

Managing Light - a basic introduction to Digital Photography

1. Cameras and eyes

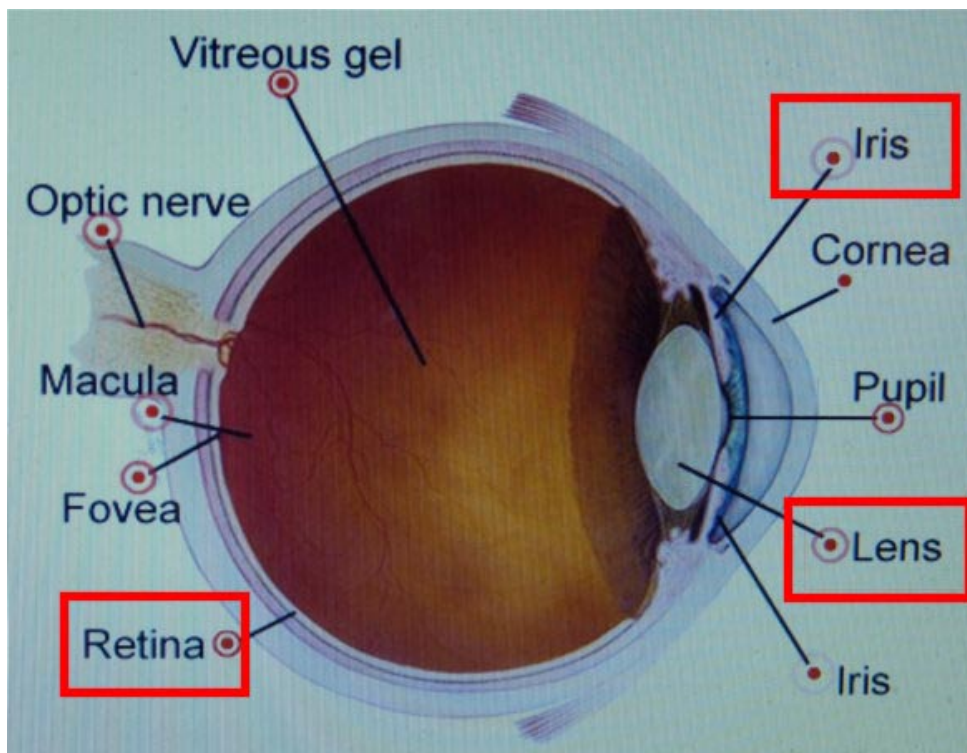
- A camera 'captures' images that we can see with our eyes which function automatically.
- Cameras used to be controlled manually, according to basic light management concepts but now they are complex computers with semi or totally automatic operations.
- But they still use the same basic concepts of managing light.

2. Taking control of the camera

- All cameras have Auto setting when the camera and its computer is in control. This can work perfectly well in a lot of situations so why bother with anything more 'complicated'?
- Camera computer is sophisticated but it guesses and goes for the 'normal'. So understanding the basic concepts and taking control will improve your photography.

3. How is the image managed?

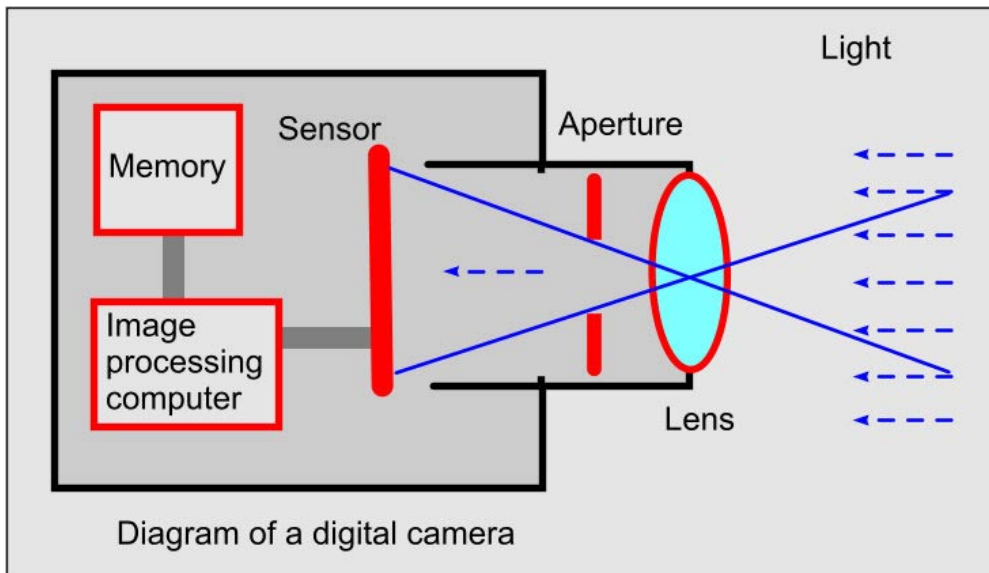
- **Exposure** comprises aperture – size of hole letting in light, Time/shutter speed – time light is allowed in and ISO – sensor sensitivity to light.
- **Focus** involves DoF – depth of field – how much is in focus (a function of aperture) and use of Auto focus.
- **Lenses** involve concepts of focal length and fixed or zoom



The human eye and features relevant to a camera

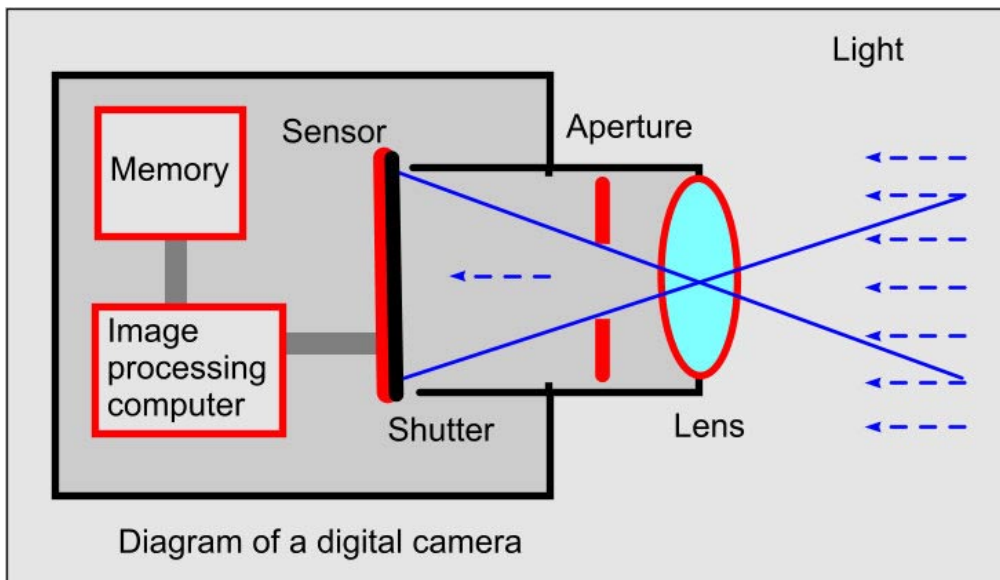
4. Exposure - aperture

- Like the eye the camera has a form of iris to control the amount of light passing through.
- To get a constant amount of light reaching the sensor it is made bigger or smaller according to the level of light.
- Called 'f' stop – typically on a scale of f1.4, f2.8, f3.5, f5.6, f8, f11, f16, f22.
- It seems illogical but the higher the number the smaller the hole!



5. Exposure - time/shutter speed

- The eye is a movie camera with no shutter but our cameras are still cameras capturing an image in an instant.
- The 'shutter' blocks off the light from the sensor and pressing the release button opens the 'shutter' for a given time to allow in a precise amount of light.
- In effect another means of controlling the amount of light reaching the sensor. It is expressed in parts of a second, e.g.
- 1/1000, 1/500, 1/250, 1/125, 1/64, 1/32, including intermediate speeds and higher and lower ones.



6. Exposure – ISO sensor sensitivity

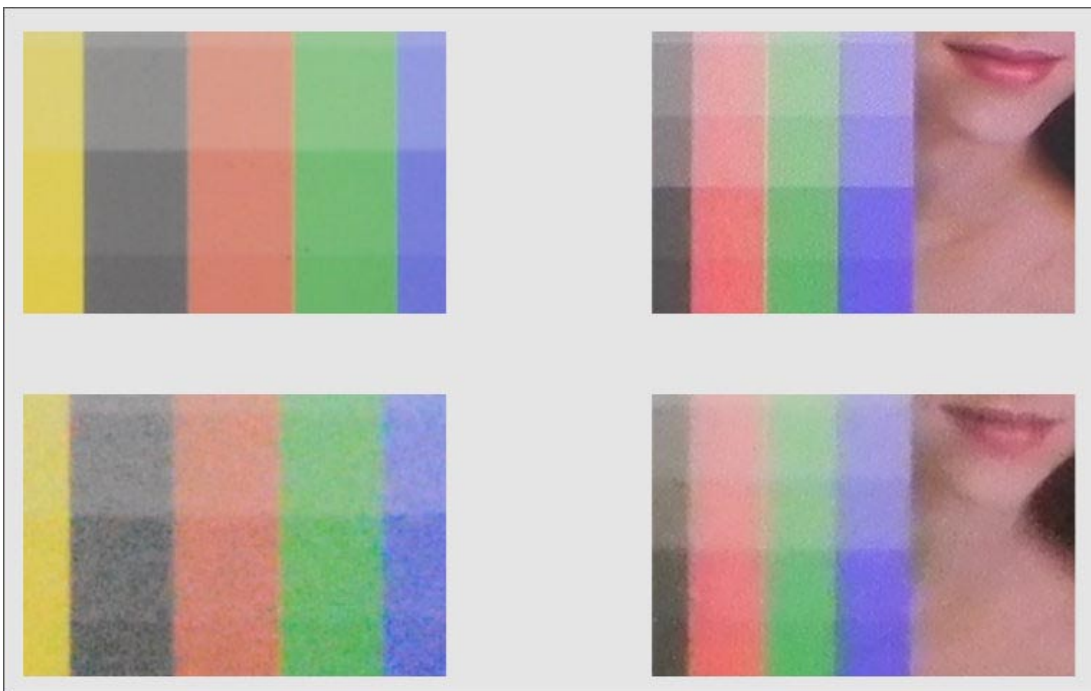
- Not the amount of light reaching the sensor but the sensitivity to light of the sensor itself, which can be varied.
- Called ISO and rated, e.g. 3200, 1600, 800, 400, 320, 200, 100
- The higher the ISO the more sensitive the sensor is to light and so can capture an image in poorer light.

7. Exposure – in summary

- Correct exposure means balancing all three elements: aperture, shutter speed/ time, ISO sensitivity to allow exactly the right amount of light to reach the sensor according to the sensitivity that has been set for it.
- Too much light = over exposure = pale.
- Too little light = under exposure = dark.

8. Exposure – choosing ISO

- The higher the ISO the 'grainier' the image – more 'noise', so why choose high ISO?
- Low light levels the main reason.
- For most photography you can set a level that gives least noticeable noise. This depends on sensor size and number of megapixels – varies from camera to camera.
- ISO 400 is OK for most modern cameras



Examples of noise

Top left: Nikon DSLR D3200 ISO 100

Bottom left: Nikon DSLR D3200 ISO 12800

Top right: Nikon Compact P100 ISO 1600

Bottom right: Nikon Compact P100 ISO 3200

9. Exposure – relationship of aperture and shutter speed

- If we assume a constant ISO setting, for a given amount of light, exposure is a combination of speed and aperture, say 1/125 at f5.6.
- For a constant amount of light the following pairings would also allow in the same amount of light to the sensor:

f2.8	f4	f5.6	f8	f11
1/500	1/250	1/125	1/64	1/32

10. Exposure – choosing different shutter speeds

- Keeping the camera steady – camera shake. Most people cannot hand hold below 1/60 and generally 1/125 is safe. But what is 'safe' depends on the type of lens.
- Capturing motion – your choice - e.g. do you want to freeze a waterfall or allow the water to blur to convey motion?



**1/1600
at f5.6**



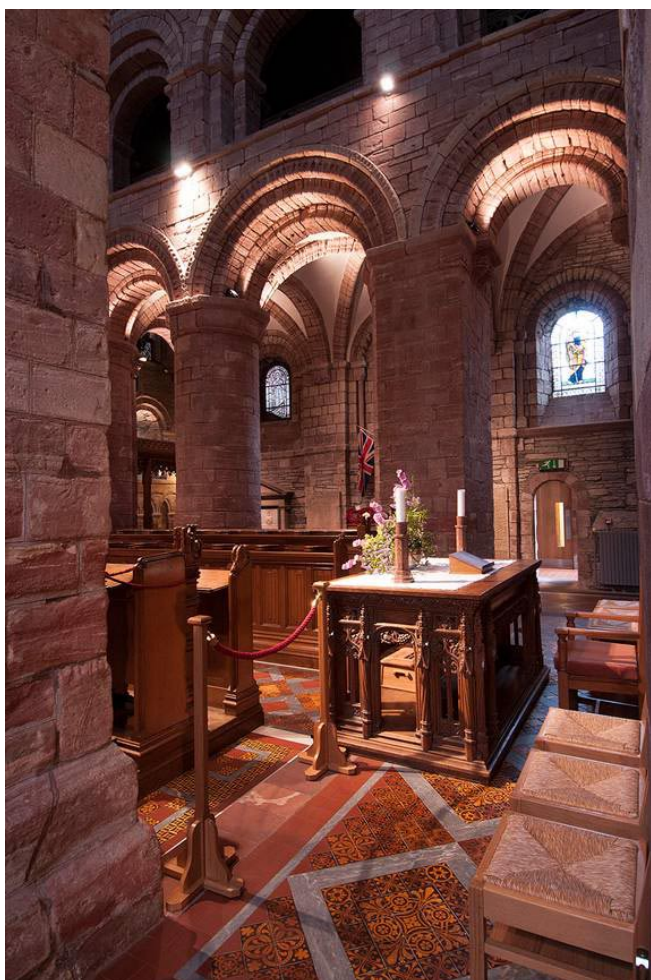
**1/4 at
f29**

- Some broad guidelines:
- First question: is the subject moving across the image or towards you? Walking: 1/125 - 1/250 generally OK. Running: 1/500 probably OK. Faster movements 1/800 and higher. Remember telephoto exaggerates movement.
- In some cases panning might be the answer with a slower shutter speed. The blurred background gives a sense of motion.



Example of panning to convey the sense of motion

- In some cases a very slow shutter speed is necessary where the light level is low. Flash is often not a realistic alternative. A tripod is ideal to hold the camera rock steady and so avoid any camera shake. A very good alternative is a bean bag – and much cheaper! Sometimes just wedging the camera against a support will work.



Two examples of slow shutter speed where flash would not have helped.

Left: St Magnus Cathedral, Orkney

Camera wedged on pillar at 1/6 at f6.3

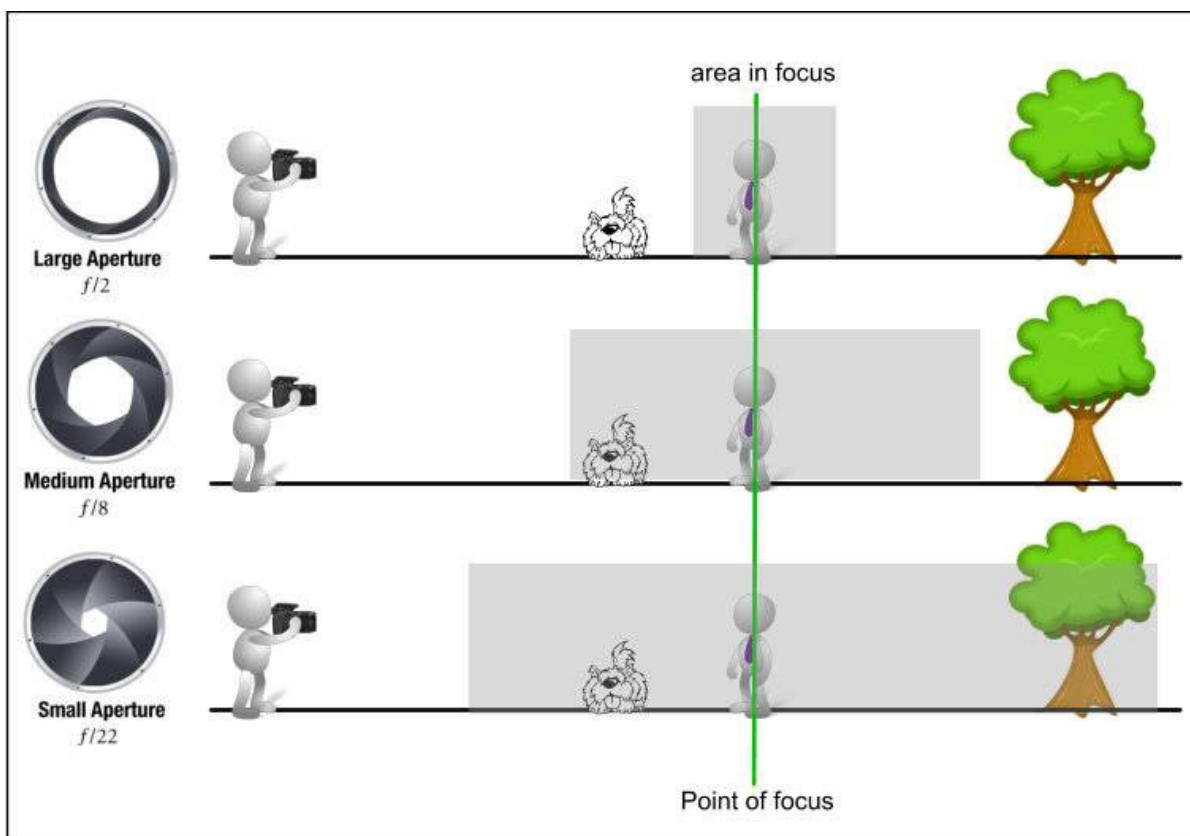
Below: The Italian Chapel, Orkney

Camera wedged on rail with bean bag at 1/4 at f8



11. Aperture – choosing different apertures

- Main reason is the concept of 'Depth of Field' or 'Depth of Focus' – DoF. It is the distance between the nearest point that is in sharp focus and the furthest point that is in sharp focus.
- The extent of this varies according to the f stop used. f1.4 = shallow, f22 = deep



Note that the area in focus is always deeper beyond the point of focus than in front of it



**Shallow depth of focus to isolate lead cyclist from those behind - separation.
Exposure: 1/640 at f4.5**

Below: smaller aperture to bring foreground and distant objects into focus

Exposure: 1/200 at f8

Point of focus: middle distance.



12. Focus – issues to remember

- Auto focus or manual? In macro (close-up) work manual focus can be essential.
- Normally auto focus is best BUT take control of the point of focus. What is important, e.g. the eyes in portraits, in landscape remember DoF and so focus on a mid point to get maximum DoF.
- Half press release button to gain focus point, recompose and complete press.

13. Exposure – bringing it together in practice

- Choose an ISO that works best in terms of image quality – only change it when you need to. Best to avoid Auto ISO setting.
- Think about the image you are going to take. What is important the depth of field or capturing motion?



Mode settings in a DSLR and Scene modes in a compact camera

14. The different camera modes

- **Auto/iA** = camera chooses ISO, aperture, speed and flash.
- **P** Program mode = camera sets speed and aperture – you can vary the combination.
- **A** Aperture = you select the aperture and camera sets speed.
- **T** Time (or **S** Speed) = you select shutter speed camera sets aperture.
- **M** Manual = you set both speed and aperture
- **Scene** modes = various combinations of aperture, speed, ISO and other things like flash control which the camera manufacturer has decided.
- **Decide** who is in charge, you or the camera

15. Lenses - focal length

- The distance from centre of lens to the sensor. To keep it simple compacts are referred to in terms of Nx zoom and as if they had old 35mm camera lenses.
- But lenses for interchangeable lens cameras (DSLR, CSC) are marked in terms of how they would perform on a FF/35mm camera.
- Fish eye or super wide angle: 8mm-20mm
- Wide angle: 20mm-50mm
- Standard: 50mm
- Short telephoto: 50mm-135mm
- Long telephoto: Over 135mm, e.g. 200mm, 300mm, 500mm

16. Lenses – features

- **Wide angle** distorts perspective if tilted off horizontal. In taking in wide view distant objects lose impact – mountains look smaller. Big depth of field
- **Telephoto** Condenses perspective – distant things appear larger. Shallow depth of field.
- Specials, e.g. **Macro**. Able to focus very close up



Wide angle to telephoto from the same position

17. More on lenses

- Prime lens = fixed focal length, In absolute terms give the best quality
- Zoom lens = cover a range of focal lengths. A very flexible lens. The bigger the range the poorer the quality in absolute terms at some point in the range. Different widest aperture on zoom lenses – fixed/variable. Generally the wider the aperture the better but you get what you pay for!

18. Lens crop factor

- CSC – micro 4/3: 2x so 50mm lens creates an image like 100mm lens on a 35mm camera
- Canon DSLR (excluding FF): 1.6x so 50mm lens creates an image like 80mm lens on a 35mm camera
- Nikon DX DSLR: 1.5x so 50mm lens creates an image like a 75mm lens on a 35mm camera
- Nikon and Canon FF same as 35mm camera

19. In conclusion

- Try setting your camera on **A or T/S** modes instead of Auto.
- **Aperture** modifies depth of field.
- **Speed** controls motion.
- Change **ISO** if it is essential to get the image in low light.
- **Focus** on what is critical.
- **Think** about the image you want to create.
- **Take charge of your camera.**

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