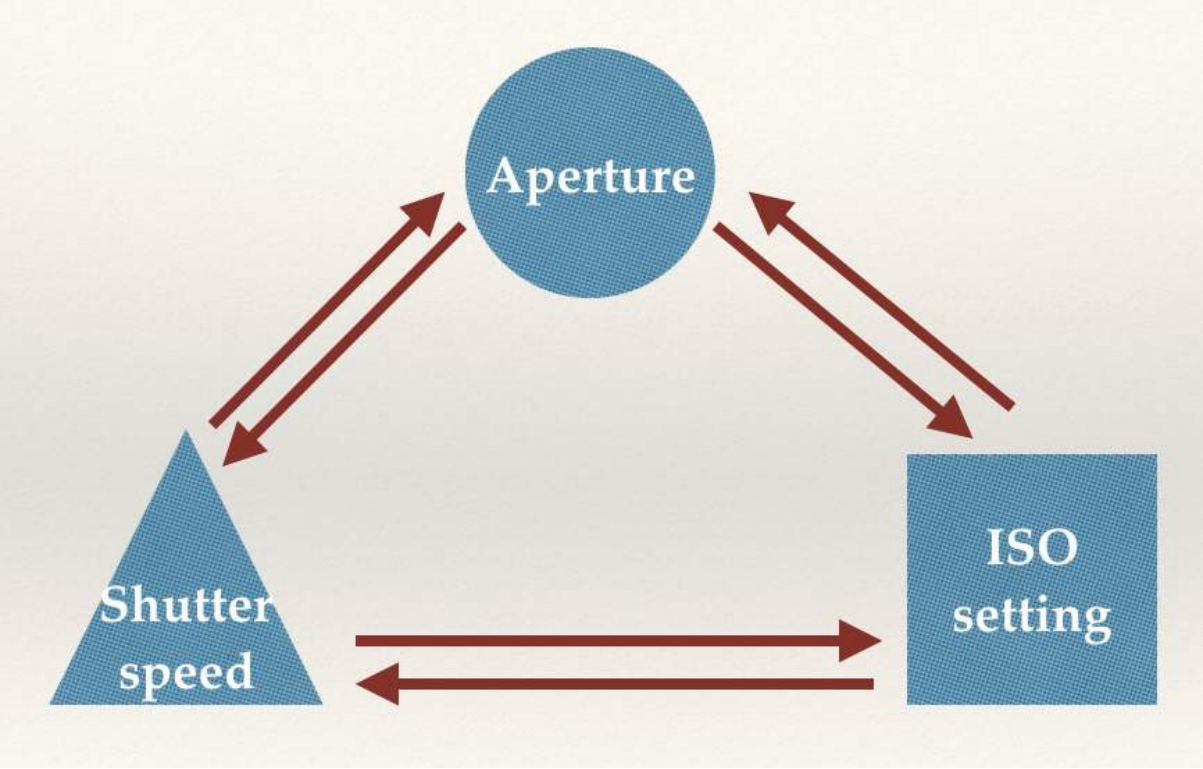
"Correct" exposure will give appropriate details in all areas of the image.

Of course, skilful processing with software such as Lightroom or Photoshop can help you to some extent to compensate for incorrect exposure, but it's best to try to get right in camera.

The nature of the scene you are trying to capture, and the type of image you are trying to produce will determine what "correct" exposure

is. In the following two images, for example, “correct” exposure has produced quite different, but desirable, results.

Essentially the challenge you have is this: Presented with a particular scene that you want to capture in a particular way, how do you control the way in which the camera deals with the light entering the lens so that the final image is "correctly" exposed? From this perspective, achieving correct exposure depends on your ability to control three inter-related settings on your camera - aperture, shutter speed and ISO.



The **aperture** setting determines how much light is permitted to enter the camera while the shutter is open.

The **shutter speed** determines the length of time that the shutter is open to allow light into the camera.

The **ISO setting** determines how much the signals produced by the digital sensor are amplified.

So, aperture and shutter speed are the only two things you can change to control how much light falls on the digital sensor. What happens after that to influence the apparent exposure of the image can

be controlled with the ISO setting. To produce a correctly exposed image you have to 'balance' these three factors.

Unless you are using your camera in"full auto" mode (which is generally not a good idea) you have control over each of three factors. Correct exposure is achieved by making a decision to fix one factor (aperture, shutter speed or ISO), then adjusting one of the others and letting the camera take care of the third factor. Or if you are using your camera in full manual mode you will adjust each factor manually.

The range of possible ways of controlling exposure are illustrated in the following diagram:

	Who controls these factors?		
Exposure Mode	**Aperture**	**Shutter Speed**	**ISO**
Full Auto	camera	camera	camera
Programmed Auto	camera	camera	**you**
Aperture Priority	**you**	camera	**you**
Shutter Priority	camera	**you**	**you**
Manual	**you**	**you**	**you**

If you choose to use **full-auto mode**, you have to trust that the camera can analyse the scene and make appropriate choices about aperture, shutter speed and ISO. Often the results will be satisfactory but you have to remember that even the best of cameras has a limited capacity for analysing the scene you want to capture and absolutely *no capacity to know what you visualise as the desired image*.

Putting your camera into **programmed-auto mode** allows you to set the ISO and, in some cameras, select a particular type of program to

determine how the camera balances aperture and shutter speed to give correct exposure. For example, some cameras will have special program modes for landscapes, portraits, snow scenes, flowers, and so on. If all you want to do is "point and shoot" you may find that you are happy with the results you get using one or more of your camera's program modes. At least by controlling the ISO you can restrict it to a range (for example, less than ISO 800) that you know will give you acceptable results in particular lighting conditions. However, if you understand what the various program modes on your camera are doing (such as selecting the smallest available aperture in landscape mode) you will probably find you can get better results by taking more control.

If, for reasons we will explore later, you want to control the aperture as well as the ISO you should select **aperture-priority mode**. The camera will then determine the shutter speed required for correct exposure. One limitation of this mode is that under low light conditions the automatically selected shutter speed may be too low if you are hand-holding your camera. If you notice this happening you can increase the ISO to compensate, but that may cause other problems such as too much digital noise in the image.

If it is important for you to control the shutter speed (for example when photographing moving subjects) then you should select **shutter-priority mode**. You still set the ISO but the camera now controls the aperture. One limitation of this mode is that the camera may select an aperture that is either too small or to large for the type of image you are trying to produce. Again, you have the option of changing the ISO to try to bring the camera-selected aperture into a suitable range.

Your final option is to use your camera in **full-manual mode** so that you can control ISO, aperture and shutter speed. You may need to resort to this in some circumstances, particularly if you are trying to produce some special effect through out-of-the-ordinary exposure. However, this is usually only a viable option in circumstances where you have time to

experiment and it may be impractical when the scene is changing rapidly (as it often is in nature photography).

The way in which different combinations of aperture, shutter speed and ISO can achieve the same exposure is illustrated in this table.

f/11	**1/125 sec**	**ISO 400**
f/4	1/1000 sec	**ISO 400**
f/16	**1/125 sec**	ISO 800
f/11	1/30 sec	ISO 100

This table simply illustrates that if you fix one of the exposure factors (say, ISO) and vary another (say, shutter speed) the third factor (in this case aperture) must also be varied by you or by the camera to maintain correct exposure.

AUTO-EXPOSURE METERING

To whole point of having various auto-exposure modes on a camera is to allow you to control the factors that you feel are most important (say, ISO and aperture) and not have to think about the third factor (shutter speed in this case). If the camera is to control the third factor it must measure the light in the scene you have framed and use that information plus the settings you have made to calculate correct exposure.

Most digital cameras give you some options for controlling what part of the scene in the frame the camera uses to determine correct exposure. The three most common auto-exposure modes are :

Matrix metering (sometimes called evaluative metering). In this mode the camera meters a wide area of the frame and attempts to take the tonal distribution, colour and general composition of the scene into account. It is usually a good default setting.

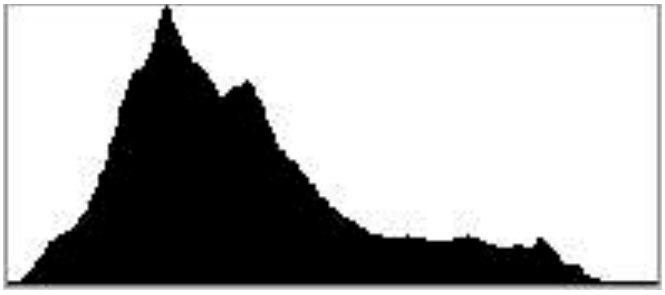
Centre-weighted metering. In this mode the camera measures the light across the full frame but gives priority to the centre area. It is a good setting for portraits when the subject is near the centre of the frame.

Spot metering. In this mode the camera meters a small area around the focus point. It can be a good choice when the background is very bright or very dark.

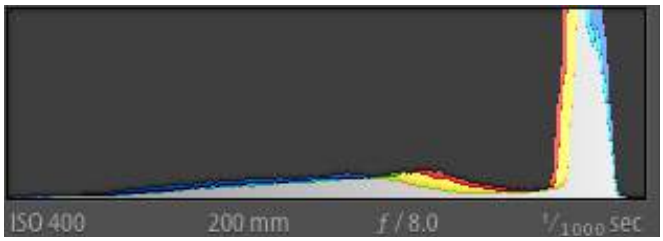
CHECKING EXPOSURE WITH HISTOGRAMS

The histogram on a digital camera display is a simple way of showing the approximate distribution of tonal values in the captured image. It can be used as a *guide* to correct exposure.

Histograms are simple graphs that show what proportion of pixels in an image are at each level of brightness (tonal value). For example, this image has relatively few very bright areas and a lot of moderately dark areas and its histogram looks like this:



This image has a much greater proportion of its tones in the light area and it's histogram reflects that fact.



The important point to note is that even though the histograms of these two images are quite different, they each come from a correctly exposed image.

There is no 'ideal' shape for a histogram. However, the on-camera histogram can help you to check for over-exposed highlights and under-exposed shadows. The following image has a considerable proportion of light tones, some of which appear to be over-exposed, and that is confirmed by it's histogram which shows pixels pushed hard up against the righthand end of the histogram.

WHY FILE TYPE MATTERS

Sometimes it is very difficult to get correct exposure across the whole frame of an image, particularly when there are some very light areas and some very dark areas, as in this image.

If this image was captured as a JPEG file it would be very difficult, but not necessarily impossible, to recover the detail that appears to have been lost in the shadows and highlights. However, because it was recorded as a RAW file much of this apparently lost detail can be recovered quite easily.

FOCUS AND RELATED MATTERS

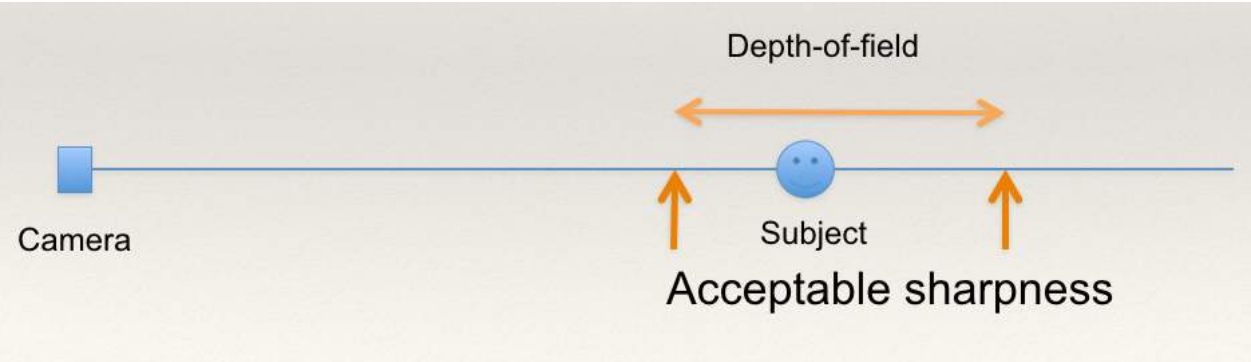
Assuming that you can capture a correctly exposed image, the next thing to consider is whether all of the relevant parts of the image are in focus. Before considering different ways of achieving sharp focus, we will consider a common way of describing the difference between the in-focus and out-of-focus areas of an image.

DEPTH OF FIELD

Depth-of-field (DoF), sometimes called depth-of-focus, is the distance between the closest and furthest points from the camera that are **acceptably sharp** in the captured image. There are various technical ways of describing "acceptable sharpness" but they are not a great help to most photographers. What we are mainly concerned with is producing images where the important parts appear to be in focus when the image is printed on shown electronically, such as in this image:

The depth of field is the range of distances over which the reproduced image is not unacceptably less sharp than the sharpest part of the image.

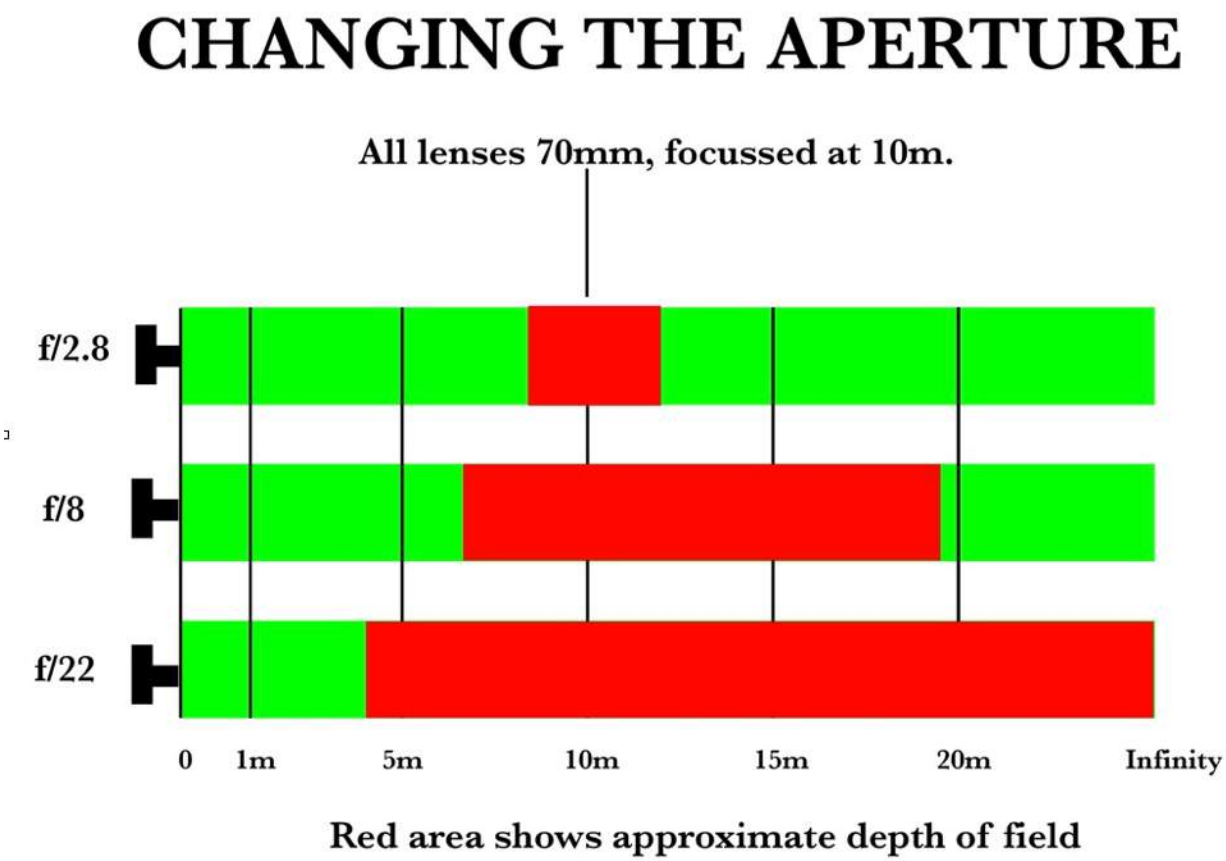
Depth of field can be represented diagrammatically like this:



For many photographers, mention of depth of field immediately brings to mind "aperture" because they are accustomed to the fact that aperture influences depth of field as shown in these images:

These images, all taken with the same lens/camera and from the same distance clearly show that as the size of the aperture is reduced the depth of field increases. That's fine and this knowledge can be used effectively to control depth of field - but it is not the full story. DoF is actually influenced by four separate things: aperture, focal length of the lens, distance to the subject and digital sensor size.

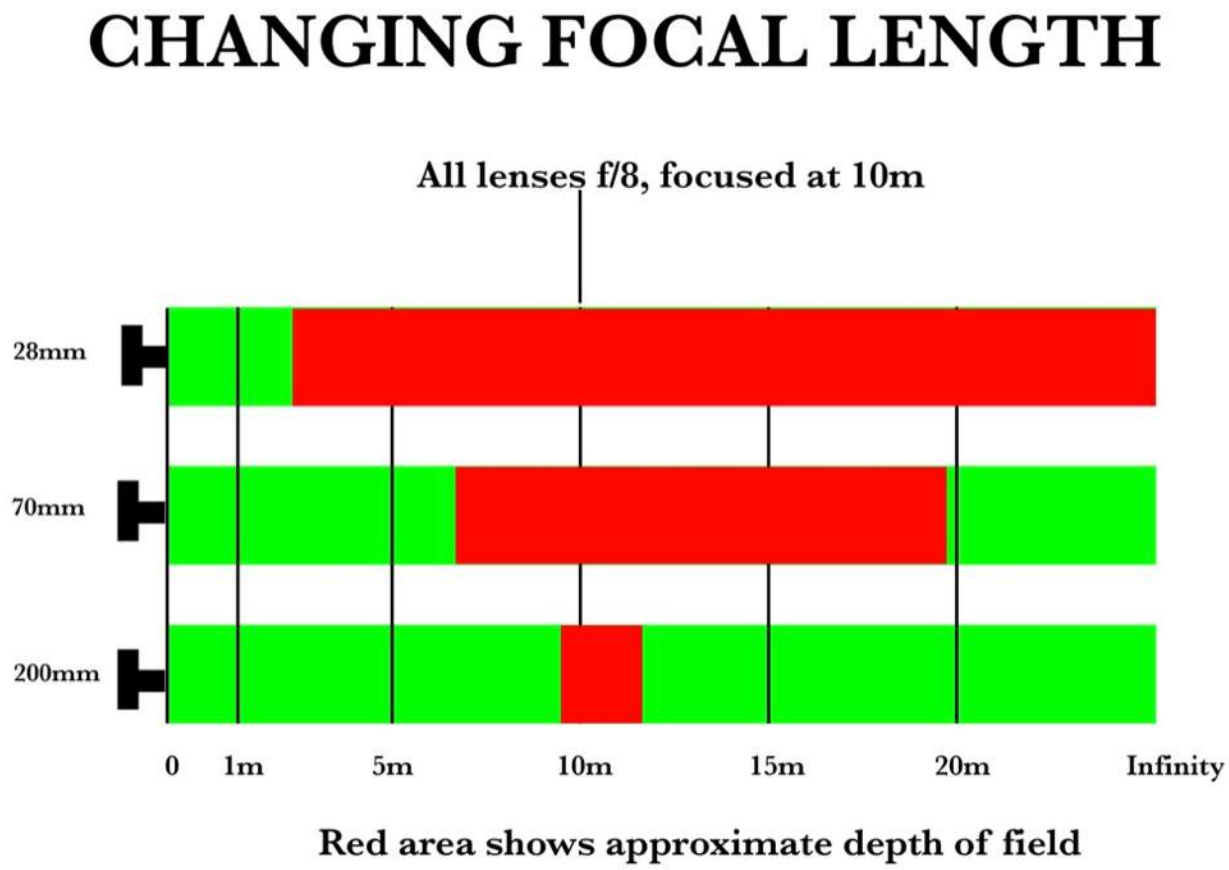
The approximate effect of changing the aperture when the other factors are constant is this:



It is obvious in this illustration that changing the aperture on a relatively short focal length lens (70mm on a full-frame camera) can make a huge difference to what is acceptably sharp and what appears blurred in the captured image. Here, the focus is at 10m and at f/2.8 the DoF extends from just 1.5m in front of the subject to just 2m behind the subject. However, if the aperture is reduced to f/22 the DoF extends from about 6m in front of the subject to infinity behind the subject.

You should notice in this diagram that in all cases the DoF extends further behind the subject than in front of the subject. It is often claimed that 1/3 of the DoF will be in front of the subject and 2/3 will be behind, but that only occurs for special combinations of aperture, focal length and subject distance. In the example above (70mm at 10m) it would be approximately correct at f/5.6.

The approximate effect of changing the focal length of the lens when the other factors are constant is this:



This diagram illustrates what most photographers know - shorter focal length lenses produce images with greater depth of field. What you may not have realised if you use a 28-70mm or a 70-200mm zoom lens is just how great the difference in DoF will be at the two ends of the zoom range on those lenses.

In the example above (aperture at f/8 and subject at 10m) the DoF in front of the subject is just 0.56m with the 200mm lens, whereas it is 3.27m for the 70mm lens and 7.5m for the 28mm lens. Behind the subject the DoF is just 0.62m with the 200mm lens, 9.47m with the 70mm lens and effectively infinite with the 28mm lens. Quite clearly these difference will make a big difference to the appearance of the image. But you also have to keep in mind that these three lenses have very different fields of

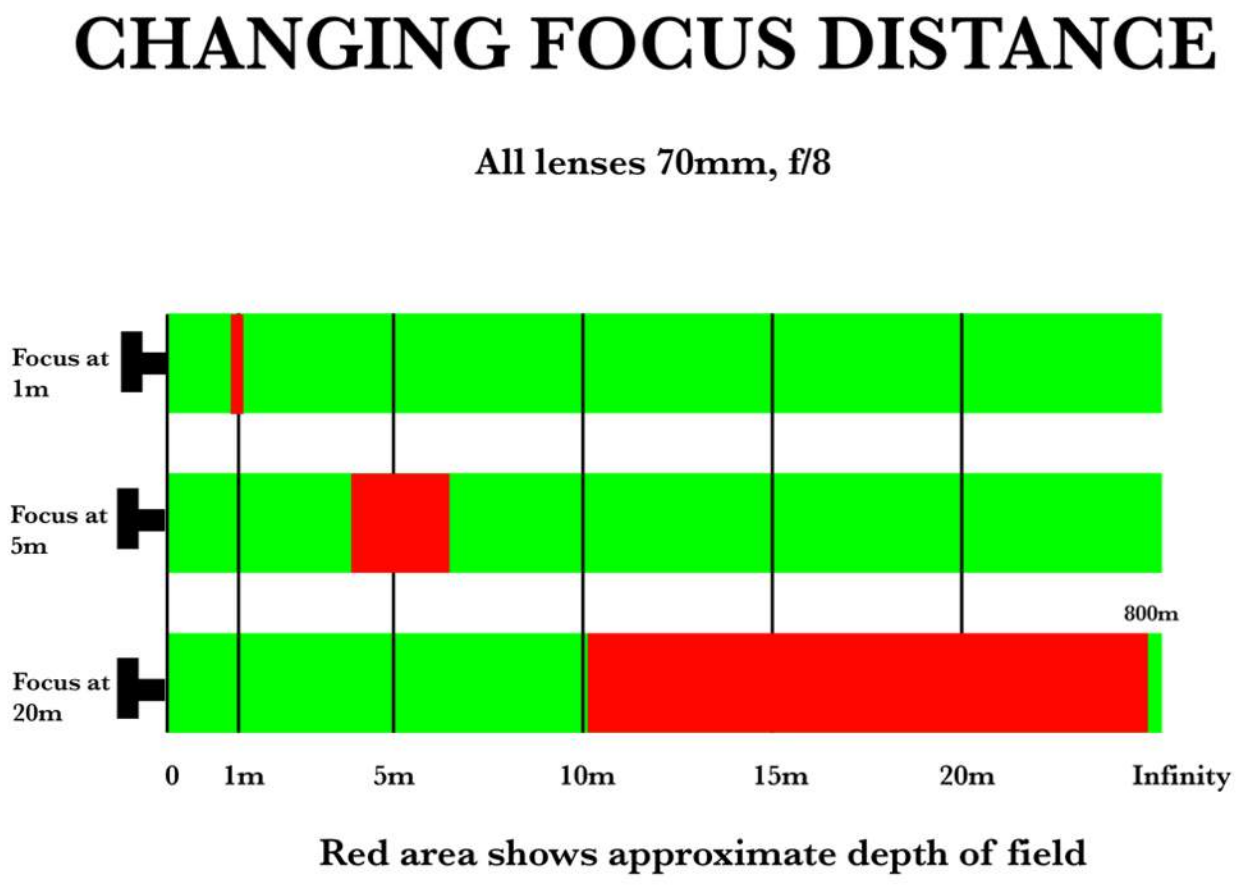
view. When focused on a subject at 10m, the above lenses will have the following *horizontal* fields of view:

20mm lens will have 18.86m horizontal field of view

70mm lens will have 5.14m horizontal field of view

200mm lens will have 1.8m horizontal field of view.

The approximate effect of changing the camera-to-subject distance for a particular lens at a particular aperture is illustrated here:



As you might expect, the further away the subject is the greater the depth of field. One of the reasons that the DoF is so great when this lens is focused at 20m is that at f/8 the hyperfocal distance for a 70mm lens is close to 20m.

If we focus any lens at infinity, the distance at which the closest object in the frame still looks acceptably sharp is called the ***hyperfocal distance***. If we focus the lens at the hyperlocal distance, the depth of field will extend from approximately half the hyperfocal distance to infinity, giving the maximum possible depth of field for the given lens and aperture combination.

Keep in mind that hyperfocal distances and depth of field are simply approximations because there is never an absolute boundary between what is or is not acceptably in focus in an image. That's why different tables of DoF values that you mind find on the internet or in an app might show different numbers - they may be based on different mathematical assumptions about what is "acceptably sharp". If you want to explore this in mathematical depth, Google "circle of confusion".

The final factor to influence DoF is the **size of the digital sensor** in the camera. Explaining how this influences DoF is not simple but it basically comes down to this:

- If you use the same lens on a small-sensor camera and a full-frame camera, then shoot from different distances so that the view is the same, the small sensor image will have greater DoF than the full-frame camera.

- If you use the same lens on a small-sensor camera and a full-frame camera, shoot at the same distance and then crop the full-frame image to give the same view as the small-sensor image, the depth of field is identical.

Whatever size sensor is in your camera, you are stuck with that, but you can still influence DoF by changing the focal length of the lens, the aperture, and the distance between you and the subject.

AUTOFOCUS MODES

Most DSLRs and some other digital cameras allow you to choose between several ways of controlling how the autofocus system operates. These options are usually referred to as autofocus "modes". In some cases they are set with a switch or dial on the camera and in some cases they are set through the menu. The most common options are:

NIKON	CANON		
Single servo (AF-S)	**One Shot AF**	For stationary subjects.	Focus locks when shutter release is pressed halfway down.
Continuous servo (AF-C)	**Al Focus AF**	For moving subjects.	Camera focuses continuously while shutter release is pressed halfway down.

Each autofocus mode has advantages and limitations. The main characteristics of **"single-servo" autofocus** are:

- Every time you lift your finger from the shutter release and press again the camera refocuses.
- Once the AF has locked, the focus stays at that distance until you refocus (by lifting your finger and then pressing the shutter halfway down again).

Because it operates this way, single-servo autofocus is not a very good way to focus on moving subjects, particularly fast moving small subjects.

The main characteristics of **"continuous" autofocus** are:

- Each time you lift your finger and press again the camera refocuses and continues to try to focus while the shutter release is held halfway down.
- If the subject moves out of the focus area while the shutter is half depressed, the camera will focus on something other than the desired subject.

AUTOFOCUS *AREA* MODES

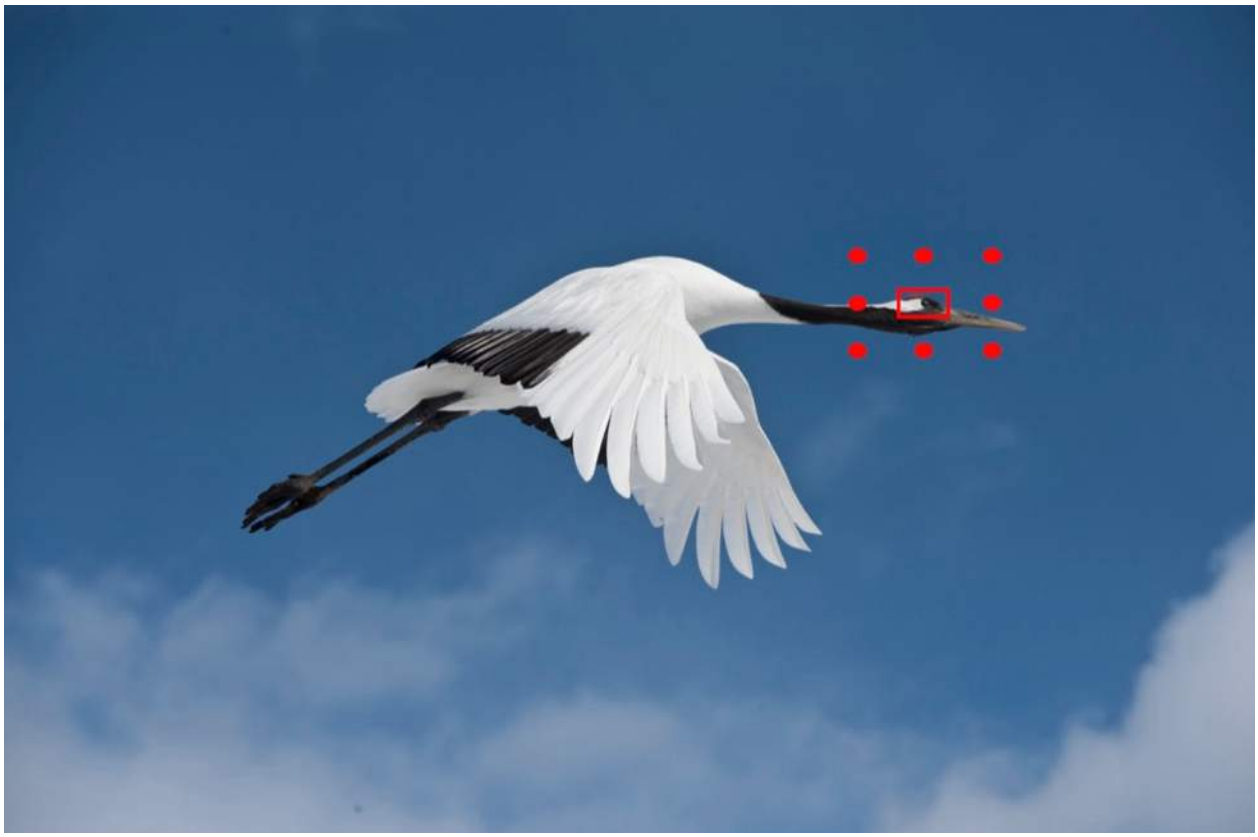
To get the best from either focus mode you also have to make a suitable choice about what area of the frame the camera will use to try to achieve focus.

The simplest choice is to use ***Single Point AF*** (Nikon) or ***Manual Point AF*** (Canon). In this mode, the camera uses just one focus point that can be manually moved around the frame. It is usually an appropriate choice for stationary subjects.

An alternative mode is **Dynamic Area AF** (Nikon) or **AF Point Expansion** (Canon). The basic method of operation is:

- Put the camera in AF-C mode.
- Select a single focus point and depress the shutter halfway to activate focus.
- If the subject moves, the camera will focus using focus points surrounding the original point selected (provided you pan to keep the subject close to the original focus point).
- The number of focus points used can be selected (e.g. 9, 21 or 51 on a Nikon D4). The less predictable to movement, the more focus points should be used.

The flowing image simulates what you would see in the viewfinder with 9-point dynamic focus selected.



In this mode, if focus is lost at the original focus point (shown by the small rectangle, the camera will try to refocus using one of the eight surrounding focus points. Provided the area you want to focus on (the birds's head in this example) remains covered by the nine focus points the camera should maintain appropriate focus.

Some Nikon cameras provide another option called **Group-Area AF**. It is similar to dynamic AF but uses a group of five focus points . The camera uses these five focus points simultaneously and gives priority to the closest subject that is covered by those five points. As an extra bonus, if you use Group-Area AF in conjunction with AF-S (single shot) the camera will activate face recognition and attempt to focus on the eye of the nearest person.

Other camera brands and models may have different AF modes.

CHOOSING AN AUTOFOCUS MODE

If you take different types of photographs (landscape, portrait, sports, nature, and so on) you will probably find that particular autofocus modes work better in some situations that others. You will have to experiment to see which mode suits each type of photography, but as a starting point a Nikon user could try the following two choices.

For stationary things, such as landscape, architecture and portraits:

Autofocus Mode: AF-S

AF-Area Mode: Single-point AF

AF-S Priority Selection: Focus

For moving things such as birds in flight or racing cars:

Autofocus Mode: AF-C

AF-Area Mode: Dynamic-Area AF (with 9 or 21 focus points) or Group-Area AF

AF-C Priority Selection: Focus+Release

Sometimes you will be in situations where it might be desirable to be able to switch quickly between AF-S and AF-C. An example would be when you were photographing a stationary subject that then started to move rapidly. This can occur frequently when photographing sport or wildlife. In these situations, the time taken to switch from AF-S to AF-C could be critical - it might cause you to miss some shots. The solution is to set up your camera so that you can engage AF-S or AF-C as you need it without having to physically switch between these modes. The secret is BBF.

BACK BUTTON FOCUS

Some DSLRs have an "AF-ON" button on the back. Others have a "AE-L/AF-L" button on the back that can be programmed through the camera menu to behave as an "AF-ON" button.

The purpose of this button is to activate the camera's auto-focus without you needing to press the shutter halfway down.

Back button focus has to be set up through the camera menu, and the process will vary according to the camera make and model.

The basic set-up process is:

- Disable the auto-focus function on the shutter release - so that all the shutter release will do is release the shutter.
- Assign auto-focus to a suitable button on the back of the camera, so the only way to focus is pressing this button.

This separates the processes of focusing and shutter release and you no longer have to switch between AF-S and AF-C. On a camera such as a Nikon D4, this is what will happen:

- Press the AF-On button to focus. (The camera behaves as though you have selected AF-S mode and were pressing the shutter release half way.)
- Release the AF-On button to lock focus. (This allows you to recompose if necessary because the camera stays focused at the same distance.)
- Press the shorter release when you want to take the photograph.

Alternatively:

- Press and hold the AF-On button to initially focus and then track the subject if it moves. (The camera behaves as though you have selected AF-C mode and continues to try to achieve focus as the subject moves.)
- Press the shutter at any time.

This can be a very effective way to capture images such as the following series:

While the vulture is stationary, a single press/release of the AF-ON button will lock focus. Even the camera moves there is no need to keep re-focusing (assuming you are stationary). As the vulture indicates it is about to take off, the AF-ON button is pressed and held. As it lifts off the shutter is released (in burst mode) to capture a series of images.

These notes have touched on just a few of the basic aspects of capturing images with a digital camera. To understand and apply these ideas effectively you will need to consult your camera manual to see exactly how the ideas can be applied with that make and model. You will then need to experiment and practice the techniques so that they become second nature.

If you would like to make suggestions for improving these notes please email me.

Roy Killen

Email: roykillen@mac.com

13th December, 2016.