Depth of field

In optics, particularly as it relates to film and photography, depth of field (DOF) is the distance between the nearest and farthest objects in a scene that appear acceptably sharp in an image. Although a lens can precisely focus at only one distance at a time, the decrease in sharpness is gradual on each side of the focused distance, so that within the DOF, the unsharpness is imperceptible under normal viewing conditions.

In some cases, it may be desirable to have the entire image sharp, and a large DOF is appropriate. In other cases, a small DOF may be more effective, emphasizing the subject while de-emphasizing the foreground and background.

The DOF is determined by the camera - to-subject distance, the lens focal length, the lens f-number, and the format size or circle of confusion criterion. Depth of field extends twice the distance beyond the point of focus compared to the distance in front of the point of focus.

For a given f-number, increasing the magnification, either by moving closer to the subject or using a lens of greater focal length, decreases the DOF.
Decreasing magnification increases DOF.
The ‘wider’ the lens the greater the depth of field.
The ‘longer’ the lens the shallower the depth of field.

22mm lens @ F11 Both images shot on Canon APS-C camera 200mm lens @ F11

Showing the effect of the focal length of the lens at the same aperture.

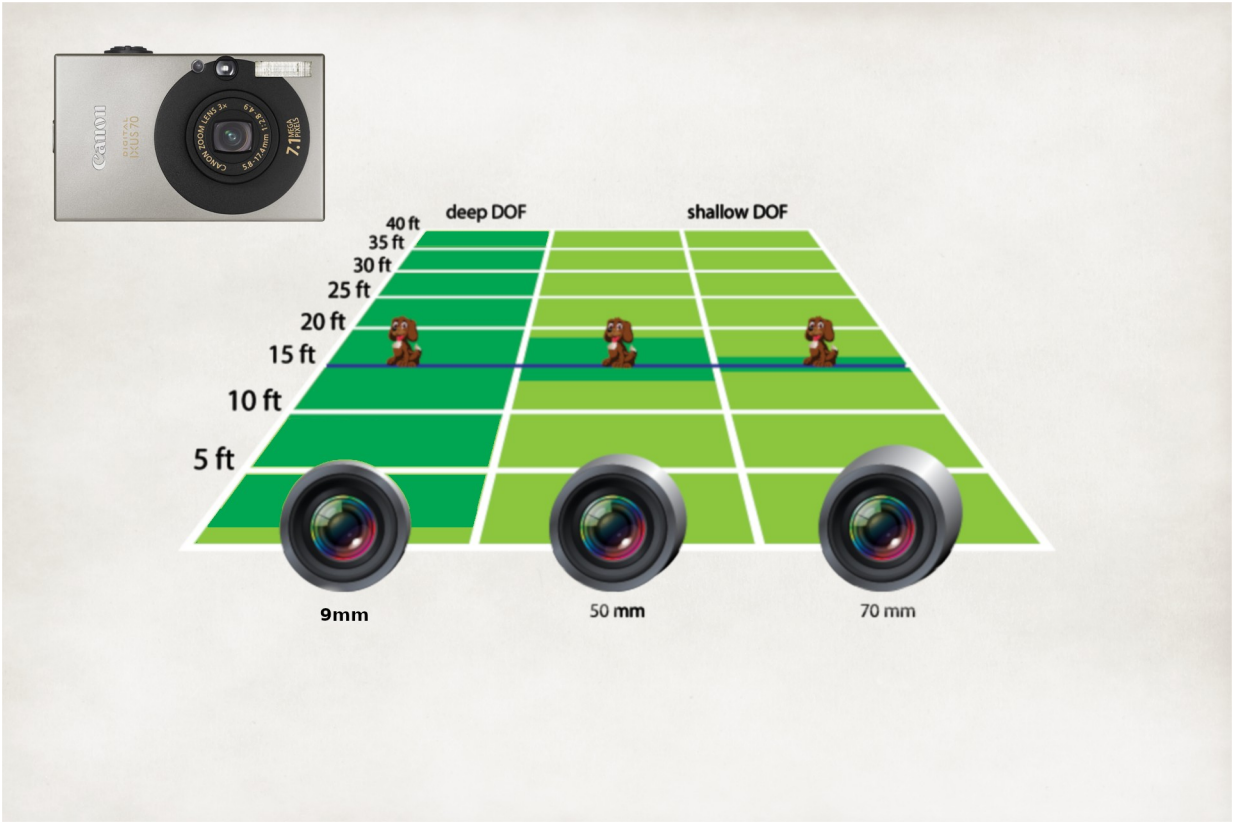
85mm lens @ F1.8 Both images shot on Canon APS-C camera 85mm lens @ F16

Showing the effect of the aperture using the same lens and subject distance.
The point of focus was on the aperture ring at the front of the camera being photographed.

For a given subject magnification, increasing the f-number, smaller aperture diameter increases the DOF (F16); decreasing f-number, larger aperture, decreases DOF (F1.8).

So for a large depth of field use a wide angle lens and a small aperture F11 - F16 - F22.
For a shallow depth of field use a longer lens with an aperture of F1.4 - F2.8 - F4.0 - F5.6.

‘Compact’ cameras and camera phones have a lens with a very small focal length 5mm - 18mm.
So will always have a very large depth of field with most things in focus whether you like it or not!

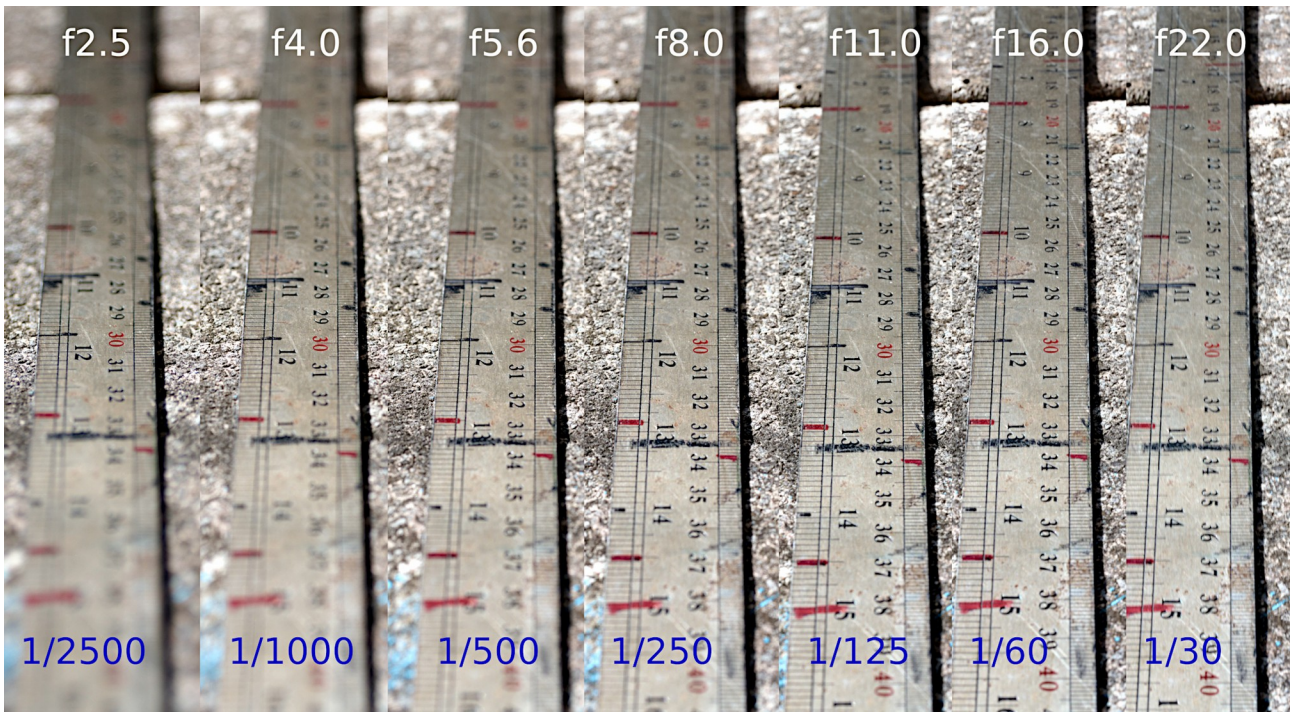


Once you understand the principles then depth of field can be used creatively.

Portraits are often shot with a shallow depth of field to isolate the subject from the background. This is most easily achieved by using a lens longer than standard and a reasonably wide aperture.

Shot with a focal length of 180mm at F6.3
This picture was taken on a Poldark location shoot. It was photographed on a beach in Cornwall and the background behind the two actors is the sea.
Photographer: Mike Alsford.

Image taken with a 20mm lens at F 8.0 showing almost everything in focus because a 20mm lens creates a large depth of field and F8.0 is enough to extend the acceptable focus throughout the subject which is all relatively close to the camera .



A composite of 7 images shot with a Canon 50mm macro lens at different apertures to show depth of field.

The point of focus was at 12” on the ruler which was about 15” in front of the camera.
The closer the subject is to the camera, so the smaller the depth of field.

As you change the aperture so you need to change the shutter speed to maintain the correct exposure. One stop smaller on the aperture reduces the light by a half, so to compensate the shutter speed need to be twice as long.

The ruler on the right of the image was shot at f22 and has the greatest depth of field but is less sharp because I was hand holding the camera and at 1/30th of a second there is a small amount of camera shake present.

Most DSLR cameras will work with the lens open regardless of the aperture selected. The lens only stops down as the picture is taken. This means you do not see the effect of the aperture on DOF.

Most of my (Canon) DSLRs have a ‘live view’ option which can show the image on screen rather than through the viewfinder but they do NOT stop down the lens. The image on screen is always displayed with the aperture wide open and therefore does not show the depth of field in the image you will capture.

Some mirrorless cameras MAY have the option to show depth of field in the viewfinder.

Some cameras have a depth of field preview button.
The DOF button when pressed will stop the lens down and show you what will and won’t be in focus.

The exercise.

Depth of field concerns the amount of the picture that is in focus.
So for this exercise we are looking for image that make use of this effect.

How easy or difficult this might be will be determined by the camera you are using and your understanding of the way it works.

The easiest way to demonstrate depth of field is to work at the opposite extremes.
Assuming that you have a camera where you can adjust the aperture, try taking two versions of the same subject, setting the aperture on the first one to its widest and the second to its smallest.
This will work best if you have something close to the camera and other objects in the distance.

The wider the lens the less obvious this will be, the longer the lens the more this will show.
So try using a ‘long lens’ or zooming to the telephoto end of the lens.

If you have a ‘full frame’ camera sensor a 50mm lens is standard.
Anything with a smaller focal length e.g. 28mm will be wider and a lens with a longer focal length will be considered a telephoto, e.g. 100mm.

On other size sensors the focal length of a standard lens will be different.
On an APS-C chip a ‘standard lens’ would be about 33mm.
On a Four Thirds sensor a standard lens is 24mm or 25mm.
A 50mm lens is a telephoto lens on a Four Thirds camera.
To have the equivalent of a 28mm lens on a Four Thirds camera you need a 14mm lens.
On some compact cameras a standard lens might be 9mm so wide angle might be 4mm.

The depth of field is determined by the focal length of the lens, the aperture and the relative distances to objects in the frame, not the size of the sensor. A 25mm standard lens on a Four Thirds camera will show the same composition as a 50mm lens on a full frame camera but is going to have a greater depth of field than a 50mm lens on a full frame camera at any given aperture.

The smaller the sensor the harder it is to get things out of focus.
If you are working with a camera with a small sensor the best chance you have to show differential focus is to place something very close to the camera and have the background some distance away.

Some cameras and most phone cameras have no actual apertures in the lens, so nothing to adjust making it impossible to carry out this task.

The image above was taken with a Canon G6 ‘compact’ camera the lens had a focal length of 9mm and the image was shot using an aperture of F2.5.