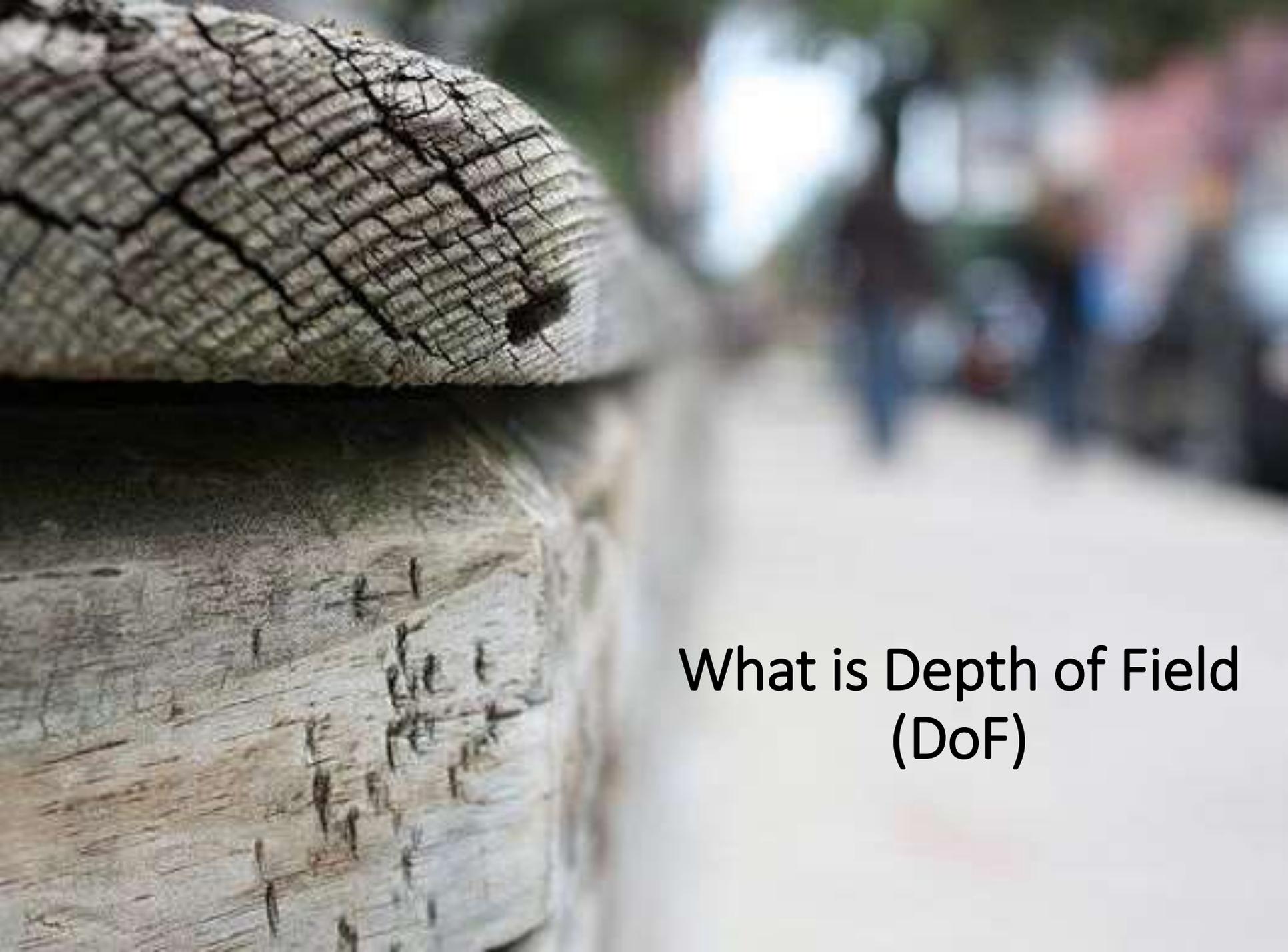




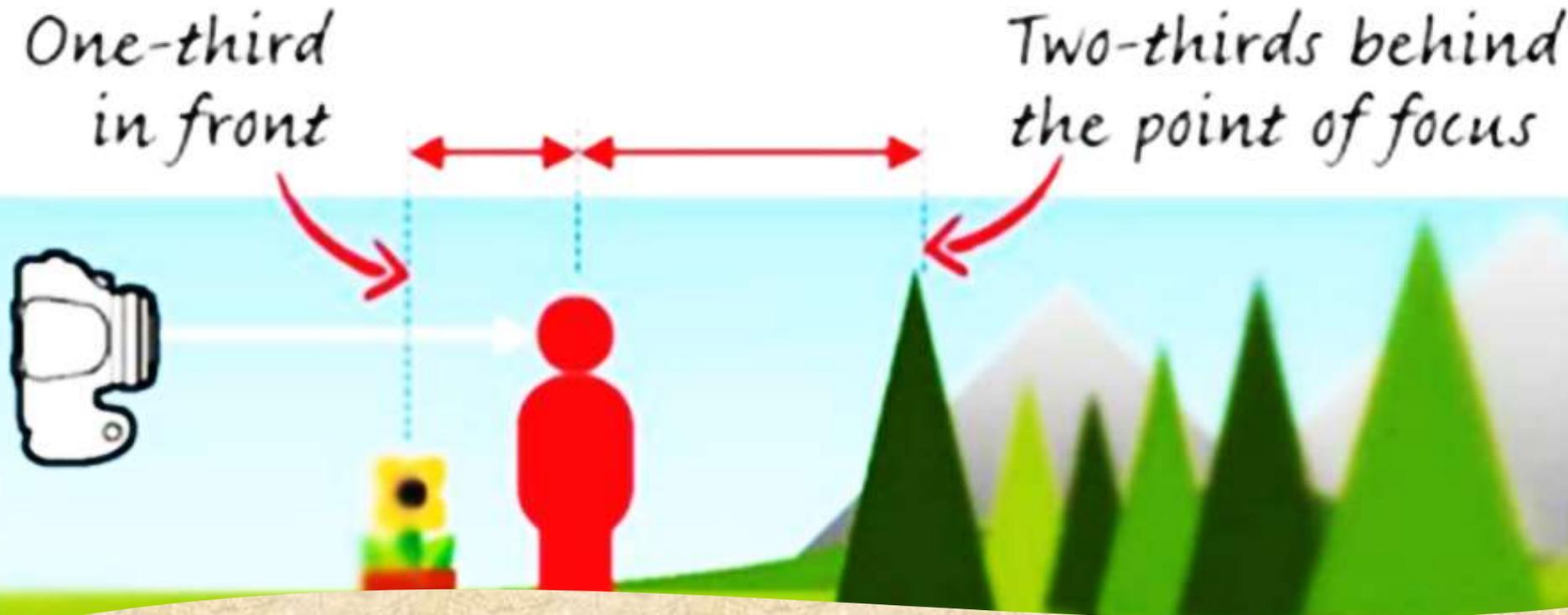
DEPTH OF FIELD: what is it, and how do you control it?

Accurate focusing and fast shutter speeds can help to improve the sharpness of your pictures.

But choosing the right “Depth of Field” is also crucial.



What is Depth of Field
(DoF)



What is Depth of Field (DoF) ?

- Depth of Field is the area in front of and behind the point of focus, where the image sharpness begins and ends, it extends from about one-third in front of the point of focus to two-thirds behind it.
- You can vary Depth of Field to :
 - imply space.
 - to suggest being inside the action.
 - to emphasise and separate elements within the picture area.



Shallow DoF



Deep DoF

What is Depth of Field (DoF) ?

- Depth of Field is described as being either Shallow DoF, or Deep DoF, with anything in between referred to as being Medium DoF.

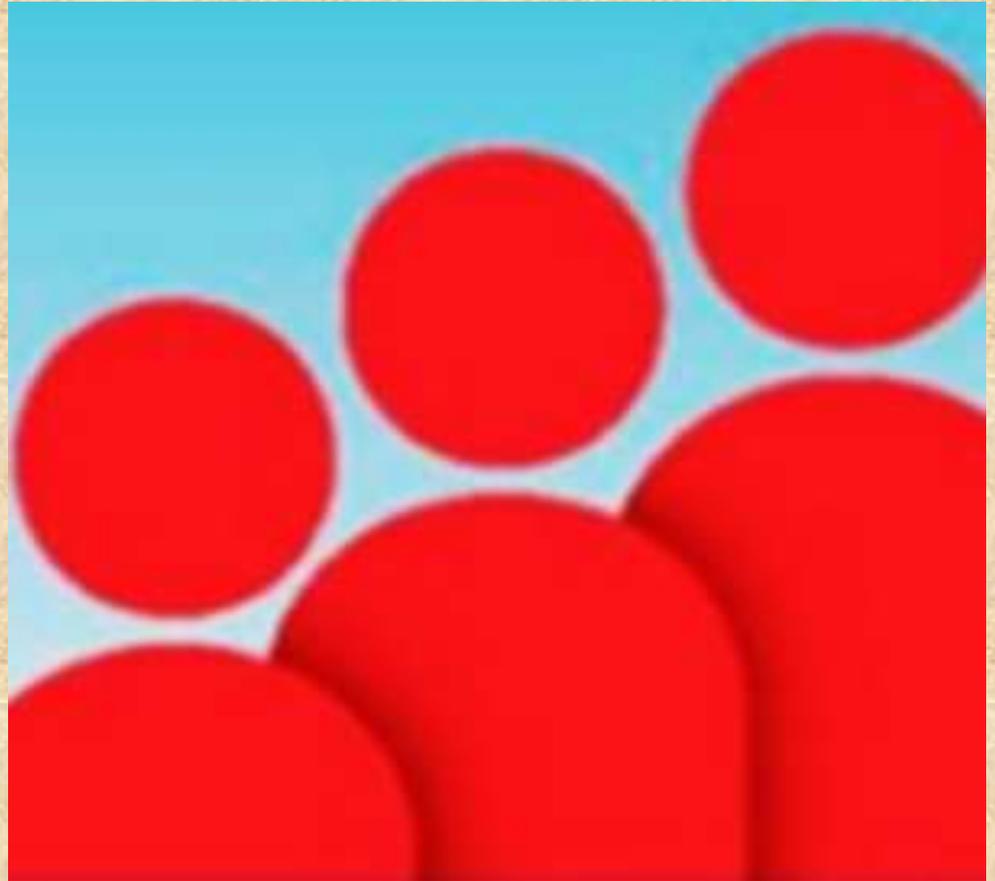
Using a Shallow Depth of Field

- A shallow Depth of Field, which renders only a small portion of the image sharp, results from using:
 - a wide lens aperture,
 - a long focal length lens,
 - Focusing close-up
 - or a combination of these factors
- Is often used for:
 - Portraiture, to help concentrate viewers attention.
 - Reducing distraction from elements that cannot be removed from the field of view.
 - Isolating a subject from the distracting visual clutter of it's surroundings.



Using a Deep Depth of Field

- A deep Depth of Field can be achieved by using:
 - a small lens aperture,
 - a wide-angle lens,
 - distant focusing,
 - or a combination of these
- It is often used for the following types of subject:
 - Landscapes, such as wide-angle, general views.
 - Architecture, in which the foregrounds to buildings are important features
 - Interiors, including nearby furniture or other objects, and far windows and similar features.



What Affects Depth of Field?

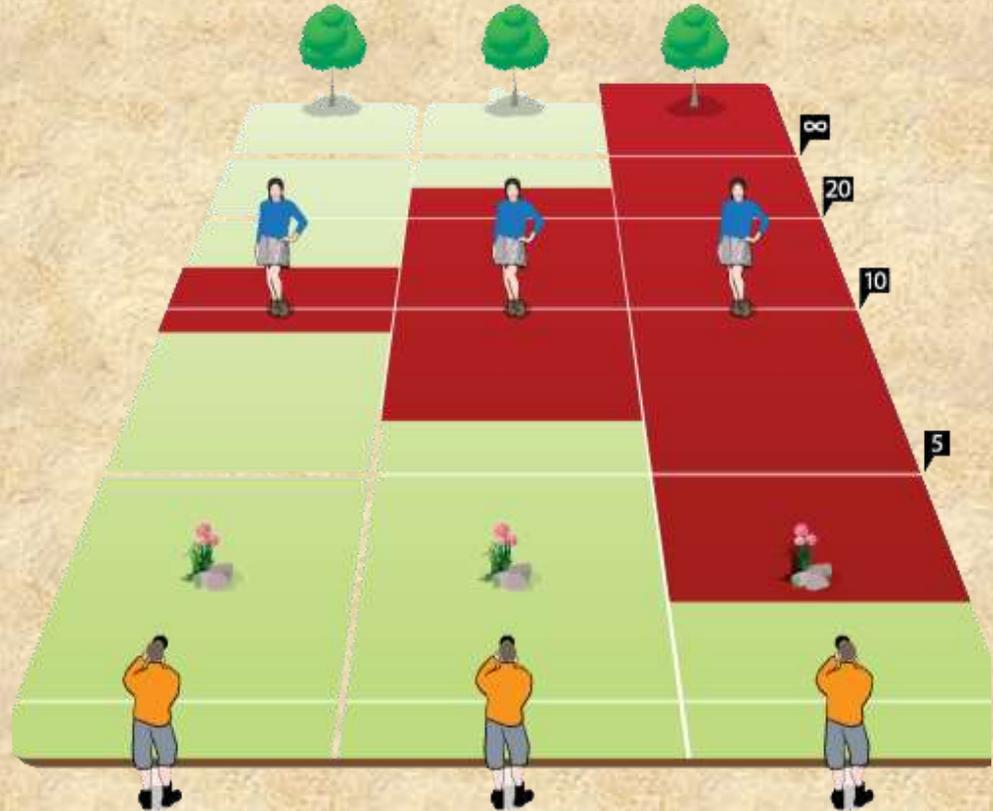
Depth of Field may be affected by each or all of the following three factors :

1. Aperture.
2. Focal Length
3. Focus Distance



CHANGING APERTURE

- Altering the aperture is usually the most convenient method of changing Depth of Field, as you don't have to move the camera.
- The larger the aperture, the shallower the depth of field you will record.
- This can be useful for hiding distracting parts of a scene.



**Focused at 10m
with Zoom at 70mm**

**SHALLOW DoF
Aperture f/2.8**

**MEDIUM DoF
Aperture f/8**

**LARGE DoF
Aperture f/22**



The depth of field can be determined by **focal length**, **distance to subject**, the acceptable **circle of confusion** size, and **aperture**.

For a given circle of confusion (c), focal length (f), f-number (N), and distance to subject (u), the approximate depth of field can be given by the formula :

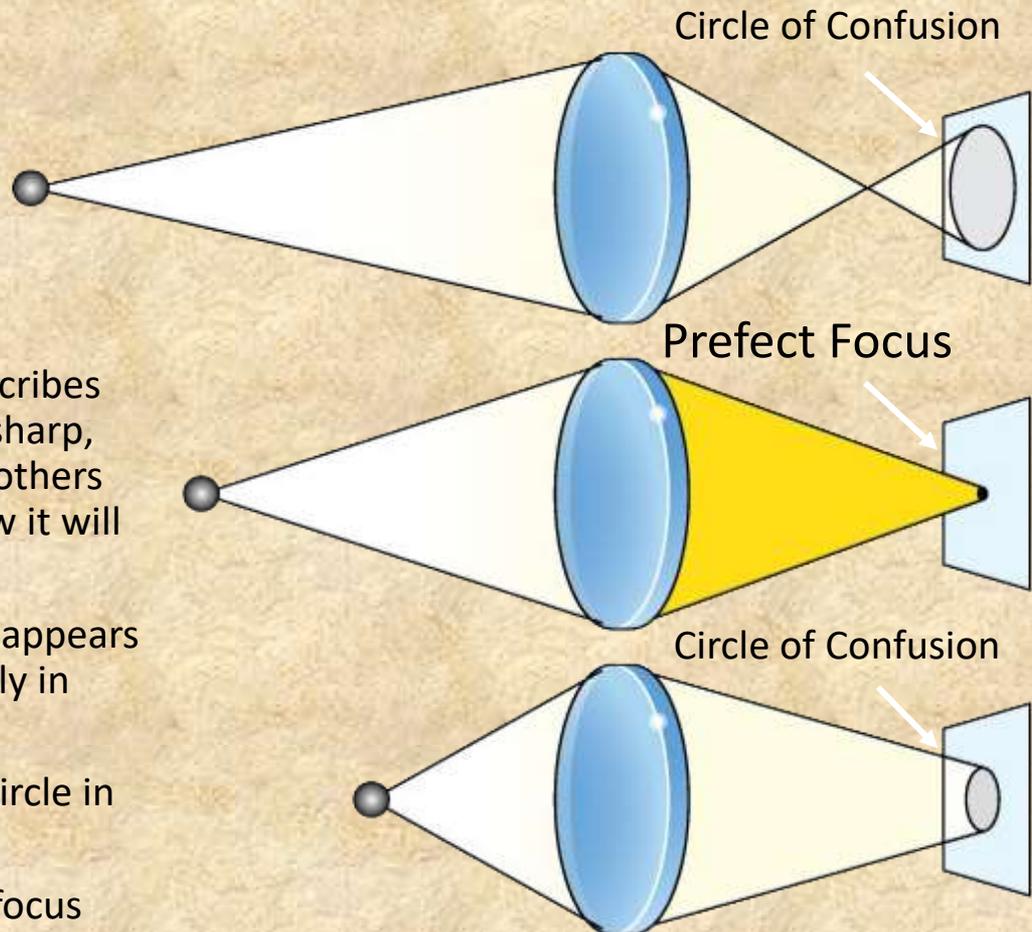
$$\text{DOF} = (2u^2 Nc) / f^2$$

In optics, a **circle of confusion** is an optical spot caused by a cone of light rays from a lens not coming to a perfect focus when imaging a point source.

It is also known as **disk of confusion**, **circle of indistinctness**, **blur circle**, or **blur spot**.

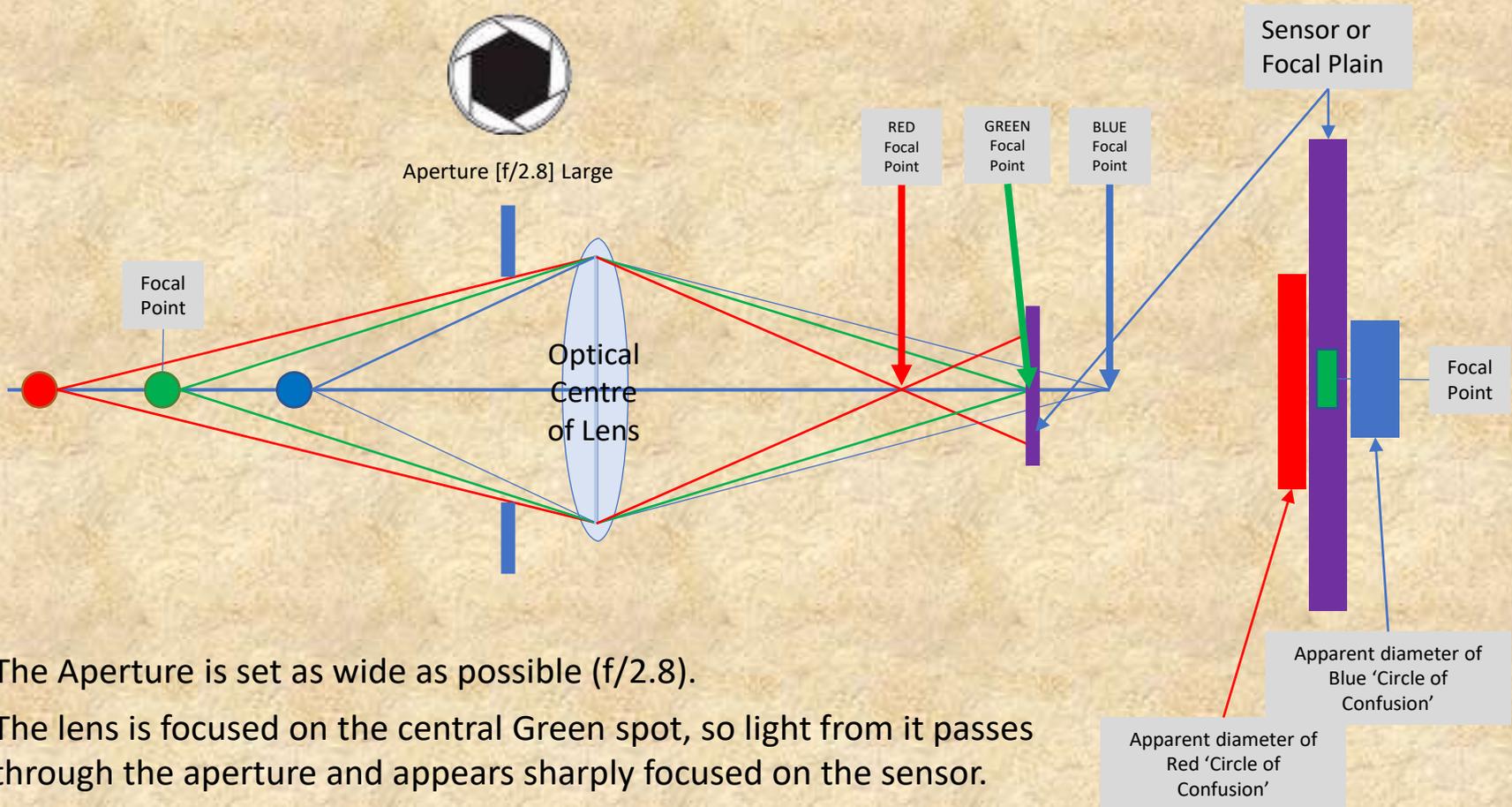
Aperture and the Circle of Confusion

- The term '**circle of confusion**' describes why some parts of an image will be sharp, some will be 'acceptably sharp' and others will be out of focus and, explains how it will create a Depth of Field.
- A single point on the subject only appears as a point on the image if it's perfectly in focus.
- If it's not, the point appears as a circle in the picture.
- The amount of blur in the out-of-focus areas varies, and the objects that are just outside of the depth of field may remain recognizable, even if they're not pin-sharp.



Setting Aperture For A Shallow Depth of Field

!! - This is where we get a bit technical - !!

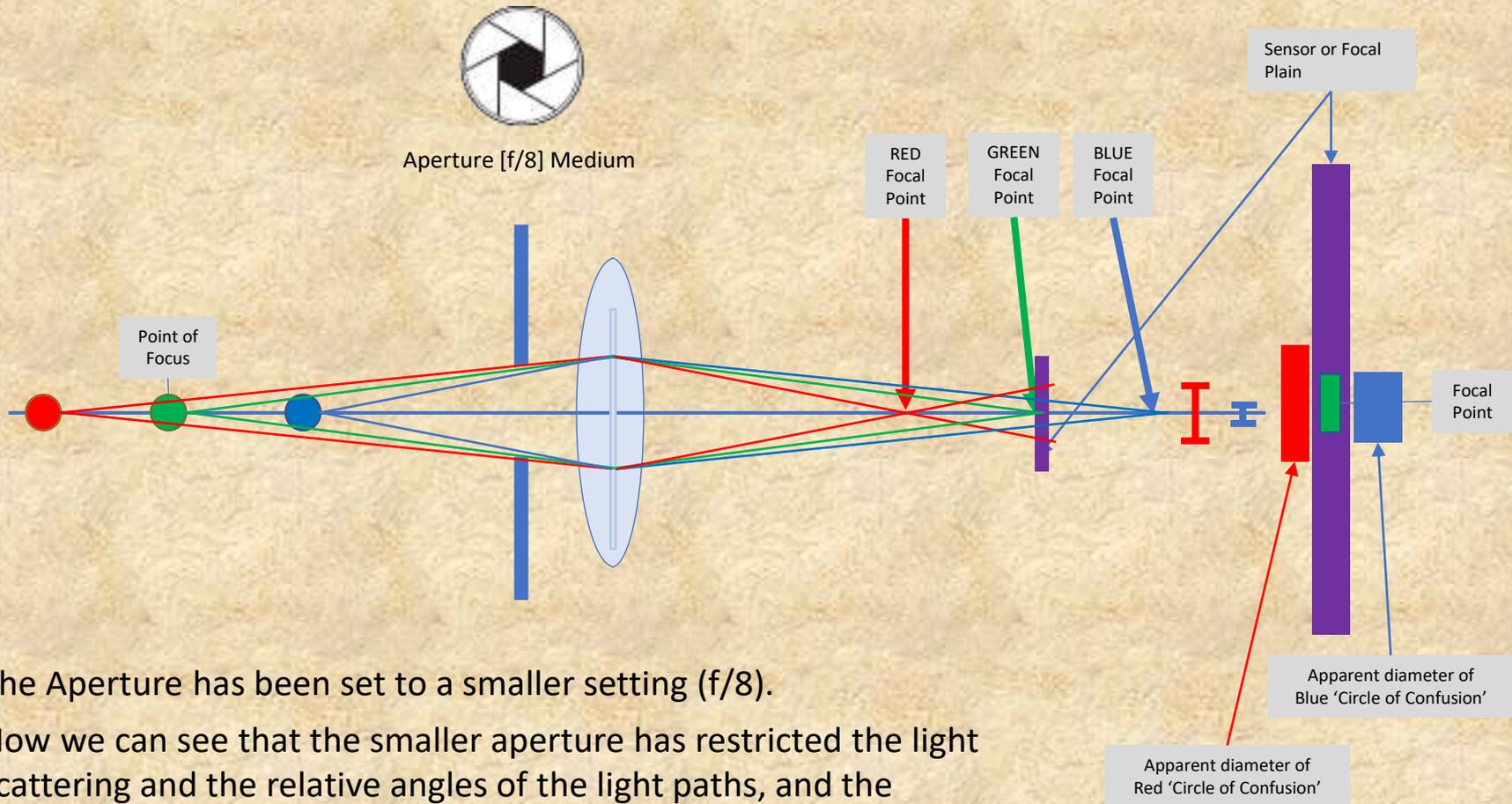


The Aperture is set as wide as possible (f/2.8).

The lens is focused on the central Green spot, so light from it passes through the aperture and appears sharply focused on the sensor.

Light from the Red and Blue spots also pass through the aperture, but the Red spot focuses a short distance in front of the sensor, while the Blue spot focuses a short distance behind it.

Setting Aperture For A Medium Depth of Field

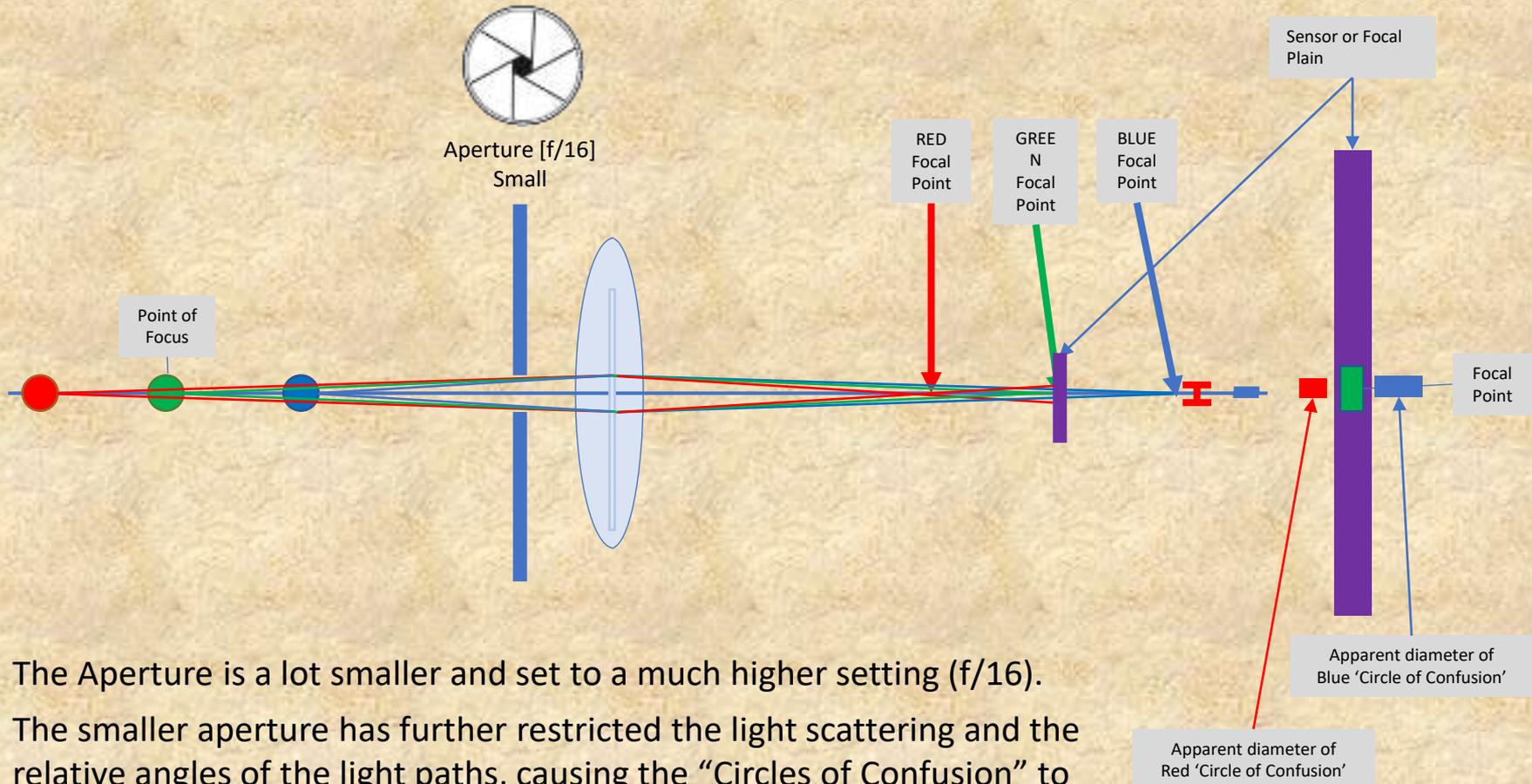


The Aperture has been set to a smaller setting (f/8).

Now we can see that the smaller aperture has restricted the light scattering and the relative angles of the light paths, and the "Circles of Confusion" are smaller.

This makes the Red and Blue spots appear slightly sharper, but they are still out of focus.

Setting Aperture For A Deep Depth of Field



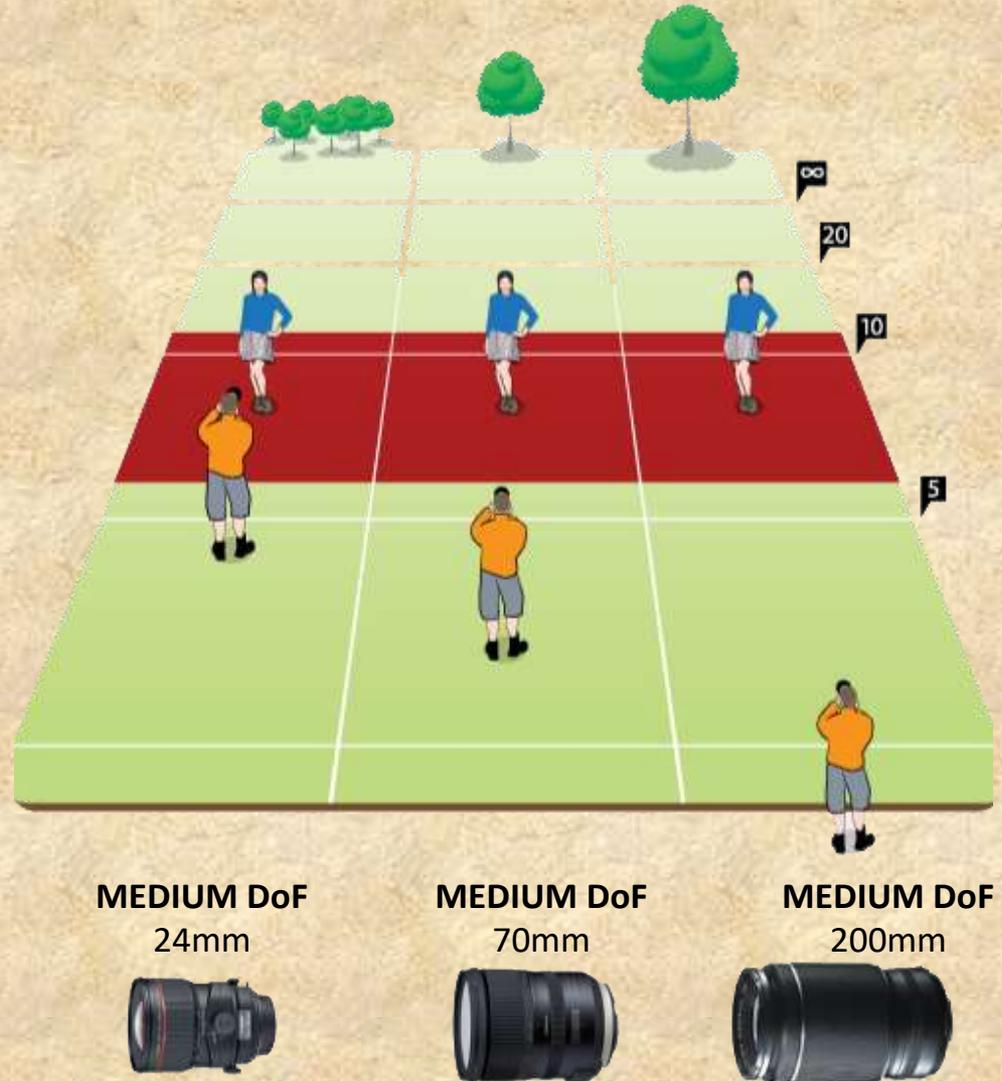
The Aperture is a lot smaller and set to a much higher setting (f/16).

The smaller aperture has further restricted the light scattering and the relative angles of the light paths, causing the "Circles of Confusion" to be almost non-existent.

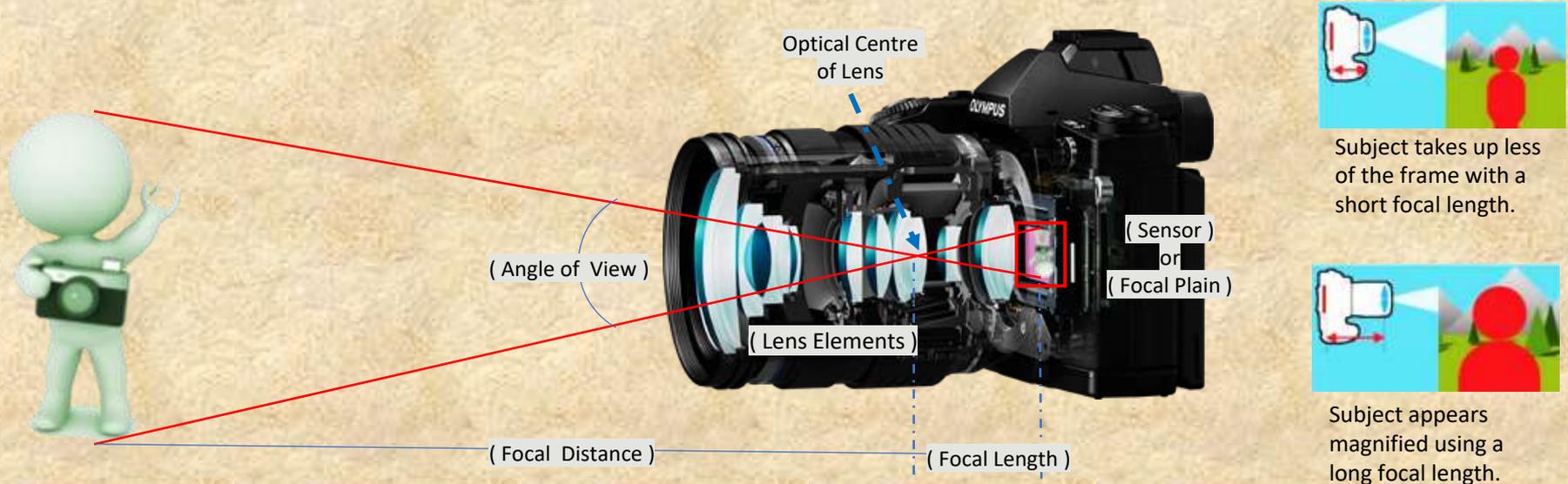
This makes the Red and Blue spots appear much sharper. They are still slightly out of focus, but the effect is not so noticeable.

CHANGING FOCAL LENGTH

- if you stand in the same place and choose a longer focal length, you'll see a noticeable reduction in the depth of field, although the narrower view will also have an affect on the composition of your pictures.
- A longer focal length will also magnify background details, so any blurred areas will appear larger and make the depth of field appear shallower.
- Using a longer lens reduces the depth of field unless you move farther away so that the subject is the same size in the frame, as shown here.



What is Focal Length ?

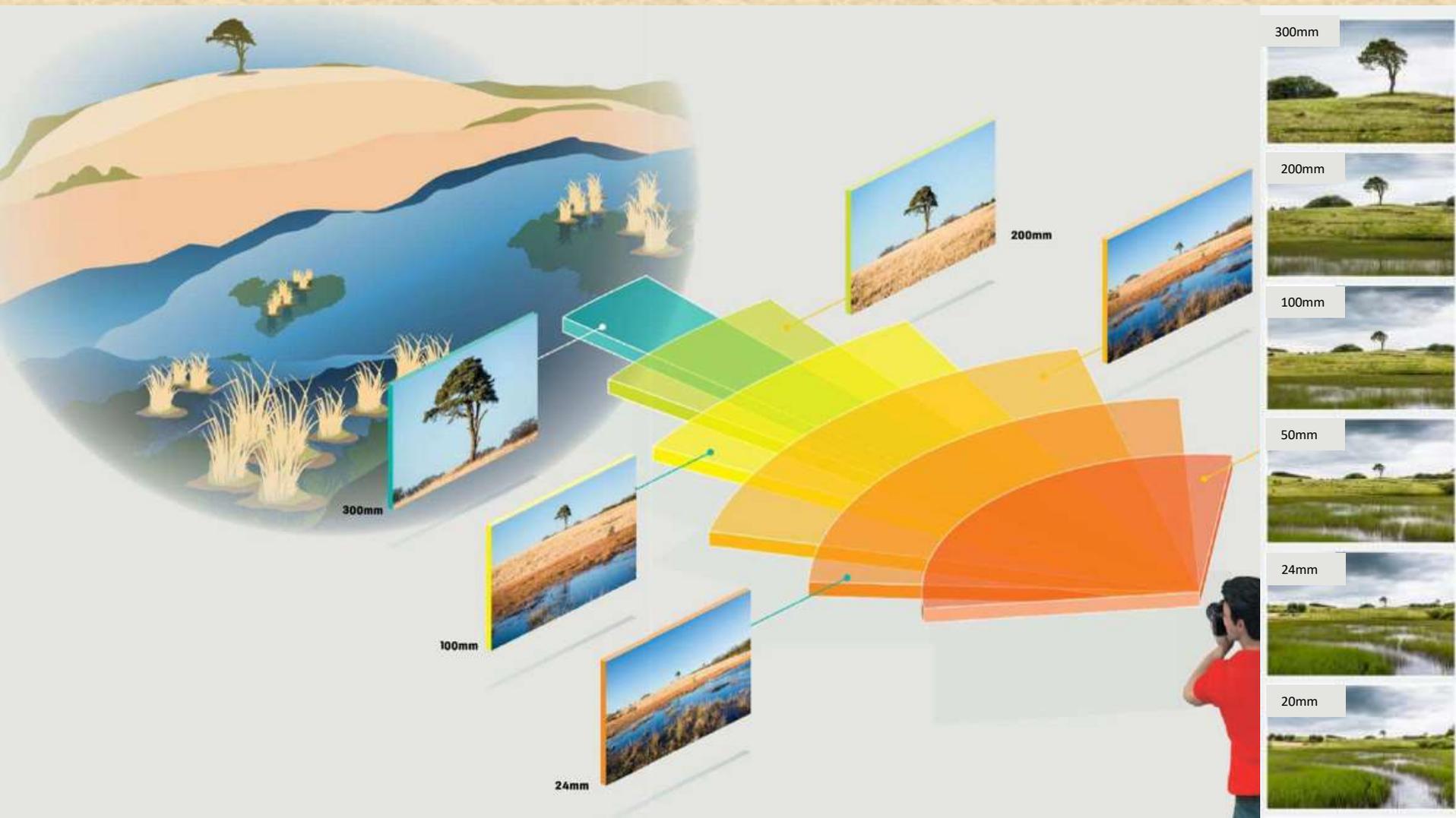


Focal Length is the measured distance between the Optical Centre of Lens, and the Sensor or Focal Plain. To change Focal Length, the distance between the Lens Elements and the Sensor is physically adjusted.

Because of the way modern lenses are made, the lens itself consists of a series of different lens elements, which when combined reduce actual length to one which is more manageable.

Imagine a pocket camera which has a maximum focal length of 300mm, it wouldn't fit in your pocket.

Changing the Focal Length and Angle of View of the camera will directly affect the Depth of Field.

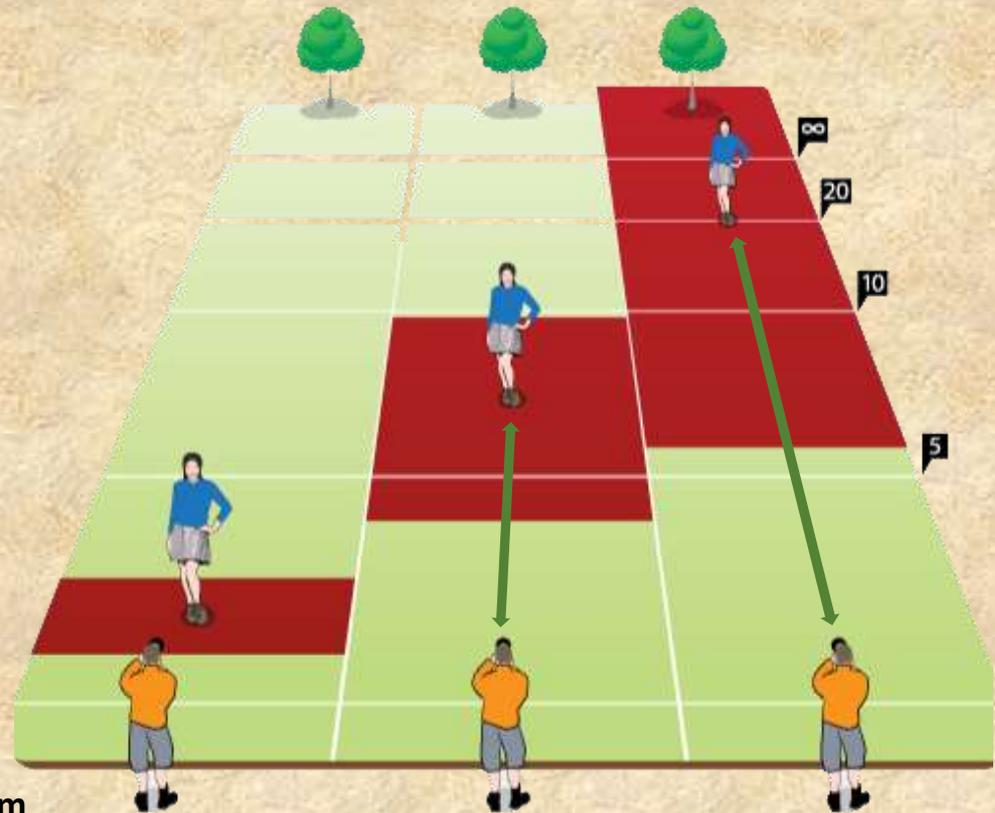


CHANGING FOCUS DISTANCE

- Moving to a different position is probably the least preferable option but, taking a few steps closer to the subject can have a dramatic effect.
- The further you are from the subject you're focusing on, the greater the Depth of Field you capture on camera.



Aperture f/8
with lens at 70mm



SHALLOW DoF
Lens Focused
at 2.5mtrs

MEDIUM DoF
Lens Focused
at 7.5mtrs

LARGE DoF
Lens Focused
at 20mtrs

Get up close.

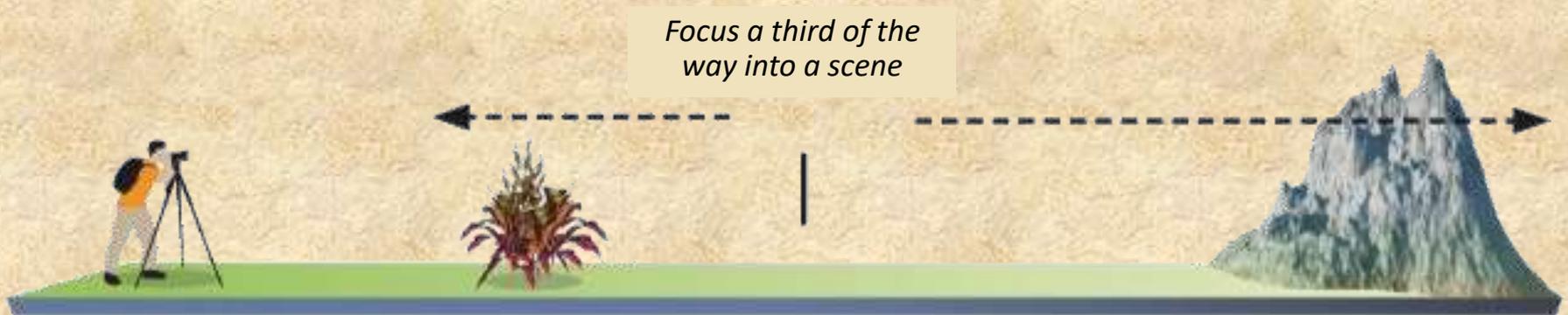
- ***Closeup and macro photography pose the stiffest depth-of-field challenge***
- When your camera is very close to the subject, even the smallest aperture may give you a Depth of Field that spans just a few millimetres.
- But by carefully aligning a Focus Point with the subject's most important feature, you can still make the most of the sparse sharpness and maximise the depth of field for a given aperture.
- Failing that, you can always try framing the shot from farther away and cropping the picture later, although you'll sacrifice some image resolution.



Using The Rule-Of-Thumb To Focus

As we already know, Depth of field extends approximately two thirds beyond the point of focus and one third in front of it.

Which is why there is a rule-of-thumb guidance for front-to-back sharpness, and that is to simply focus a third of the way into a scene.



This technique is not precise or reliable, mainly because it doesn't factor in the aperture you've set or the lens you're using.

!!! But there is another way !!!

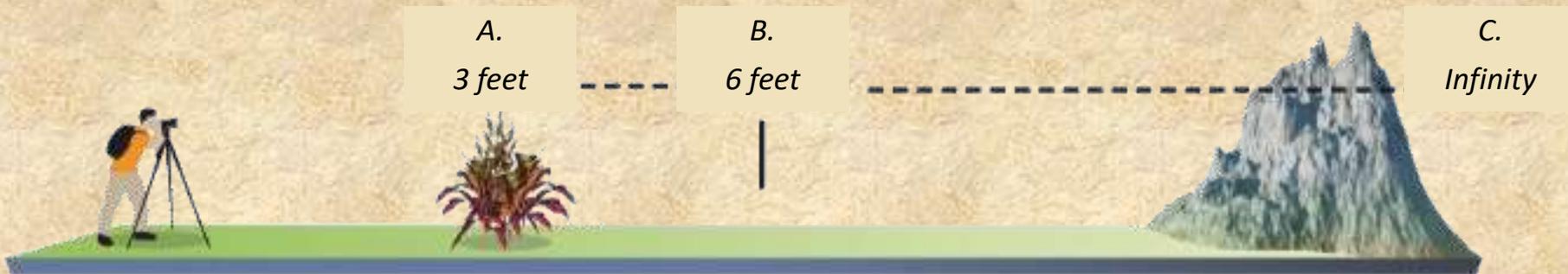
Hyperfocal Focusing

Maximise back-to-front sharpness using this tried and tested shooting technique.

Hyperfocal focusing requires you to manually focus the lens at the hyperfocal distance, which is the closest point at which you can focus while keeping objects in the distance acceptably sharp.

It can be tricky to gauge where the hyperfocal distance is, but there are ways to get it more or less in the zone.

- A. Estimate the distance to the closest object that you want to appear sharp.
- B. Then focus the lens at double that distance.
- C. Everything from half the distance at which you've focused to the background should appear acceptably sharp.



Focusing on the Foreground

- Using a 20mm lens at an aperture of f/8 and focusing on the closest object means that:
 - The depth of field in front is wasted.
 - The background also falls beyond the depth of field.



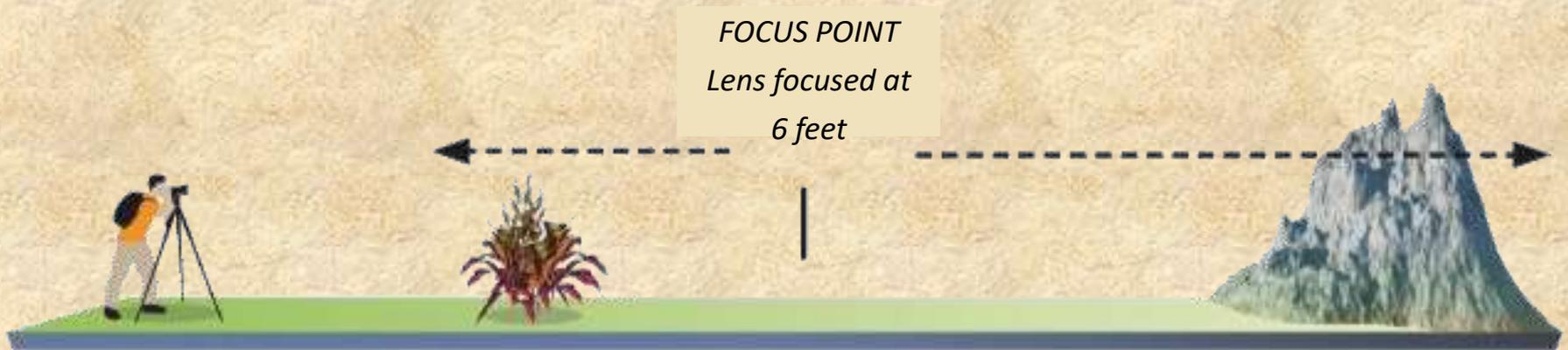
Focusing at Infinity

- Using a 20mm lens at an aperture of f/8 and focusing on the background suggested that:
 - The extensive depth of field beyond the point of focus is wasted.
 - The foreground is blurred.



Focusing at the hyperfocal distance

- Manually focusing the lens at the hyperfocal distance of 6ft, for this combination of focal length and aperture, means everything from 3ft to infinity falls within the depth of field.



Using Depth of Field

Using depth of field (DoF) when composing an image lets you highlight important elements while downplaying distractions. The following images display how depth of field can be used.



Deep Depth of Field

A deep Depth of Field can be used to give objects context, blur distracting backgrounds, isolate details, and direct the viewer's eye around the frame.



Farm in snowy landscape.
Everything in the image is sharp from front to back.



Seats in a sports stadium.
It can emphasise patterns, encouraging the eye to recognise repeating shapes.



Queue of people.
Detail can still be seen in objects farthest from the camera.



Banff National Park.
All elements are sharp, giving everything almost equal relevance.

Medium Depth of Field

Medium Depth of Field with the background out of focus but still recognisable, tells the viewer that the secondary elements are still relevant.



Cakes on a table.

Objects in the foreground are in focus. Background details are blurry but still identifiable.



Beach volleyball game.

Background details are recognisable, giving context.



Scientist handling a test tube.

Foreground is actively highlighted by slightly blurring elements in the background.

Shallow Depth of Field

A shallow Depth of Field can transform a messy background into a wash of colour, letting the main subject take centre stage.



Set of coloured pencils

A small part of the subject is in focus, the rest is blurry.



Blowing seeds from a dandelion.

The subject is in focus, background unidentifiable.



Close-up of a leaf.

Viewers eye is drawn to a small part of the frame.

Conclusion

- Noticing where sharpness begins and ends in your pictures, and learning how to control this area.
- Deciding which areas of the frame should be sharp and which should be out of focus.
- Knowing that Depth of Field depends on three elements of photography:
 1. The aperture.
 2. The distance between the subject and the camera.
 3. Focal length of the lens.

Are all skills a photographer need to master.

Well now you know it, master it.