Taking Pictures

06 May 2008

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Contents

Welcome to this short introduction to photograph. Many books describe how to photograph different situations in terms of light, is a subject moving etc but don't describe the basic operation and controls of a camera. To me this is the same as teaching how to drive a car by learning what to do for each different bend and junction not what the actual controls of a car do. While cameras do come with manuals they frequently to brief and give little information of the effects of aperture, shutter speed, depth of field etc..

The fundamental principles of photograph are easy to lean but applying them to create good pictures takes years of fun and experimentation. I hope you will find this guide to taking pictures both concise and informative. So as this is taking my time to write, and yours to read I'll be as brief as possible.

1 Introduction

Film cameras use photographic film which reacts to light. Digital cameras use a sensor instead of film. The basic operation of film and digital cameras is the same. With film cameras light falls onto the photographic film and chemicals react to the light. With digital cameras light falls onto a Silicon Chip and electrical signals are produced.

(From now on I will only consider digital cameras in these instructions.)
The amount of light falling onto a sensor is very important. Only a certain range of light can be measured. If too much light fall on the sensor then the picture appears too light, too little light and the picture will be too dark. Controlling the amount of light is one of the main functions of a camera, the other being to focus the image onto the sensor.

To focusing the image a lens is placed in font of the sensor. The quality of the lens will determine the quality of the picture. Poor quality lenses result in poor quality pictures having washed out colours, blurring and distortion.

To take a picture the camera measures the light reflecting off the subject and then using this information controls the amount of light falling onto the sensor.

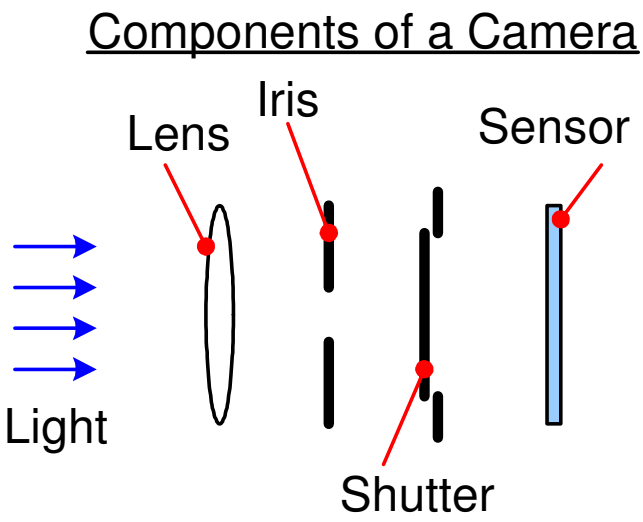
1.1 Controlling The Amount Of Light

There are two ways the amount of light is controlled:

1) To control the amount of light falling onto the sensor a window is placed in front of the sensor. This window is called a shutter, when open it lets light fall onto the sensor. The length of time the shutter stays open for is controlled by the camera. The longer the shutter is open, the more light fall on the sensor.

2) The second method of controlling the amount of light is to place a hole behind the lens. This hole can be varied in size and is called an “Iris”. The size of the hole the Iris makes is called the Aperture.

The following picture shows the described components of a camera.



1.2 Taking a picture

Cameras have different modes of operation. These modes are usually selected by a wheel on the top or side of the camera. Most of the modes are for people who have little interest in controlling how the picture is taken, they want to point the camera and press a button. Cameras that only have these simple modes are called "Point and Shoot" cameras.

The following picture shows the mode dial of a camera. The camera is set to manual mode. The other modes on the dial are C2, C1, M, Av, Tv, P, Auto, SCN, Panorama and Movie.

These modes have to following meanings:

Mode	Meaning
Auto	Automatic
P	Same as automatic but with some control
Av	Aperture Priority
Tv	Shutter Priority
M	Manual

To take a picture with a "Point and Shoot" camera you turn it on and press the shutter button. When the Shutter button is pressed the camera measures the light coming from the subject. Then the camera adjusts the Iris and shutter speed. The shutter is then opened and the image stored on the memory card.

To summarise the following happens:

1. The Camera measures the light reflecting off the subject
2. The shutter speed and aperture are set to control the light falling on the sensor
3. The shutter is opened and closed
4. The image is read from the sensor and moved to the memory card

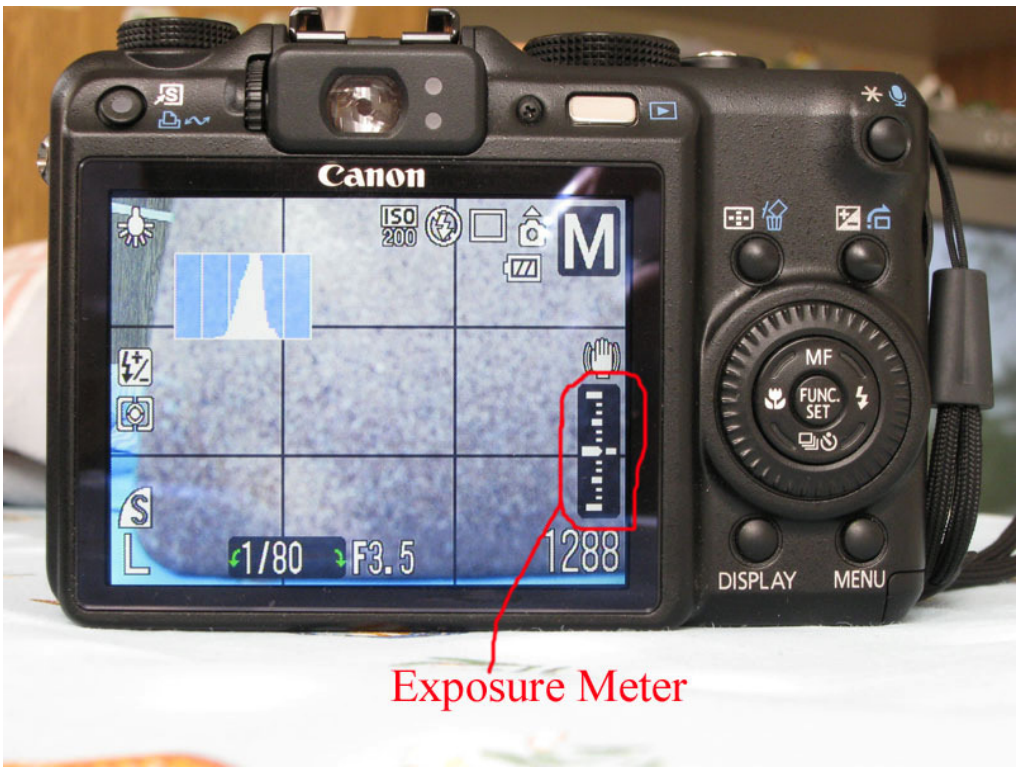
So there we are why do we need more than a point and shoot camera ?

... well I will continue.

2 Aperture/Shutter Priority and Manual Modes

2.1 Manual Mode

In the manual mode the camera measures the light reflecting off the subject but you as the photographer set the aperture and the shutter speed. The camera displays the light level reflecting off the subject using a light meter also termed an exposure meter. The following picture shows the light meter.



The next picture shows that there is too much light termed over exposed.

The next picture shows that there is too little light termed under exposed.

The amount of light used for the picture is called exposure. A dark picture which did not get enough light is described as being 'under exposed' and a picture which had too much light is termed 'over exposed'.

Adjusting the exposure so that the meter is in the middle, as shown in the first exposure meter picture, may not always give the correct exposure if the scene has difficult lighting. Referred to the section on metering for more information.

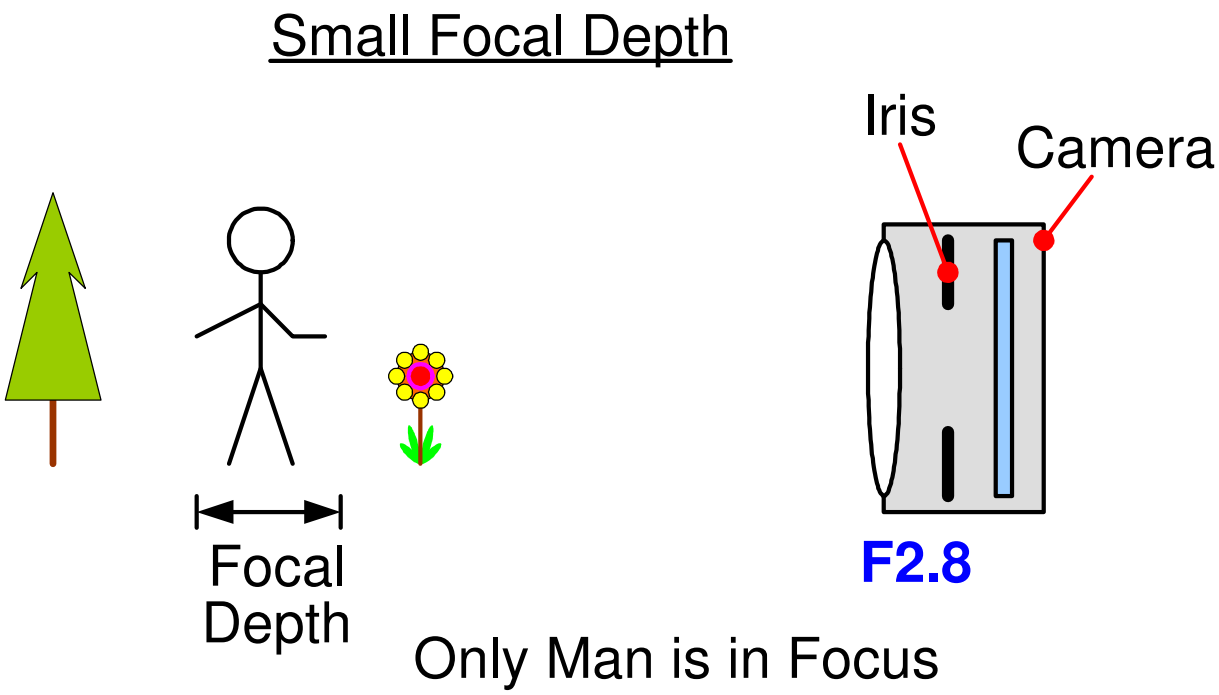
I will now describe the effect of shutter speed and aperture adjustments on the picture the camera records.

2.1.1 Aperture

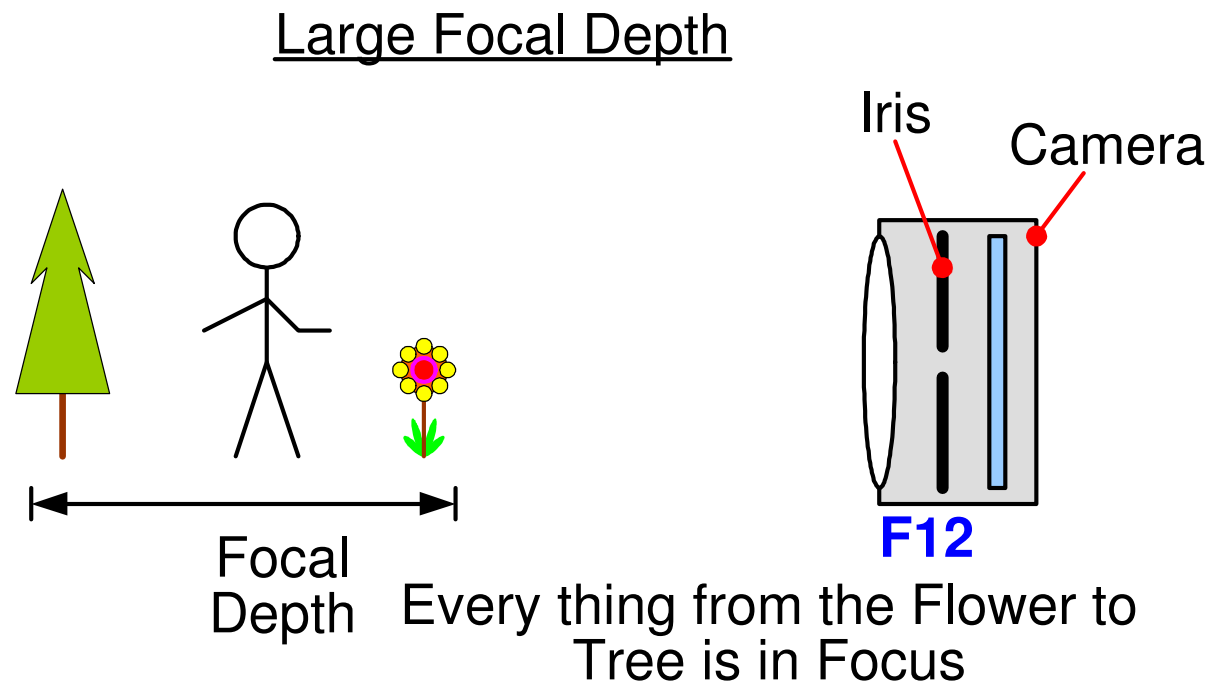
To recap, the aperture is the size of a variable hole placed in front of the sensor and the main effect of this hole is to control the amount of light falling onto the sensor. The other effect the size of the aperture (variable hole) has is to change how much of the picture is in focus. The amount of the picture in focus is called the depth of field. The variable hole is called an Iris.

When a subject is photographed the lens focuses the an image of the subject onto the sensor but objects in front and behind the subject will also be in focus, the range of distance in front and behind the subject that is in focuses is the depth of field.

The following picture shown how a large aperture Eg: F2.8 which gives a small Focal Depth.



The following picture shown how a small aperture Eg: F12 gives a large Focal Depth.



The size of the aperture is giving as a number, and the bigger the number the SMALLER the aperture (smaller hole). It is some time called the 'F' number as it has an 'F' in front. (This is only a basic explanation read more if you want).

So typical apertures used when taking a pictures might range from f2 to f12.

The Aperture (given as a 'F' number) depends on the lens used. All lenses limit the light passing through them which gives a minimum 'F' number which means the most light the lens will let though to the sensor.

To allow more light on to the sensor requires bigger lenses. The maximum amount of light allowed through a lenses is one of the most important specifications of a lens. This maximum amount of light is given as the minimum 'F' number.

2.1.2 Shutter Speed

Sutter speed means how long the shutter (window) stays open for. The shutter speed (for many cameras) can be set from 1/2000 of a second to 15 seconds. Expensive cameras can range from 1/4000 of a second to many minutes. The faster something is moving the less time you have to take its picture before it will look blurred, for example some one on a bicycle might have disappeared in a second so you would need a fast shutter speed. Another reason for using a fast shutter speed is that if the shutter speed is too slow then the picture will be blurred due to you not being able to hold the camera still! There is a rule, which works form most people, which gives the slowest shutter speed, any slower and you picture might be blurred. The rule is that the shutter speed should be

$$\text{Shutter speed} = \frac{1}{\text{Focal Length}}$$

The Focal length is the amount of zoom used. The zoom range is dependent of the camera and lens used. SLR cameras have removable lenses with other cameras having built in lenses. A typical zoom range for a lens is 35mm to 130mm.

- 35mm will give a wide angle shot fitting in a wide area in front of the camera.
- 130mm will give a telephoto shot fitting in a narrow part of the scene in front of the camera.

It is worth saying that the more zoomed in a lens is the less light it gathers and you also need a quicker shutter speed as the focal length is longer.

An example: taking a picture at 40mm would require a shutter speed of

1 / 40 = 0.025 Seconds

Again an example: taking a picture at 100mm would require a shutter speed of

1 / 100 = 0.010 Seconds

Some cameras have image stabilisation which helps steady the image. Such cameras include the Canon G9 and Canon A590IS. (SONY and Olympus SLR cameras have image stabilisation built into the camera, Canon and Nikon SLR cameras have the image stabilisation built into the lenses.)

3 Taking the Picture

Most of the time you will be limited by the available light, usually there is not enough light. If there is not enough light to get a correct exposure then a tripod can be used or the film speed on the camera changed (higher film speeds give higher noise !).

The two controls for controlling the amount of light falling on the sensor are the Aperture and Shutter Speed. To get more light the sensitivity of the camera to light can be adjusted, this is done by increasing the film speed. The film speed control on a digital camera effectively increases the gain of the electrical signal from the sensor. Unfortunately as well as increasing the signal levels it also increases the noise. So the film speed should always be set as low as possible typically ISO 80 or ISO 100. Remember higher film speeds give more noise in the final image. Speeds up to ISO 400 are usable but much higher and the noise will be really noticeable.

Here is a summarised procedure for taking pictures.

1. Select the film speed, try the lowest setting ISO 80 (Canon G9, A950)
2. Press the shutter button halfway down, this will make the camera measure the light. The light meter will stay active for about 10 seconds.
3. Now adjust the aperture, wide(eg f2.8) for blurred back ground (shallow depth of field) or narrow (eg f14) for a high depth of field.
4. Now set the shutter speed to get the correct light reading on the light meter. (Termed correct exposure)
5. Press the shutter button all the way down.

Tip: when pressing the shutter button try to be as still as possible, hold you breath and gently squeeze the button, don't make a sudden press of the button, be smooth. Many people wobble the camera when they take pictures, which gives blurred images. Be smooth, be relaxed !

The aperture is set in F stops Eg: F4 and the speed is set in fractions of a second Eg: 1/250 Second. Both these adjustments effect how much light reaches the sensor. In fact adjusting the speed has exactly the same effect as adjusting the aperture, so that if you want a quicker speed you can select a wider aperture and the light reaching the sensor will be exactly the same. The speed and aperture have main divisions which are sub divided into thirds of a division, (some cameras allow these sub divisions to be set into half divisions as well as thirds of a division). These divisions are also known as 'stops' F stops (the phase stopping down means to reduce the aperture). Most lenses work better when set to a smaller aperture than there maximum. EG. a Sigma 18-200 Lens gives sharper images if stopped down to F8 even though its maximum aperture is F3.5(when zoomed out).

For each F stop reduction the light is reduced by half (as when the speed is reduced). It easier to see with the speed as each increase in shutter speed is half the previous speed. The following two tables show the F stops and speed settings.

F Stop
F2.8
F4
F5.6
F8
F11
F16
F22

Shutter Speed in Seconds
2
1
0.5
1/4
1/8
1/15
1/30
1/60
1/125
250
500
1000
2000

Remember your camera will show not only these numbers but also third increments between these numbers.

So to summarise if you camera is set to F8 and the speed is 1/125 seconds then changing the aperture to F5.6 and leaving he speed at 1/125 seconds will double the amount of light. An other example: if the camera is set to F11 and 1/60 sec then changing to F8 and 1/125 sec will give exactly the same amount of light to the sensor.

3.1 Aperture Priority (AV Mode)

This mode is almost the same as manual mode except you select the aperture and the camera automatically selects the shutter speed. This mode is useful if you want to take pictures quickly. You have maximum control but the camera does the last minute calculation for the correct exposure.

3.2 Shutter Priority (TV Mode)

Again this mode is almost the same as manual mode except you select the shutter speed and the camera automatically selects the aperture. This mode can be difficult as the aperture range is limited Eg: F2.8 (wide) to F8

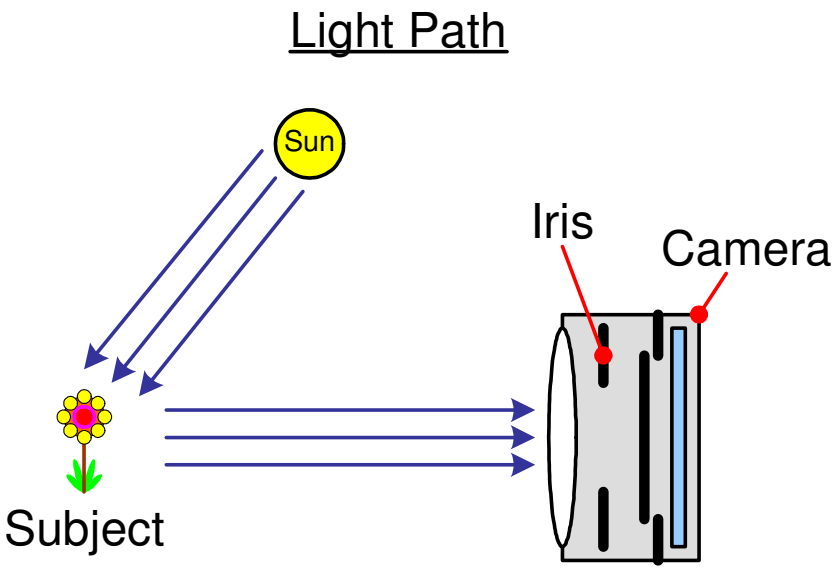
(narrow aperture) for a Canon G9. This means that the camera may not be able to select the aperture because you have set a shutter speed that is too high or too low.

3.3 Summary Of Taking A Picture

- To take a picture select the camera mode.
- Press the shutter button half way, the camera measures the light.
- You set the shutter speed and aperture to get the correct amount of light on the sensor.
- Take the Picture by pressing the shutter button all the way down.

4 Lighting and Metering

The way light gets onto the sensor is at the hart of photography. The light starts form a source, illuminates the subject and some of the light then reaches the camera. When the light reaches the subject only the colours present in the object will be reflected the other colours are absorbed by the subject. This process gives objects colour. In the following diagram the light source is the sun and the subject is a flower.



White light is a term used to describe light which contains all colours before any colours are filtered out. An example of how light affects pictures is when pictures are taken near the end of the day. At this time the sun light passes through more of the atmosphere than in the middle of the day. This filters out some of the blue and green light making subjects look more red.

The camera has a control for the white balance in an image. You can set this for different light sources. This is useful because a light bulb produces a different mix of red green and blue light than does sun light. Again most cameras can try to control the white balance automatically, cameras with manual control also allow you to set the white balance.

4.1 Metering

The camera measures the light coming from a scene and used this measure of light to calculate the 'correct' amount of light needed. The problem is that this measuring of light makes certain assumptions about the type of scene. The main assumption is that the scene is grey and reflecting 18% of the light ? This might seem strange but how is the camera supposed to know what its taking a picture of ? Two extreme examples are a snow man and a block dog for each the camera will probably measure and then calculate the exposure incorrectly. This is because the black dog is darker than most subjects and the snow man is lighter. Controls are available in most cameras to allowed you to tell the camera to make the image brighter or darker than would normally used. This control is called the exposure compensation.

Another control available is being able to set how the camera measures the light. The options are usually: Evaluate, Centre weighted and Spot.

They have the following meanings:

Evaluate	This uses the average light over the whole scene.
Centre weighted	This use the whole scene but uses the brightness of the centre region more than the rest for the exposure calculation, hence centre weighted.
Spot	This measures the light over just the centre spot of the scene usually the centre 3% of the scene.

A useful technique is to use spot meeting to measure the light levels at different point in the scene, most useful would be the subject, the brightest area and the darkest area. Then set the exposure so that no area is over or under exposed.

-- The End --