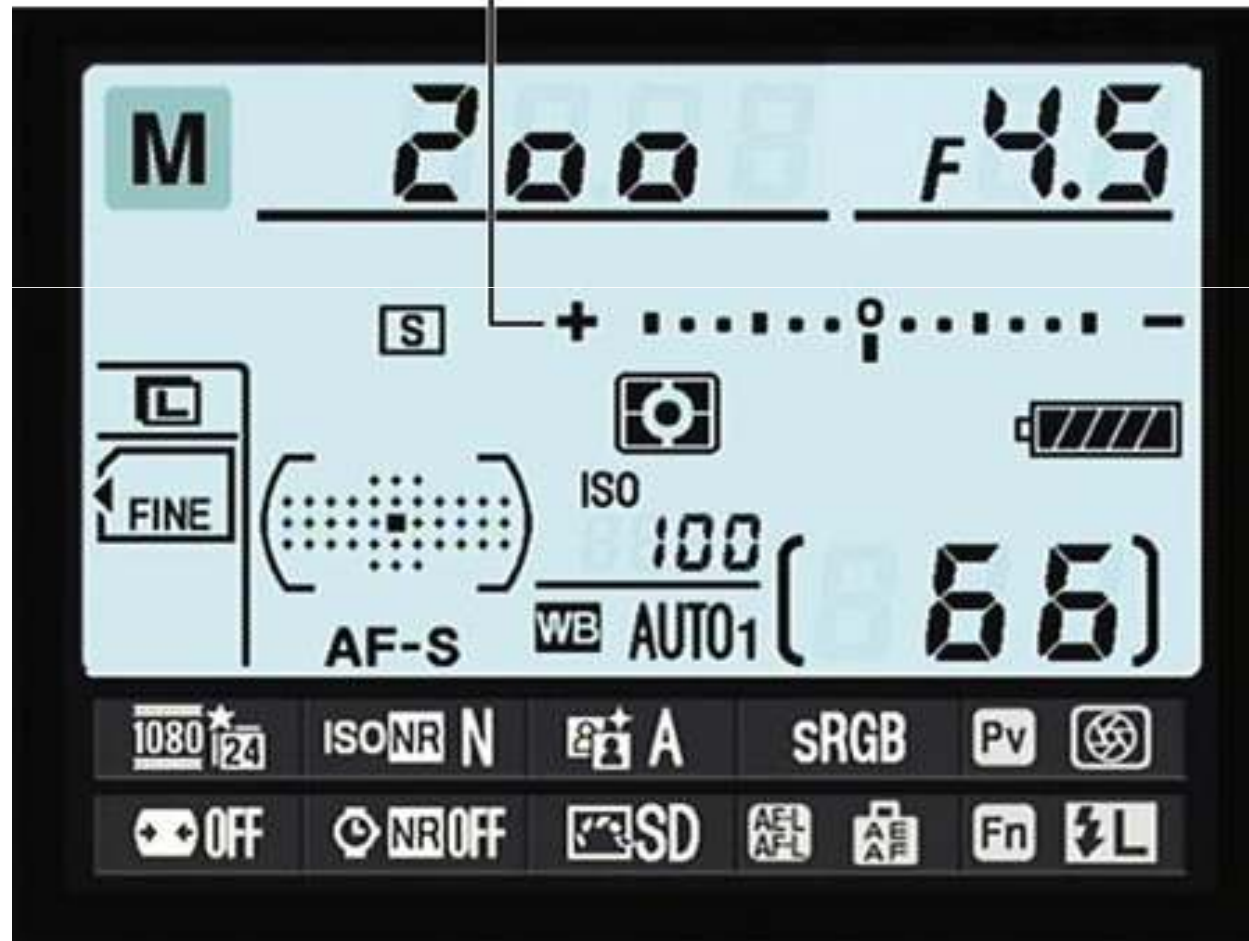


Aperture, Exposure and Depth of Field

Exposure

Exposure meter

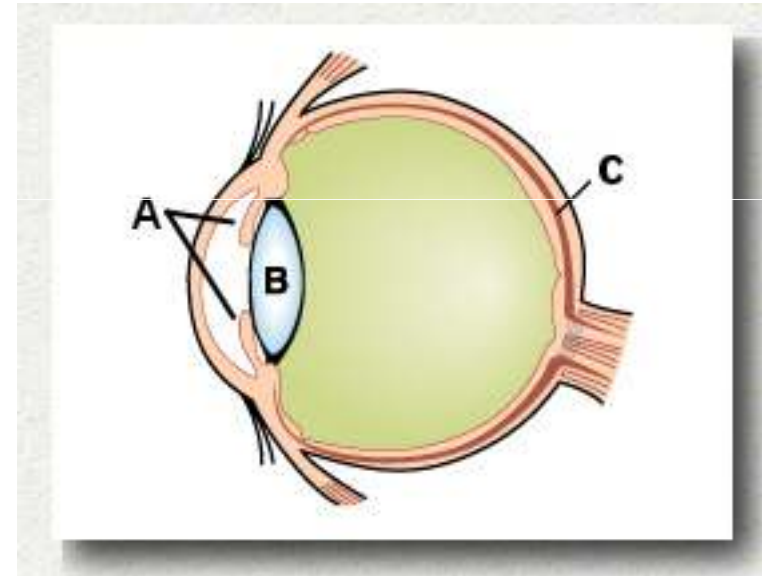


PASM



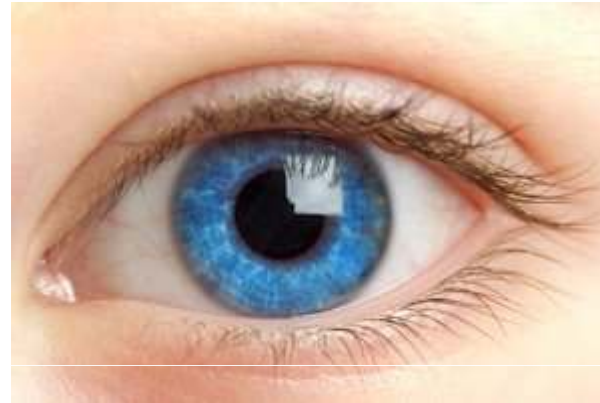
The Eye

- **Iris** – changes the amount of light entering the eye (A)
- **Lens** – can change shape to focus (B)
- **Light sensitive area** where an image is formed (C)

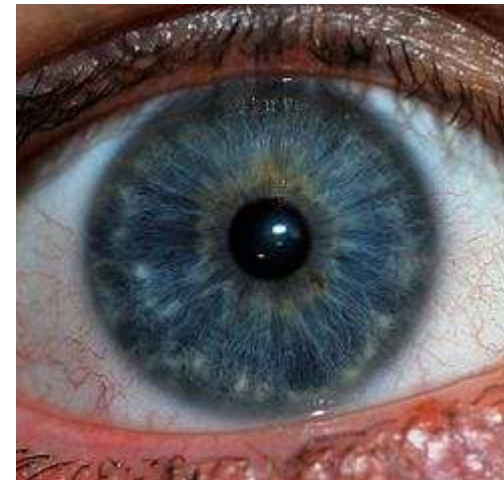


The Eye

- Open human iris



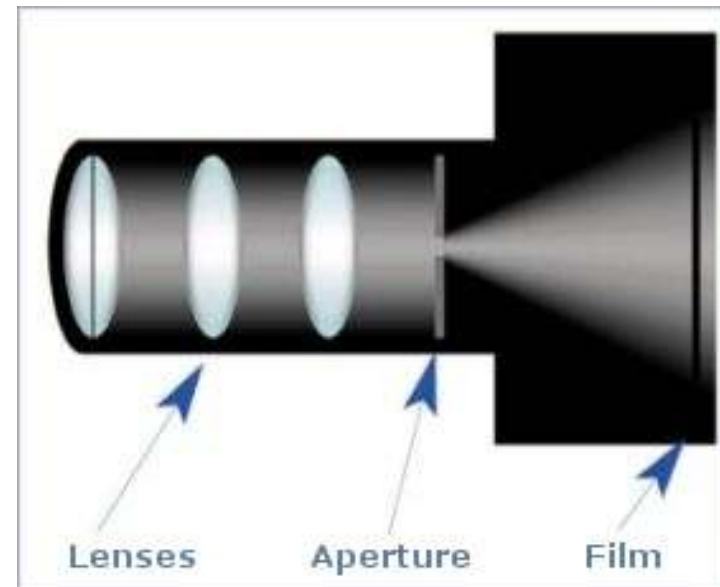
- Closed human iris



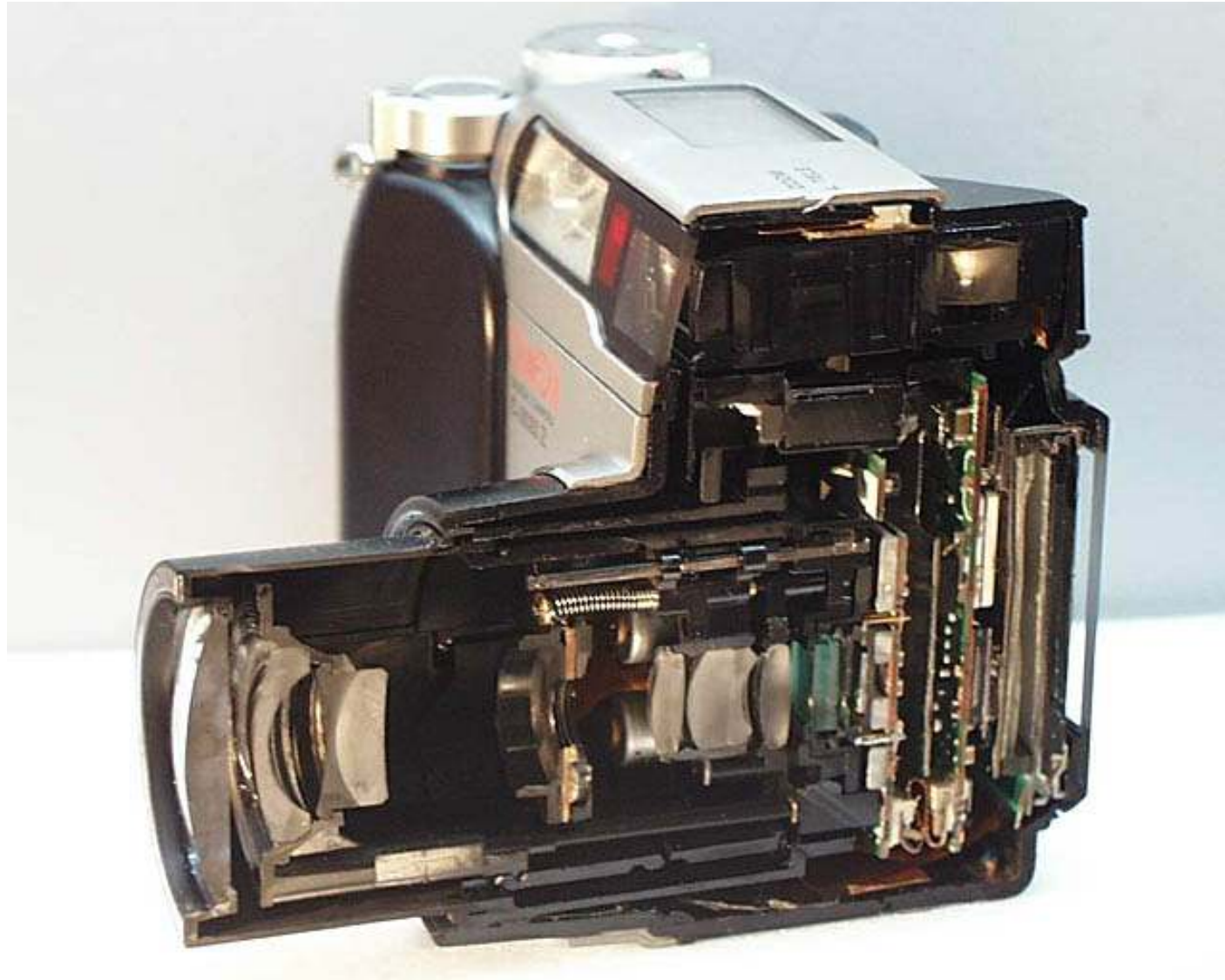
The Camera

Cameras are very similar to eyes:

- **Light sensitive area** – film or digital sensor
- **Lenses** – Instead of changing shape, they move closer or further away to the light sensor.
- **Aperture** in the lens controls the amount of light reaching the light sensor
- A **shutter** also opens and closes to let the right amount of light fall on the light sensor and get a correctly exposed image



The Camera



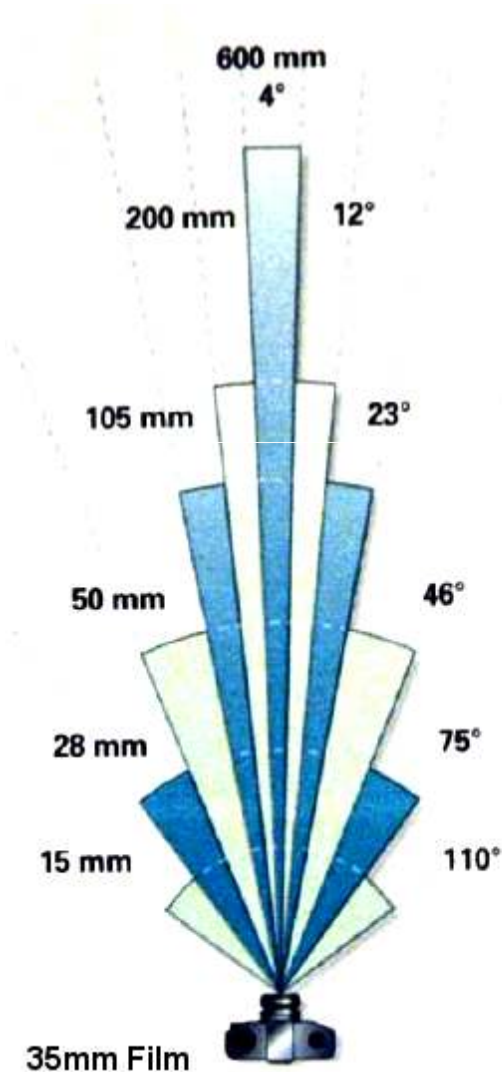
Types of Lenses for 35mm cameras

- Removable – for SLR cameras
- Fixed – on compact cameras
- “Prime” Lens
(Fixed focal length)
- Zoom – most common
(Range of focal lengths)



What does Focal Length mean?

- Wide Angle = large field of view (focal lengths under 50mm)
- Standard (50mm) = same perspective as the human eye
- Telephoto = high magnification (focal lengths over 50mm)



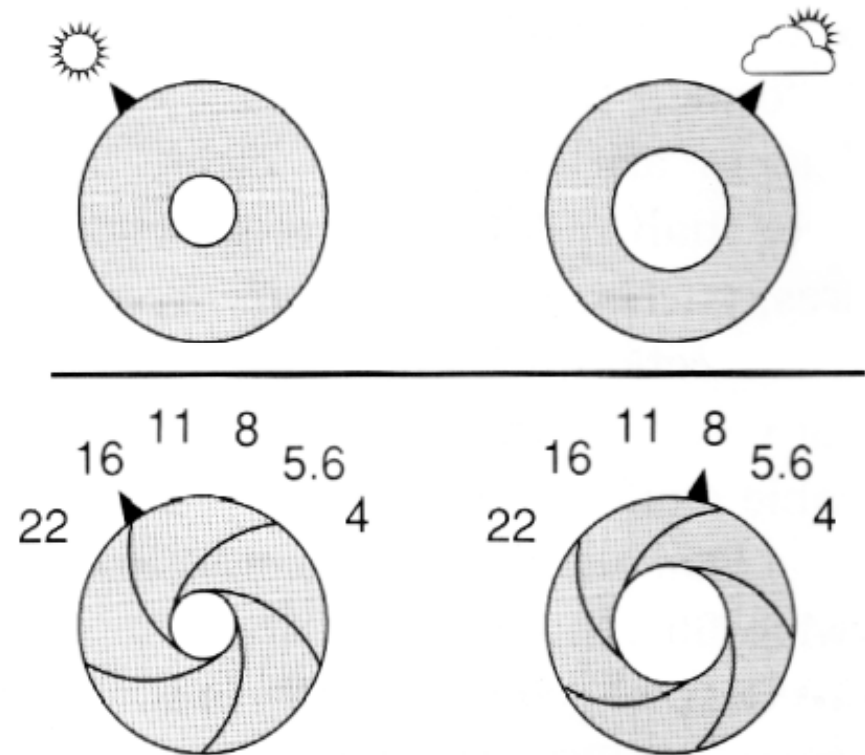
Aperture

- We can use the Aperture to change the amount of light entering the camera
- To describe aperture we use “f/stops” and these have an f number.
- e.g. f2, f2.8, f4, f5.6, f8, f11, f16, f22



Aperture

- Small Apertures
(e.g. f11, f16, f22) only let a small amount of light through
- Large Apertures
(e.g. f4, f5.6, f8) let through a lot of light
- So for a sunny day you might need to use a small aperture to get the correct exposure

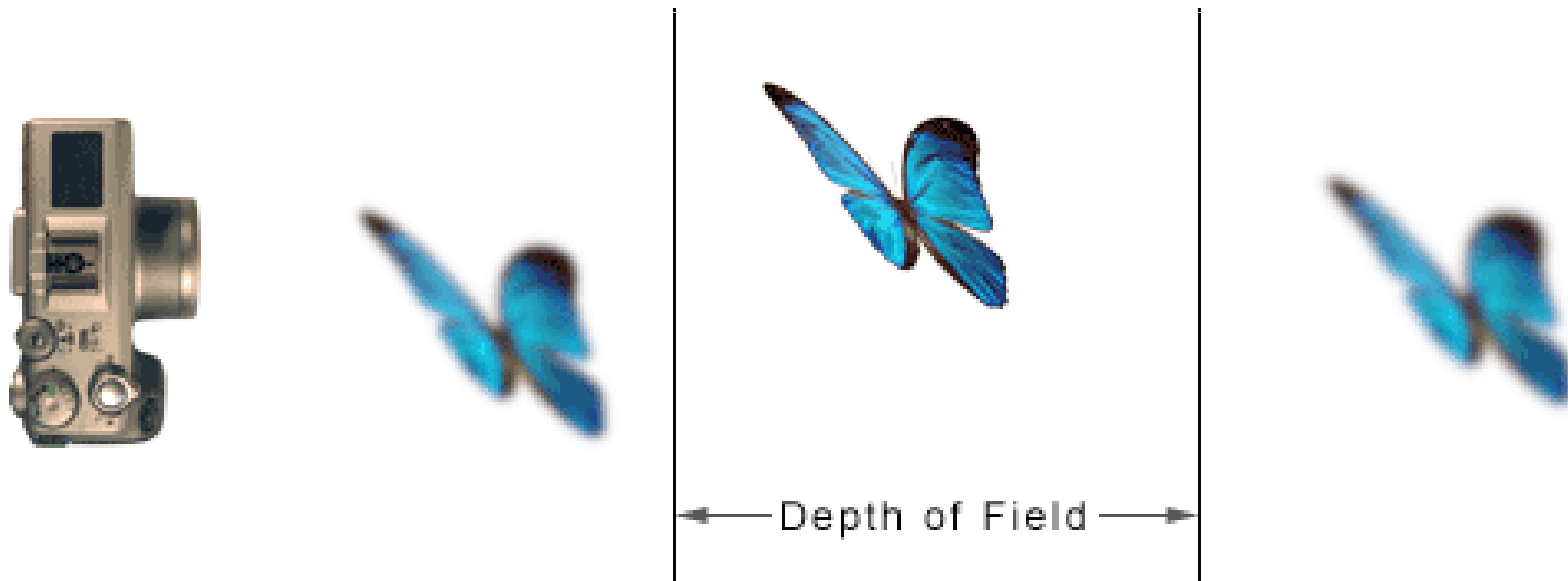


Aperture

- **Each change of f/stop either halves or doubles amount of light entering the camera**
- The largest f/stop on a lens is called the maximum aperture. The maximum lens aperture is important because it indicates the largest amount of light that the lens will transmit
- A smaller maximum aperture f number (= a larger aperture) = a brighter lens = generally more expensive

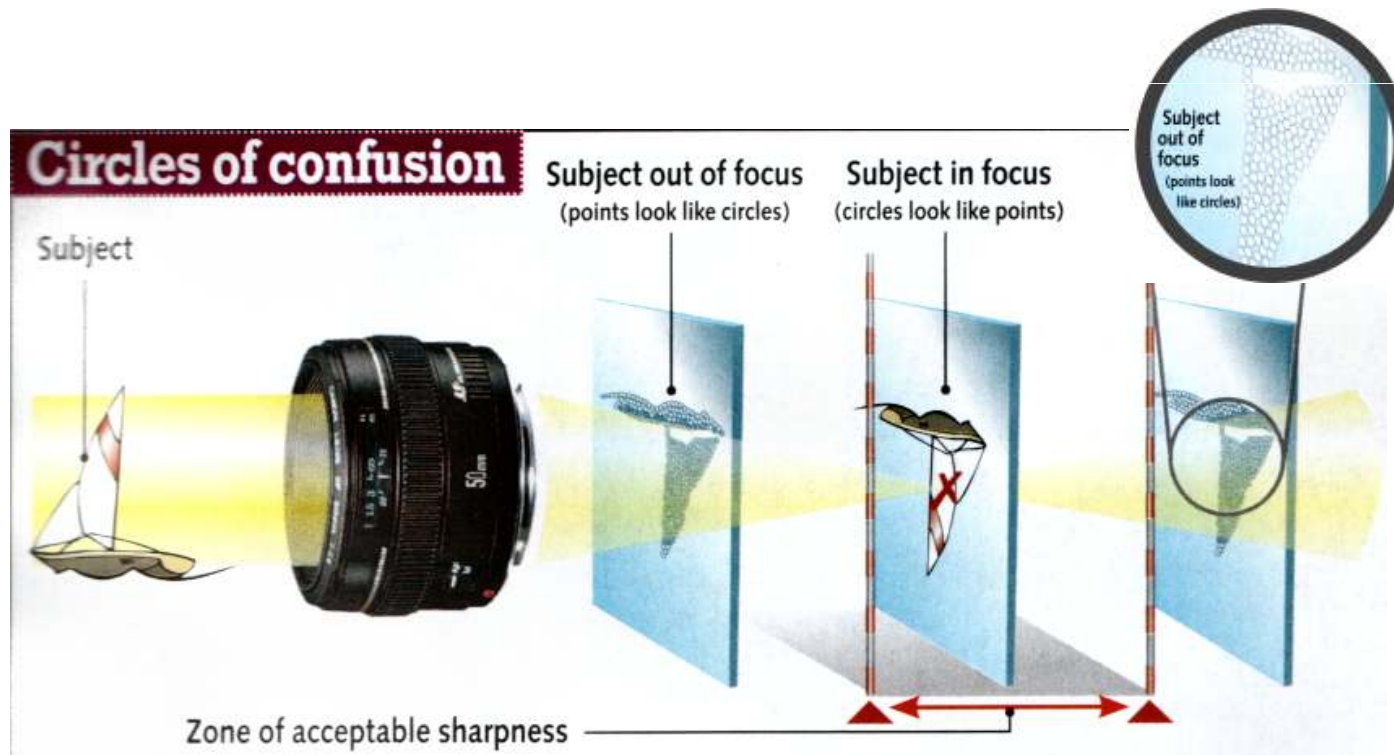
Depth of Field

- Changing the aperture of a camera also changes the amount of the image that is in focus – this amount is called the depth of field



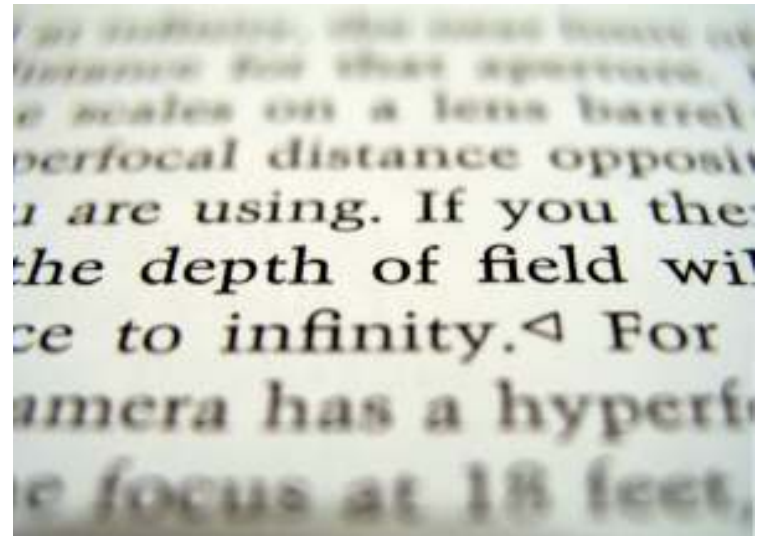
Circles of Confusion

- Only light at the focus depth is exactly in focus, the rest of the depth of field has varying circles of confusion.
- The further from the focus depth, the bigger the circle, and the more out of focus that point appears.



Depth of Field

- Depth of field can vary between shallow and deep
- Large Apertures give shallow depths of field (small f numbers)
- Small Apertures give deep depths of field (large f numbers)



Depth of Field

- Apart from using aperture, the DOF can also be changed by varying:
- Focal Length (varying magnification)



NORMAL FOCAL LENGTH In this sequence, focus distance and aperture are fixed at 5m and f/5.6. Here a 70mm lens is used to widen depth of field.



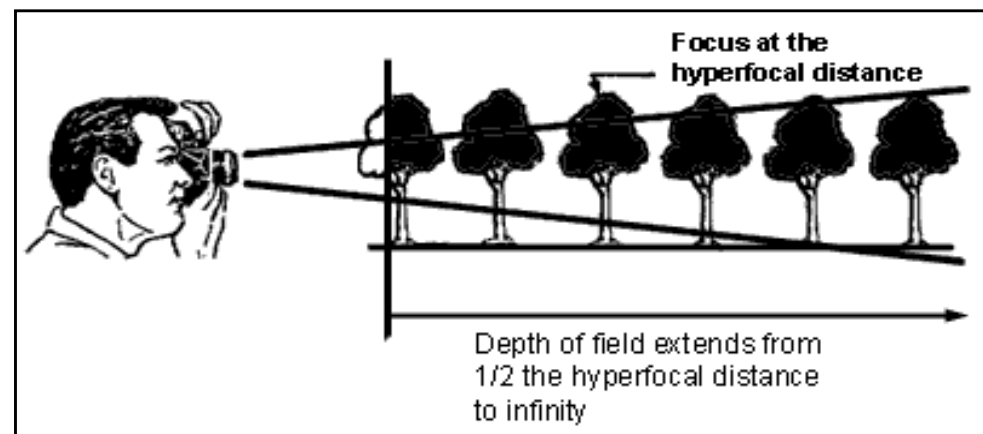
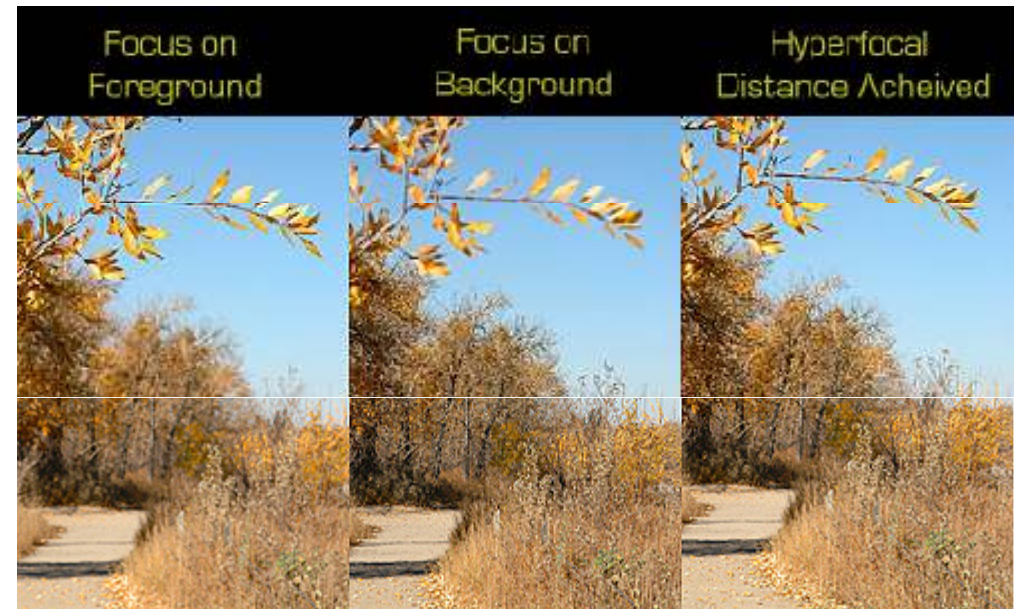
SHORT TELEPHOTO LENS Switching to 135mm lens has visibly reduced the depth of field, causing significantly more blurring of the houses behind the statue.



TELEPHOTO LENS Switching to a 300mm lens has dramatically reduced depth of field to the point where the buildings are reduced to soft, abstract shapes.

Hyperfocal Distance

- The concept of hyperfocal distance is easy to understand: focus a lens at the hyperfocal distance and everything in the photograph from some near distance to infinity will be sharp. Landscape photographs are often taken with the lens focused at the hyperfocal distance; near and distant objects are sharp in the photos.

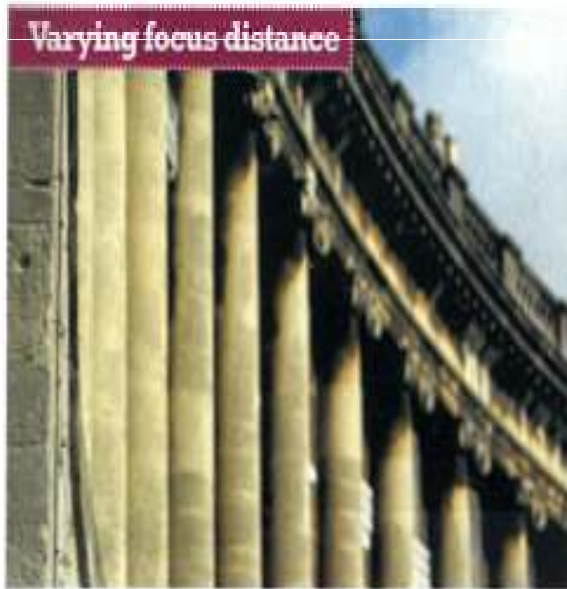


Preview button



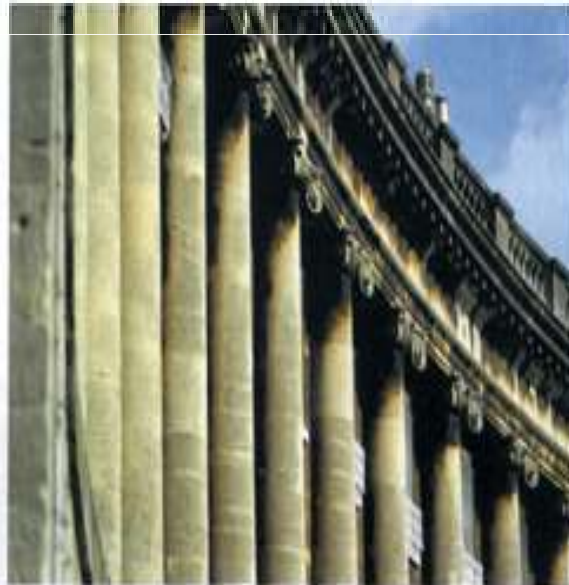
Depth of Field

- Apart from using aperture, the DOF can also be changed by varying:
- Focus

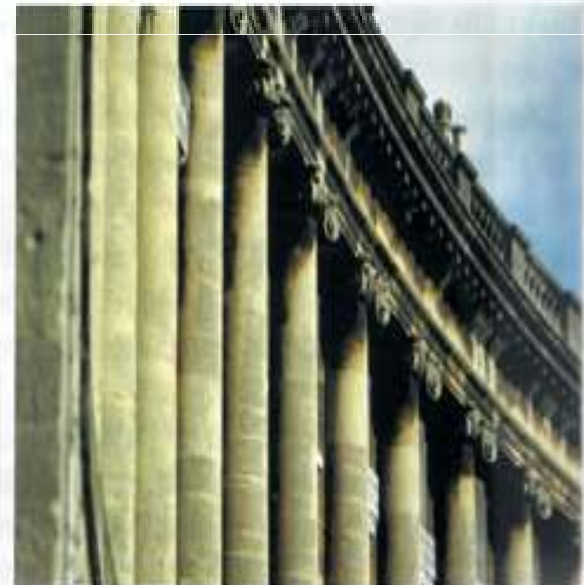


Varying focus distance

FOREGROUND FOCUS In this sequence the lens is fixed (105mm, F4.5) and the focus distance altered. Here, focused on the nearest house, depth of field is minimised.



MIDDLE DISTANCE FOCUS With the lens focused on the middle house, depth of field now extends about five times further than it did in example one.



BACKGROUND FOCUS Focused on the farthest house, depth of field is increased again and now extends almost as far back to the lens as it did in example two.

Creative Use of DOF

- Separate your subject from the background
- Give a feeling of space or distance to a scene
- Highlight a area of the image

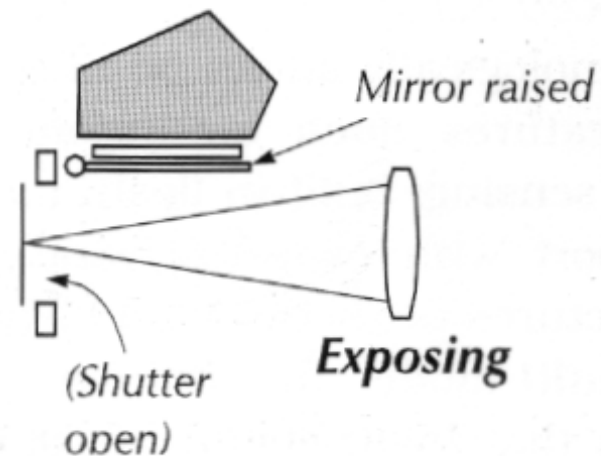
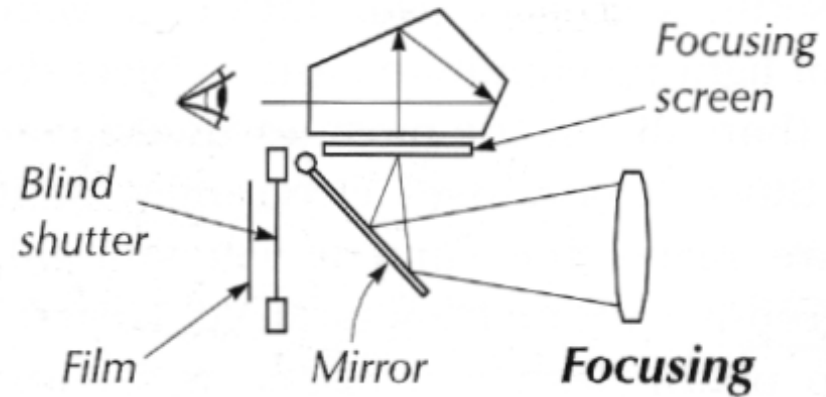


Creative Use of DOF



Exposure / Shutter Speed

- In many cameras a physical shutter will open for a small length of time then close.
- This allows the film or digital sensor to receive light for an exposure.
- In digital compact cameras (and video cameras) the shutter may be electronic, which is where the sensor is only receptive to light for the shutter period



Shutter types

- **Focal plane shutter**
- Found in front of the CCD. The shutter curtain moves sideways or up or down to cover the CCD, limiting the amount of light reaching the sensor



- **Leaf shutter**
- Consists of a number of thin blades which briefly uncover the camera aperture to make the exposure.



- **Electronic Shutter**

Shutter lag

- Shutter lag is the delay between pressing the shutter button and the camera recording the picture.
- Minimise the shutter lag by
 - *Pre-focusing.*
 - Use continuous auto focus.
 - Shut the flash down.

Exposure / Shutter Speed

- The effect of varying shutter speed while keeping a constant aperture:



The images start underexposed (too dark) with a short exposure, are correctly exposed around 4s, and become overexposed (too bright) at 15s+

Exposure / Shutter Speed

- A fast shutter speed (creating a short exposure of the film/sensor) is required to freeze motion (e.g. 1/1000s)
- A slow shutter speed (creating a long exposure) can blur motion for interesting effects (e.g. 1/15s)



Shutter Speed

- Very long exposures (30 seconds+) may be required in low light, but this can produce nice effects – look at the sea.



Dunstanburgh Castle, Northumberland by Lee Frost
(www.leefrost.co.uk)

Reciprocity

- Changing the shutter speed by +/-1 increment changes the exposure value by 1 stop (e.g. 1/30s to 1/60s)
- Changing the aperture by +/- 1 increment also changes the exposure value by 1 stop (e.g. f11 to f8)
- As these changes are equivalent, it means that there are a number of combinations that will give a correct exposure.
- e.g. 1/30s @ f11 = 1/60s @ f8 = 1/125s @ f5.6...

Reciprocity

- This is important, as it allows us creative control over the camera by varying the aperture and shutter speed to get the both correct exposure and the creative effect we want in the image.

Now the test!

- Under or over exposure?



Now the test!

- Which is the largest aperture?



Now the test!

- Under, or over exposed?



Now the test!

- Small or large aperture?

