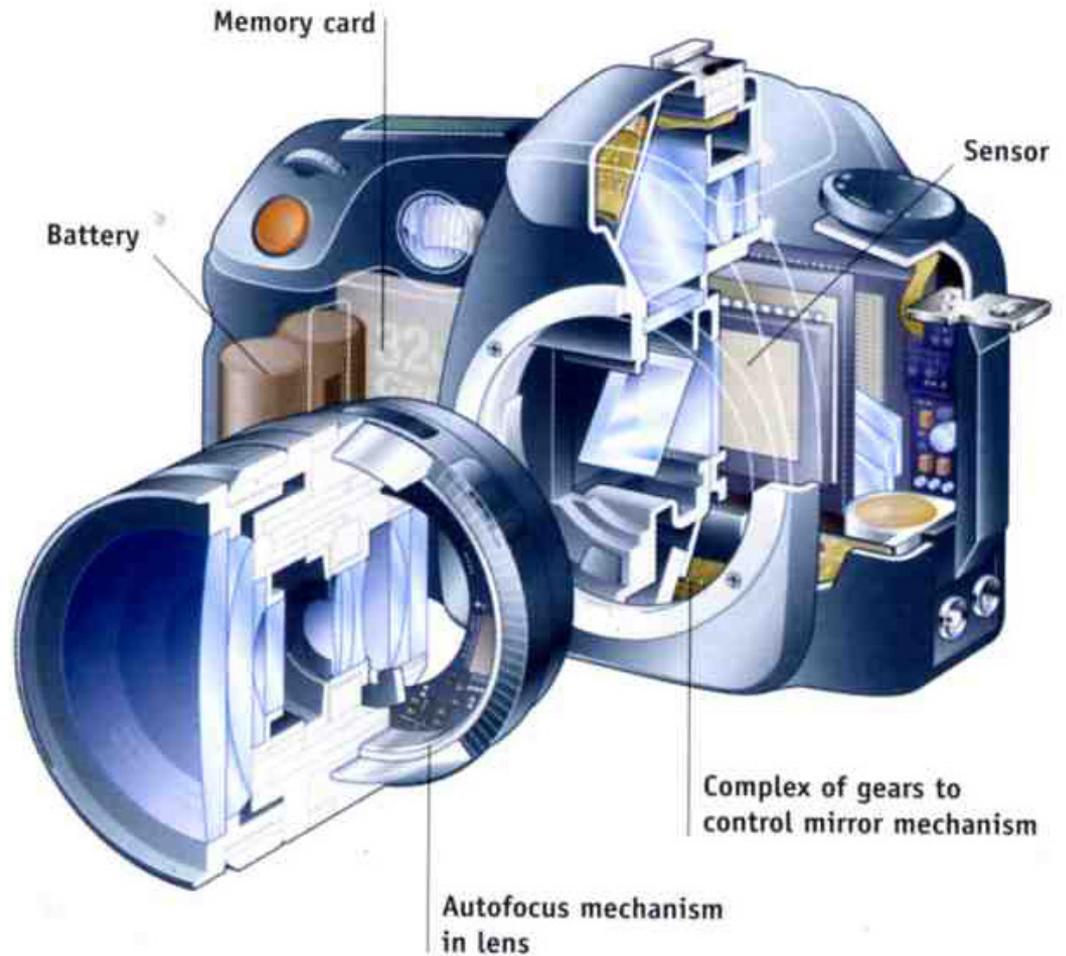
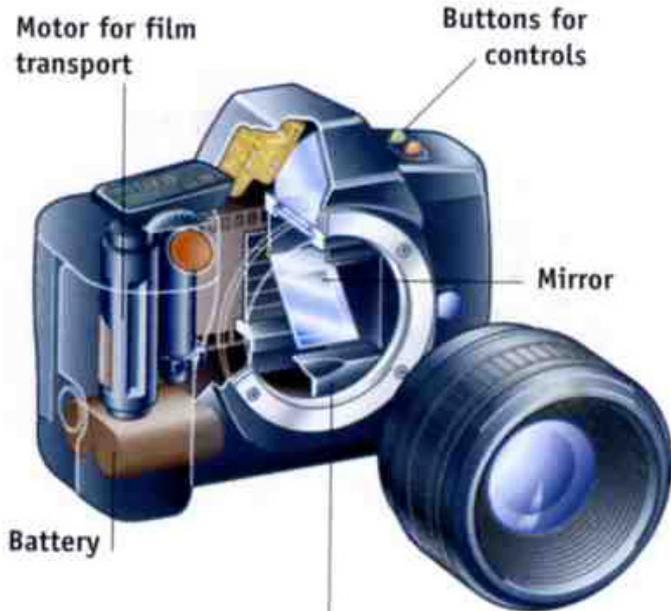


THE DIGITAL CAMERA

Claudia Jacques based on Curt Belshe

Film cameras

The core of the camera is an extremely precisely machined, rigid box that aligns the lens with the film and viewfinder optics.



Digital cameras

Similar in construction to a film camera, but with the space occupied by the film and its transport mechanism taken up by electronic components for processing electronic image data.

The Parts

Sensor

Shutter

Aperture

- The basis of all cameras is very simple.
- There is either film or a sensor device which when exposed to light captures an image.
- A digital camera uses a sensor usually a CCD (charged coupling device) or sometimes a CMOS, which is beginning to be used for capturing HD video.
- The sensor device is an array of millions of individual light sensitive sensors each representing a pixel in the final image.

Shutter

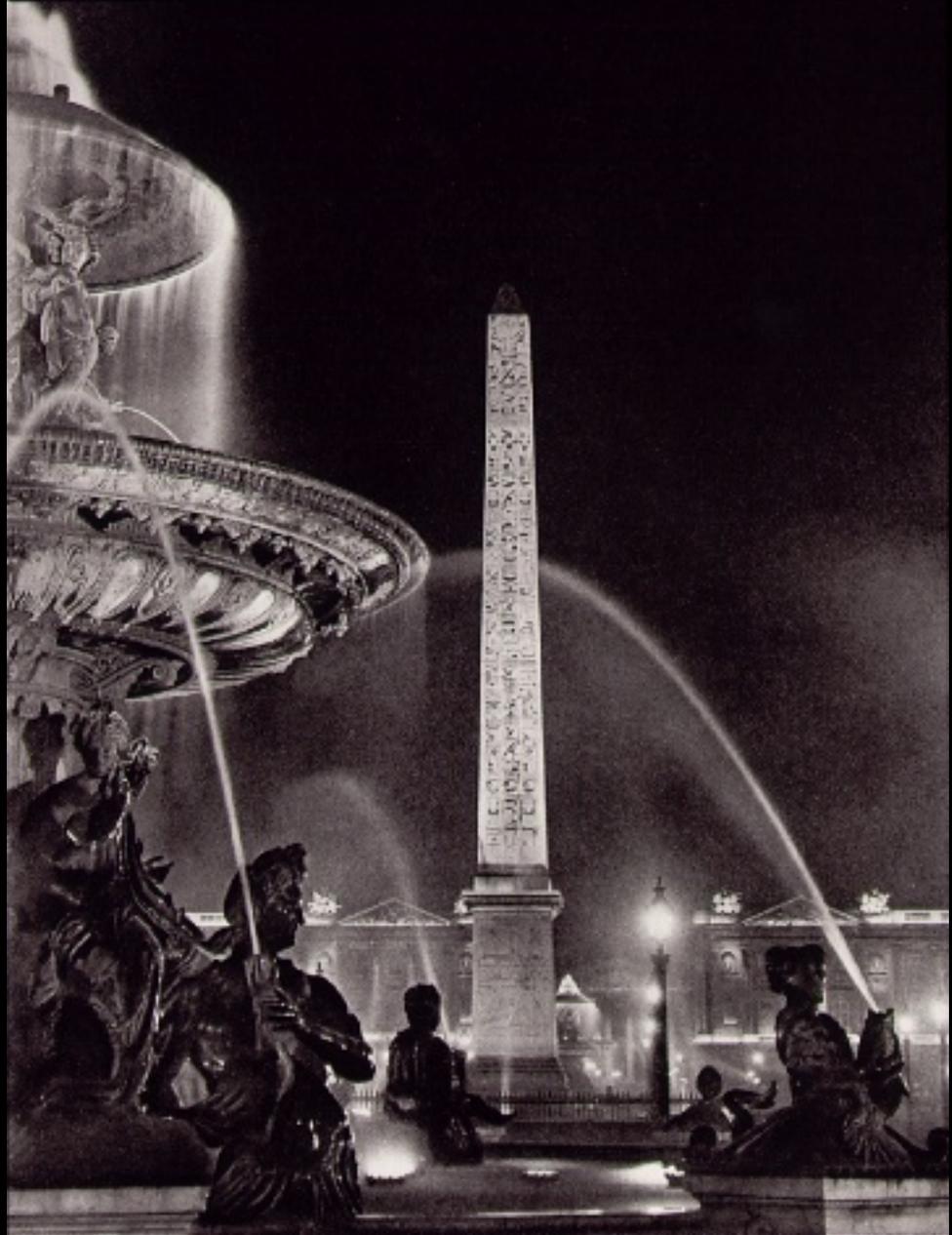
- The Shutter controls the length of time light is allowed to strike the Sensor known as Shutter Speed.
- Different Shutter Speeds can be used to produce different results.
- A Slow Shutter Speed (allowing the light a longer amount of time to strike the sensor) is used in low light or to blur movement.



A really slow shutter speed will produce a trail of tail-lights and the large glow of the street lights. A tripod is necessary for this type of shot.



This photo from Brassai's famous *Paris at Night* series shows how a slow shutter speed allows the water to blur together into a sort of soft flow rather than stopping the action of the water.



Fast Shutter Speed:

- Allows the light a **short amount of time** to strike the sensor
- Can be used in **bright light** or to **stop movement**.
- A Fast Shutter Speed (1/125 of a second or faster) is useful for taking **sharp pictures, stopping sports action, stopping water movement** etc.
- Most **point-and-shoot cameras** give the best results in bright sunlight because the **shutter speed** is automatically set to a **fast setting**.

A really fast shutter speed will freeze the action.



A fast shutter will stop the action.

Also notice the contrast of the boys dark clothing and the light wall directs our eye to the figure.

Also the lines of perspective bring our eye to the main figure.



Aperture

- The Aperture is the other major method of controlling the amount of light hitting the sensor.
- The Aperture is the opening through which the light passes to hit the sensor.
- The Aperture is controlled by making the opening larger and smaller thus controlling the amount of light entering the camera.
- The main effect created by changing the size of the Aperture is called the **Depth-of-Field**.

f/16



f/11



f/8



f/5.6



f/4



f/2.8



f/2



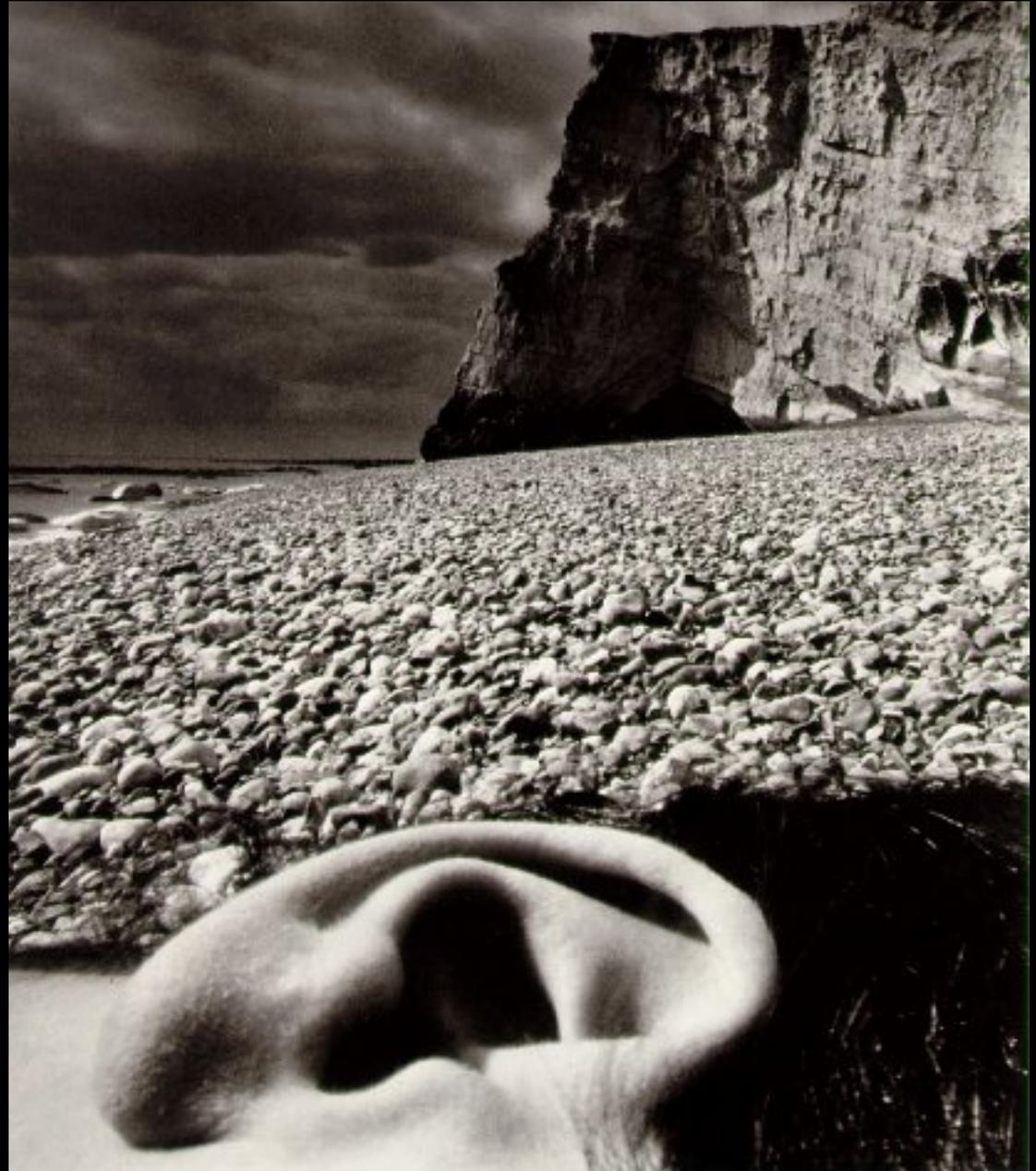
f/1.4



Depth-of-Field

- Depth-of-Field is the distance between the **nearest** and **farthest** points that appear in acceptably sharp focus in a photograph
- Depth-of-Field varies with the **lens** and the **Aperture setting**.
- With a small Aperture setting everything in the frame will be in focus. On **point-and-shoot** cameras the landscape pre-setting will usually give this effect.

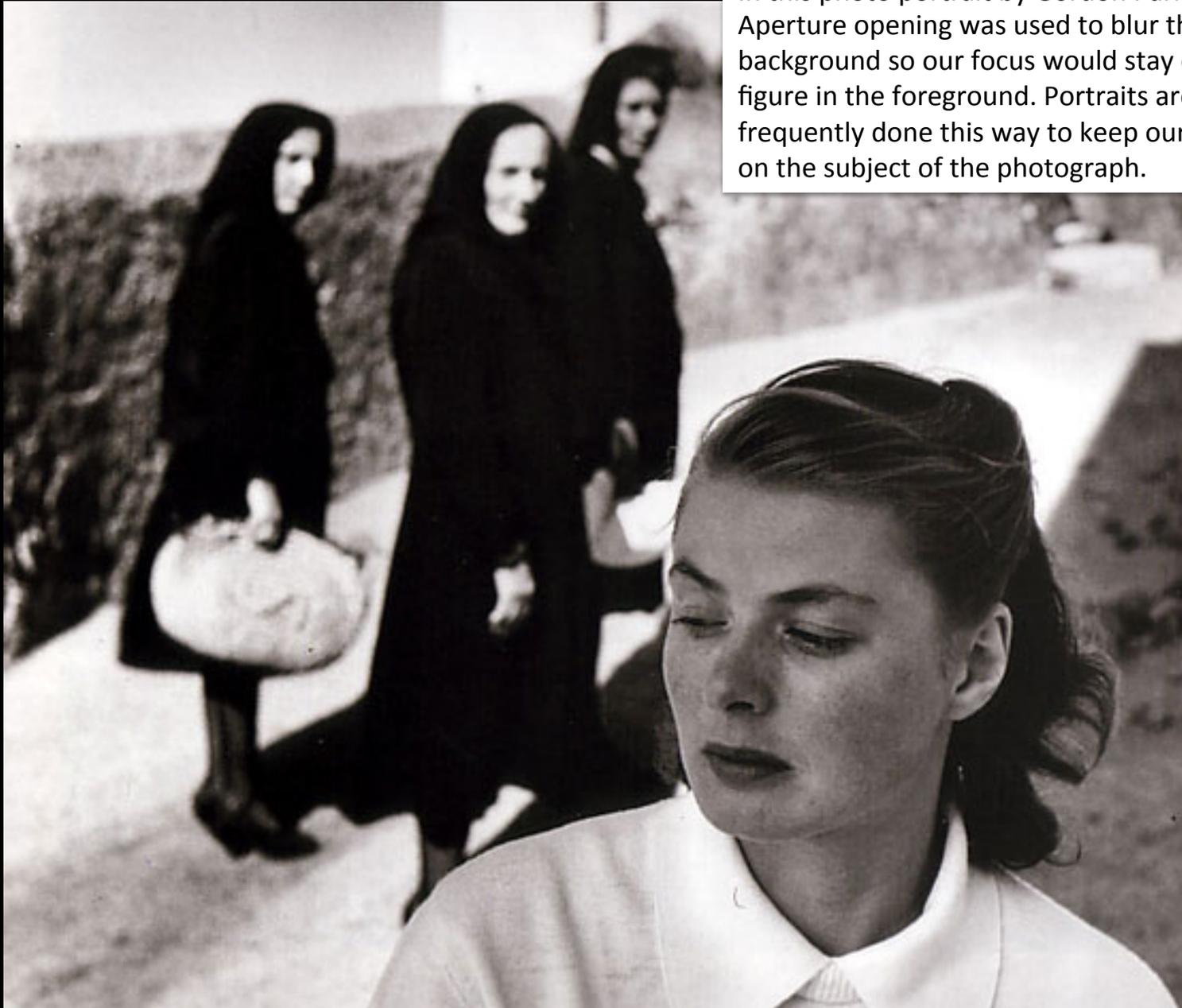
In this famous photograph by Bill Brant, notice how everything from the ear, which is very close to the camera to the rock in the background, are in focus. This would be a small aperture setting.



Depth-of-Field Large Aperture setting

- With a large Aperture setting (a large opening) only a part of the photographic frame will be in focus.
- Generally, depending on the lens, a large Aperture setting will have the foreground and perhaps part of the middle ground in focus with the background blurred. On point-and-shoot cameras the portrait pre-setting will sometimes give this effect, depending on the camera lens.

In this photo portrait by Gordon Parks, a large Aperture opening was used to blur the background so our focus would stay on the figure in the foreground. Portraits are frequently done this way to keep our attention on the subject of the photograph.



A small aperture opening will keep everything in focus.



A large Aperture opening will vary the distance from the camera that remains in focus.

The **Shutter** and the **Aperture** work together to control the **exposure** (amount of light) of your photograph.

Faster Shutter Speed = **Less Light** → **Aperture** = **Larger** for more light to keep the correct exposure.

Slower Shutter Speed = **More Light** → **Aperture** = **Smaller** to allow less light in.



A



B



C

A: **Faster** shutter speed (stopped action) and a **large** Aperture opening (blurred background)

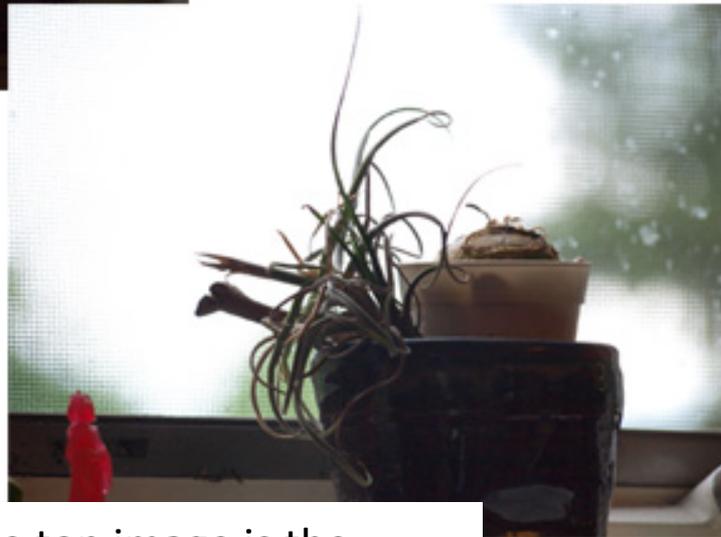
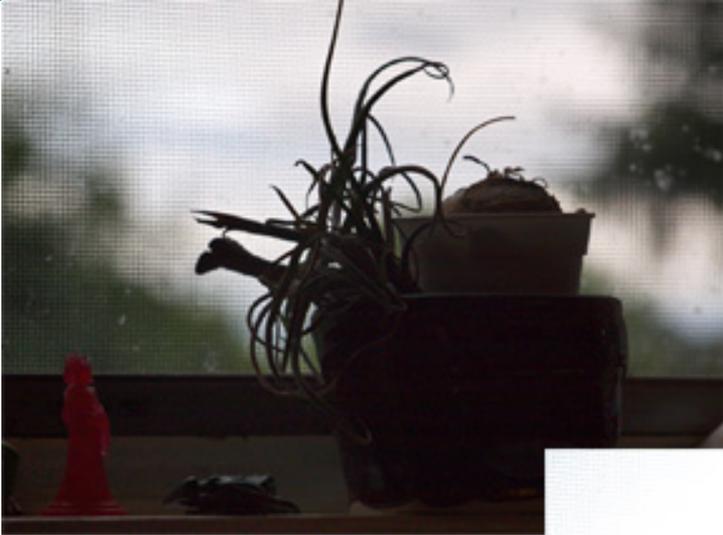
B: Mid- setting, there is some blurring of the movement and still some blurring in the background.

C: **Slow** shutter speed (a lot of blurring) and a **small** Aperture opening (everything is in focus).

Other Exposure Settings

- Two other settings which affect the amount of light on the Sensor Device are the **Exposure Setting** (EV) and the **ISO** (International Standards Organization).
- The **Exposure Setting** allows you to override the automatic exposure of your camera, letting more or less light in to the sensor.
- The Exposure Setting is very useful in certain circumstances when your camera has a difficult time setting the exposure correctly.

Sometimes it is necessary to override the automatic exposure setting of the camera. In general digital cameras will set the exposure so nothing in the shot is overexposed, even if that leaves the subject of your shot underexposed.



In this series of shots the top image is the default exposure. The center is with an increased exposure of +1.5 and is close to being the correct exposure for the subject. The bottom shot is a little overexposed at +3. Notice how the sky gets over exposed but the subject becomes correctly exposed.

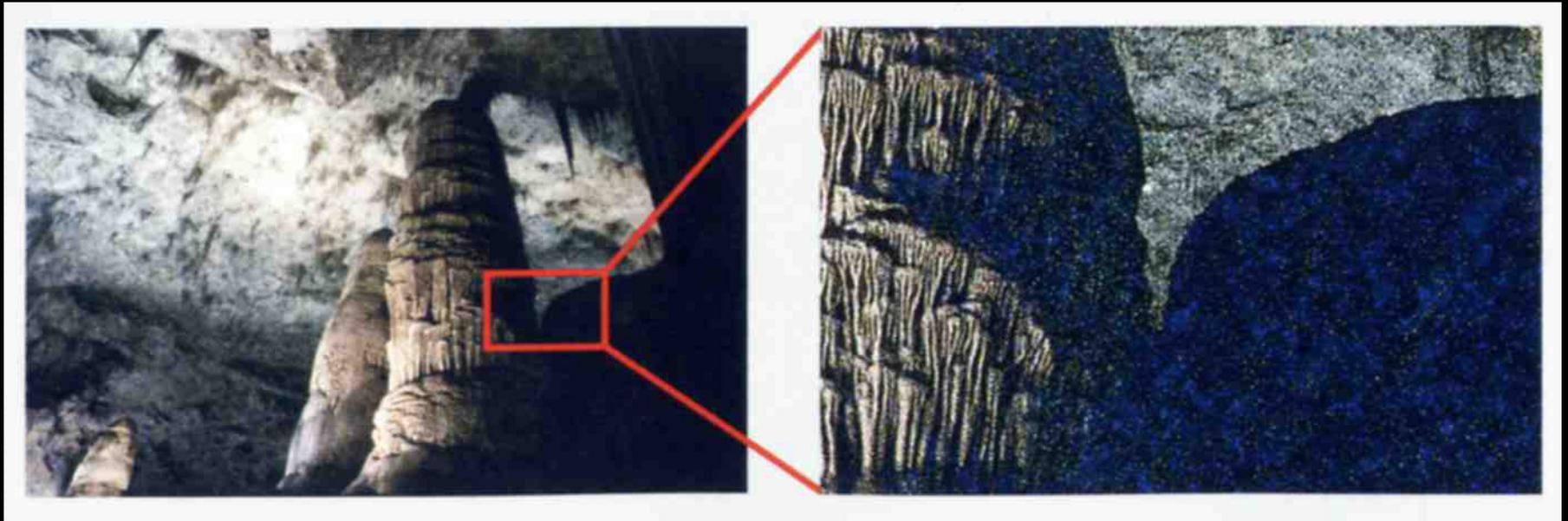


ISO

- The ISO setting does not actually let more or less light into the camera but instead makes the sensor device more sensitive to light.
- A low ISO setting is good for bright situations.
- A high ISO setting is necessary in low light situations, such as in the evening or in low light indoors.
- With a high ISO setting it is more likely to have “noise” especially in dark areas of your photo. Noise is impossible to remove later on.

Digital images can be degraded by noise, usually appearing as random light pixels that appear in dark areas.

Noise increases with longer exposures and high ISO settings.



Often with point-and-shoot cameras the default setting for the ISO is automatic.

When you shoot under **low light** conditions, such as indoors, the camera will automatically set the **ISO to its highest setting** to compensate.

This is likely to produce noise.

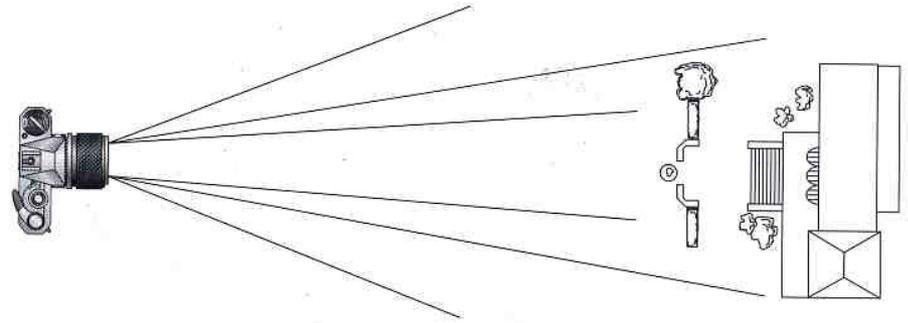
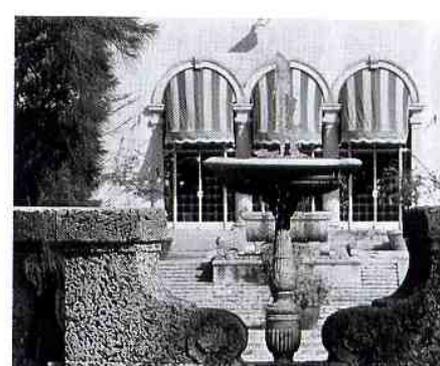
Four other Important Settings

- White Balance – A setting or adjustment on a camera that adjusts the overall image colors for the light source in which it was captured.
- File Formats – one of several standard ways a photograph can be saved, usually JPEG or RAW
- Flash – burst of light which illuminates in low light or as force flash.
- Focal Length - (the zoom)

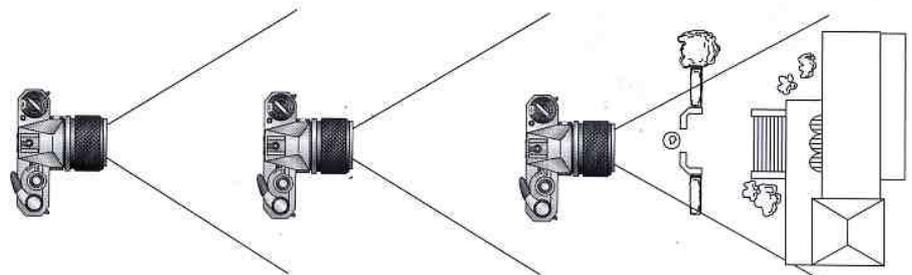
Focal Length – Zoom and Perspective

Almost all **point-and-shoot** digital cameras have a zoom lens. While the zoom lens is very useful for getting closer to the subject, when and how you use the zoom can create very different results from basically the same shot. There is a large difference between shooting something **close-up** and the same thing from further back with a **zoom**.

Changing the focal length (**zoom**) does not change perspective. Notice that the size of the fountain and the size of the windows in the background both change the same amount.



Lens-to-subject distance controls perspective. Notice how the distance between the fountain and the house seems to increase as the photographer moves closer with the camera.



When shooting portraits it is very important to consider the options in using the zoom or not using the zoom.

The portrait can look very different depending on what you choose to do.

On point-and-shoot cameras the lens without the zoom tends to **distort the face**, making it look wider than it is.



White Balance – WB is useful for adjusting the camera for different light sources, the most common being; daylight, cloudy, incandescent or tungsten lights, and fluorescent lighting. When outside the default automatic WB setting works well, indoor or at night things become more difficult. It is important to set the WB to avoid color casts usually orange, green or blue.



The most common problem with lighting is from **warm indoor tungsten** lights. The automatic WB has a very hard time setting for this type of light. Notice the orange color cast to the above images. Outdoor lighting can also create a very orange color tint.

Other **White Balance** problems generally occur when shooting under fluorescent lighting.

Fluorescent lighting will produce a very green sickly color cast. (images 1 and 3)



The photograph in the center has two problems:

The diorama was lit with fluorescents while most of the other dioramas in the museum were lit with tungsten (warm) lights.

The severe blue color cast is the result of forgetting to switch WB modes.

File Formats

File formats are the method in which your digital image is saved to the memory card.

All cameras use a format called JPEG - Joint Photographic Experts Group.

This format is known as a **lossy** compression method. Meaning that the computer chip in the camera will compress the file size to allow more images to be taken on a card, but this type of compression results in a loss of quality in the image.

Generally cameras have different levels of JPEG quality.

Higher end cameras such DSLR's (digital single lens reflex) save in both JPEG and in RAW formats.

In the RAW format there is no compression of the digital information.

The information saved to the memory card is exactly the same as is read by the sensor device. Therefore RAW or not tampered with. This is by far the best format to work with and is used by professionals.

Flash

Almost all cameras, point-and-shoot all the way up DSLR's have built-in flash.

The problem with the built-in flash is that it sits in the about same place as the lens. Because of this the light from the flash generally over-exposes bright areas in the photograph and is basically useless for quality photography.

Fortunately most cameras also allow you to turn off the flash. One of the few times you may wish to have the flash go off is in something called a fill light.

The **fill light** is useful when shooting in strong light.

In the image the subject's face is being struck by a very strong sunlight on one side of her face.

If shot without a flash fill light the other side of her face would be so dark as to lose almost any detail.

The flash fill will add a little light to the dark side of the subjects face for a more rounded portrait.

To do this you need to be able to force the flash to go off.





Main Light Only



Fill Light Only



Combined Main and