Depth of Field

What is Depth Of Field (DoF)

If you focus on a specific subject in a scene (a tree in a landscape for instance) then the distance in front and behind this point that appears sharp is the DoF.

So why would you want to have an unfocussed photograph? The main reason is to give more attention to the subject you are trying to photograph without the foreground or background detracting from this.

Controlling DoF

There are three basic principles that affect DoF :-

Aperture Size	The size of the opening in the lens when a picture is taken. This is measured in f numbers called stops and the lower the number the more light is allowed to hit the cameras sensor. 
Focal Length	When a subject is in focus the focal length is the distance between the image sensor and the lens. The focal length is usually expressed in millimetres. Lenses are usually described by their smallest and largest focal length e.g. 18m – 50mm.
Focus Point	This is the main point of focus (main subject) of the photograph

These three principles can be implemented individually or combined to give varying degrees of DoF.

DoF – Aperture Size

Note that the smaller the aperture the larger the f number i.e. f/22 lets in less light than say f/2.8.

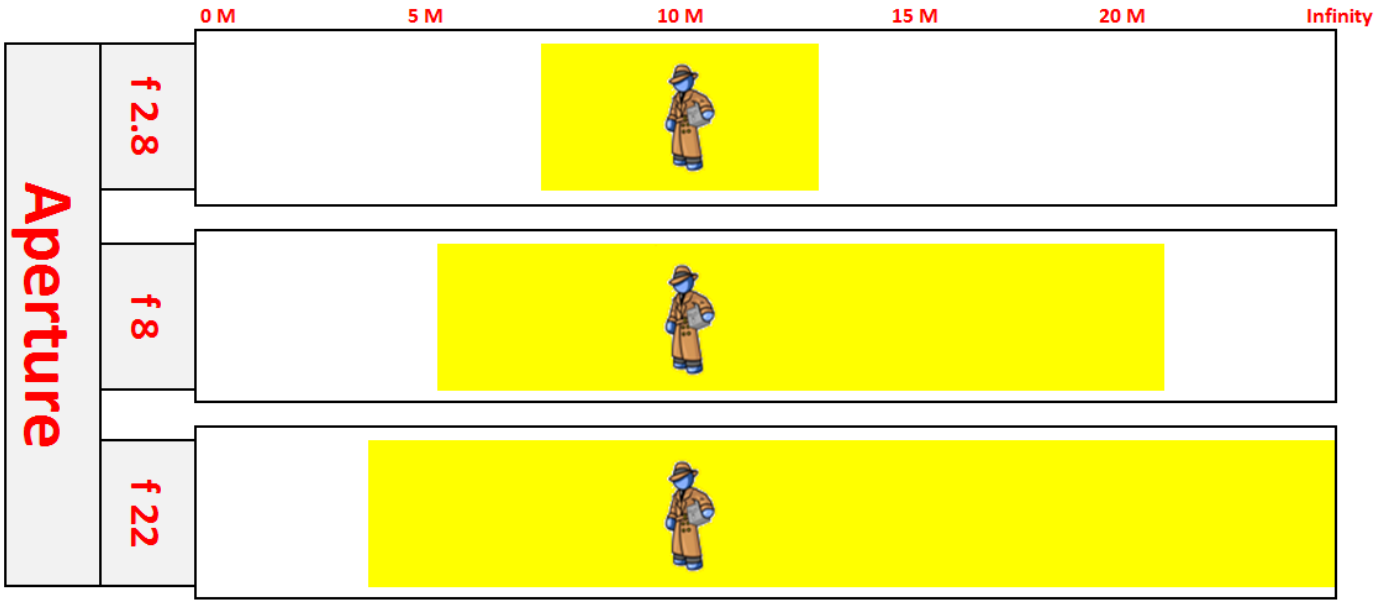
The aperture is like the pupil of the human eye. When there is less light the pupil is expanded to let more available light through to the back of the retina. As it gets lighter the pupil is dilated to let less light through.

This means that the amount of light hitting the retina under normal conditions remains relatively constant.

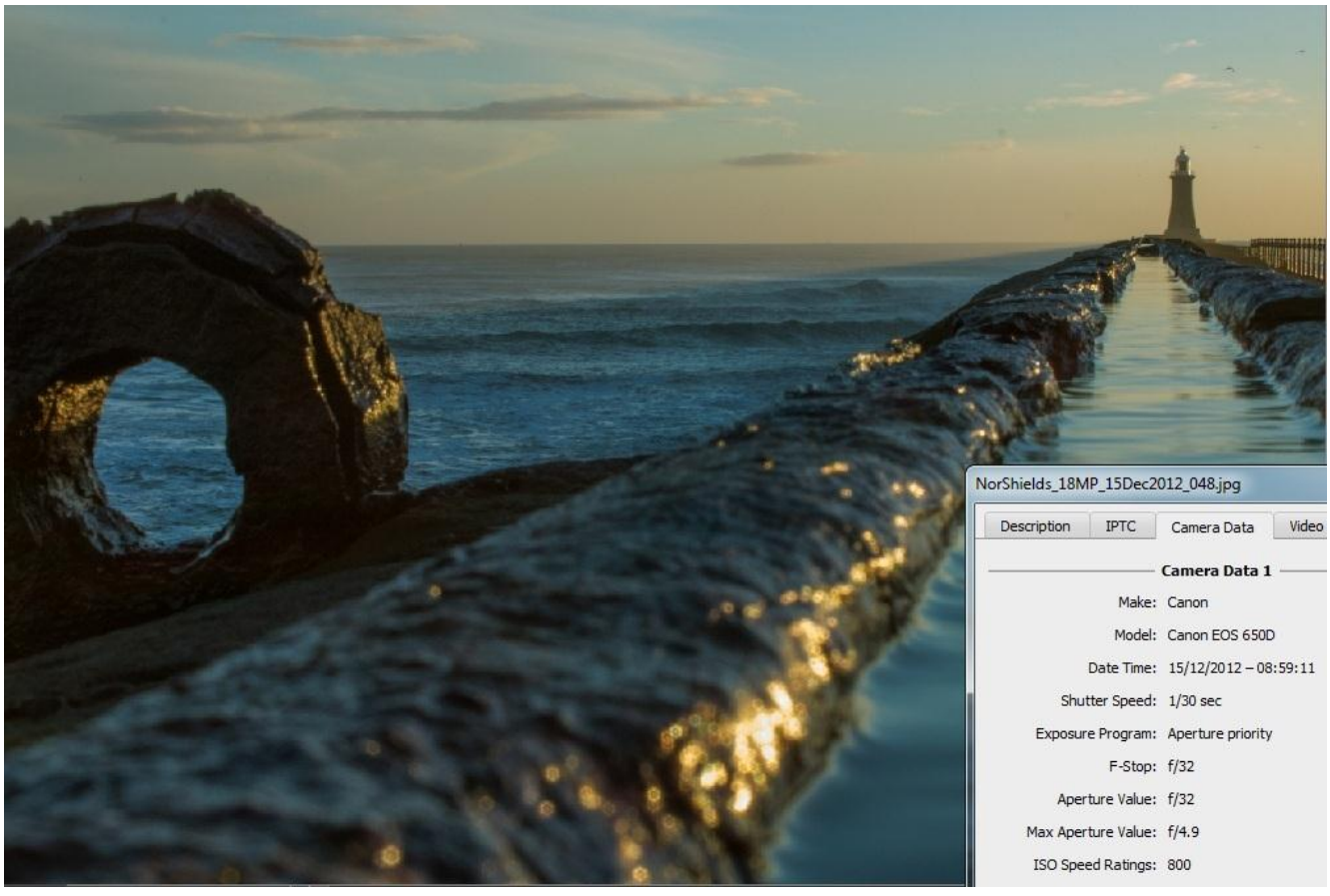
If you study the illustration below, the camera focal point is set to 70mm and the focus point is set to 10m and is not altered for all 3 shots, but the aperture is altered to f2.8, f8 and f22

The yellow area represents the area that will be in focus. Note more area is in focus behind the subject than in front.

If you want more foreground in focus than background then you will need to focus at an imaginary point at say 8 or 9 metres



The image below was taken using a small aperture of f/32 to give a maximum DoF as possible and then focussed about a third of the way into the frame.

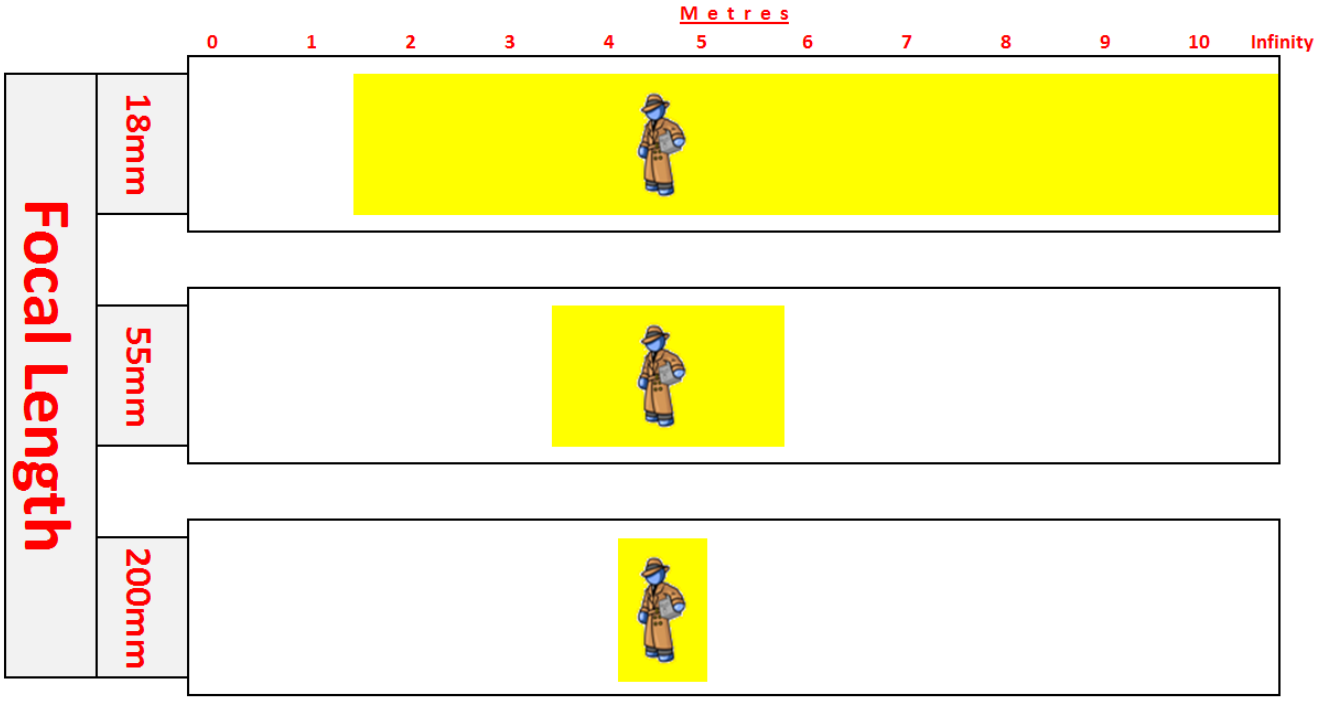


DoF – Focal Length

Another way of affecting the DoF is to use different lens lengths i.e. A lens that has a minim focal length of 28mm will produce a greater DoF than a say a telephoto lens of 200mm i.e. the longer the focal length the shallower the DoF.

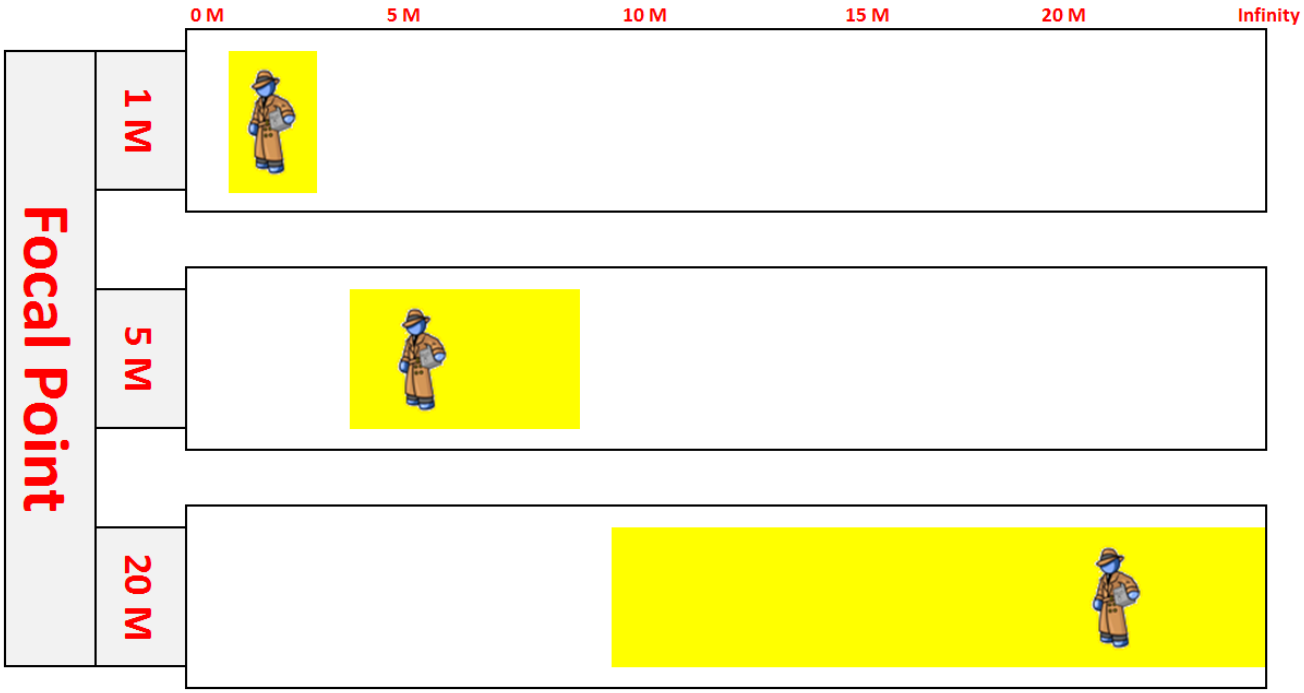
A wide angle lens (such as 28mm) will produce a greater depth of field than a telephoto lens (eg 100mm).

To really restrict sharpness to a very small area (shallow depth of field) use a wide aperture with a long lens.



DoF – Focal Point

If you focus on a close subject you get less depth of field than when you focus on something more distant, which again can be combined with aperture and focal length to widen or reduce overall depth of field.



Hyper Focal Length

Hyper focal distance is where the focal point used at any aperture size gives the greatest DoF. This means that infinity should be in focus and as much of the foreground should also be in focus.

This then lends itself to landscape photography more than portraits.

To achieve this you should focus some way into the scene (as a rule of thumb start at about a third of the way in) and vary this until you achieve the desired sharpness.

If your camera has either live view or a DoF preview button you can use these to help achieve hyper focal distance.

The diagram below shows this more clearly. If the Hyper focal distance you decide upon (H) is 20M into the scene the foreground will be in focus from 10M (H / 2) into the scene to infinity

The following chart shows some hyper focal distances (in both feet and meters) for different focal length and different apertures.

Hyperfocal Distances - APS-C Sensors (i.e. Non full frame)

Focal Length (mm)		12	15	17	20	24	28	35	50	70	100	135
Aperture f / 8	ft	3.2	5	6.4	8.9	12.6	17	27	55	105	218	395
	m	0.975	1.524	1.951	2.713	3.841	5.182	8.230	16.764	32.004	66.447	120.397
f / 11	ft	2.3	3.5	4.5	6.2	9	12	19	39	75	155	280
	m	0.701	1.067	1.372	1.890	2.743	3.658	5.791	11.887	22.860	47.245	85.345
f / 16	ft	1.7	2.5	3.3	4.4	6.4	8.6	14.5	27	54	110	198
	m	0.518	0.762	1.006	1.341	1.951	2.621	4.420	8.230	16.459	33.528	60.351
f / 22	ft	1.2	1.9	2.3	3.2	4.5	6	9.5	19.2	38	77	140
	m	0.366	0.579	0.701	0.975	1.372	1.829	2.896	5.852	11.583	23.470	42.673

There are on-line resources which will allow you to calculate all hyper focal distances as well as apps for iPhones and other smart phones for around the $2 mark.