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A brief extract from

The Photolearn Cameras tutorial

Auto focus

Autofocus will set the focus for you, and on most modern cameras the autofocus works brilliantly, for most of the time.

On some cameras there is just one autofocus point — a small section visible in the viewfinder, the camera will focus on that point. This often works well, but if the part of the picture that the autofocus point is pointing at isn't the part you need to have sharp, the result will disappoint you because the important part of the photo will be out of focus. Here are some possible situations when a single autofocus point won't work for you.

1. You take a photo of 2 people standing in front of a landscape. The people have a space between them and so the autofocus point is on the distant landscape, which will make the people blurred.
2. You take a photo of a tiger in a zoo. Fortunately for you it's in a cage with steel bars, but the autofocus point picks up the bars, which are much closer than the tiger. The result will be a blurred tiger.

There's a workaround to this — place the autofocus point on the part you need to have in focus and half-press the shutter to lock the focus. Then re-compose and press the button fully to take the shot.

Some cameras have a choice of autofocus points, on some they can be set manually and on others the camera 'knows' which part of the shot you're looking at.

Autofocus on SLR cameras only works properly if there is enough light for it to work, so in dark conditions, or when using a slow lens, it may work badly or not at all. Irrespective of light conditions and the lens, some camera bodies do a much better job of auto focusing than others.

It also needs a contrasty subject, so if your subject is, for example, a plain wall, it won't find enough contrast to focus the camera.

In these situations the best bet is usually to switch the autofocus off and focus manually.

Some cameras have predictive focusing, used for moving subjects. In this mode, used for example when the subject is moving towards you, the camera works out how far away the subject is going to be when you take the picture. This is a useful feature if you take action shots, but not all cameras are equally good at predicting the movement of the subject.

Some cameras have a choice of single shot or continuous focusing. In single shot mode the camera will only take the picture if it's managed to lock on to a focus point and focus the camera, in continuous shot mode it will try to get it in focus but will take the shot whether it's succeeded or not. It's generally better to use single shot focusing, which will normally guarantee sharp focus but there may be situations in which it's better to get an out of focus shot than no shot at all, that's where the continuous focusing mode comes into its own.

I

Some cameras have a focus assist light, which can be set to come on automatically when you half-press the shutter release button in poor lighting conditions.
This works well, but only if the subject is near enough to the camera for the focus assist light to help.

How autofocus works

Autofocus (AF) often uses a computer to run a miniature motor that focuses the lens for you.
Focusing is the moving of the lens in or out (closer to or further from the camera body) until the sharpest possible image of the subject is projected onto the film or digital chip. Depending on the distance of the subject from the camera, the lens has to be a certain distance from the film to form a clear image.

There are two types of autofocus systems: **active** and **passive**. Some cameras may have a combination of both types, depending on the price of the camera.
In general, less expensive point-and-shoot cameras use an active system, while more expensive SLR (single-lens reflex) cameras with interchangeable lenses use the passive system.

Active Autofocus
The camera sends out pulses of infrared light. The subject reflects the invisible infrared light back to the camera, and the camera's microprocessor computes

the time difference between the time the outbound infrared light pulses are sent and the inbound infrared pulses are received. Using this difference, the microprocessor circuit tells the focus motor which way to move the lens and how far to move it.

Infrared sensing can have problems. For example:

- A source of infrared light from an open flame (birthday cake candles, for instance) can confuse the infrared sensor.
- A black subject surface may absorb the outbound infrared beam instead of reflecting it
- The infrared beam can bounce off of something in front of the subject rather than making it all the way to the subject.

One advantage of an active autofocus system is that it works in the dark, making flash photography much easier - some flashguns have their own autofocussing system, based on active autofocus.

To use infrared focusing effectively, be sure the emitter and the sensor on the front of the camera have a clear path to and from your subject, and are not blocked by your fingers or by a nearby fence or bars at a zoo cage. If your subject is not exactly in the middle, the beam can go right past the subject and bounce off something else in the distance, so be sure the subject is centred
Very bright subjects or bright lights can make it difficult for the camera to "see" the reflected infrared beam -- avoid these subjects when possible.

Passive Autofocus

Passive autofocus, usually found on single-lens reflex (SLR) autofocus cameras, determines the distance to the subject by computer analysis of the image itself. The camera actually looks at the scene and drives the lens back and forth searching for the best focus.

A typical autofocus sensor is a charge-coupled device (CCD) that provides input to algorithms that compute the contrast of the actual picture elements.

Passive autofocus must have light and image contrast in order to do its job. The image needs to have some detail in it that provides contrast. If you try to take a picture of a blank wall or a large object of uniform color, the camera cannot compare adjacent pixels so it cannot focus.
It can't work in the dark, and it works badly if the light levels or low and if the maximum aperture of the lens is small - that's why it usually works better with prime lenses than with the cheaper zoom lenses.

There is no distance-to-subject limitation with passive autofocus like there is with the infrared beam of an active autofocus system. Passive autofocus also

works fine through a window, since the system "sees" the subject through the window just like you do.

Passive autofocus systems usually react to vertical detail. When you hold the camera in the horizontal position, the passive autofocus system will have a hard time with a boat on the horizon but no problem with a flagpole or any other vertical detail. If you are holding the camera in the usual horizontal mode, focus on the vertical edge of the subject. If you are holding the camera in the vertical mode, focus on a horizontal detail.

Newer, more expensive camera designs have combinations of vertical and horizontal sensors to solve this problem - this is the main reason why more expensive camera bodies will autofocus better than the cheaper ones - but it's still the photographer's job to keep the camera's sensors from being confused on objects of uniform color.

You can see how much area your camera's autofocus sensors cover by looking through the viewfinder at a small picture or a light switch on a blank wall. Move the camera from left to right and see at which point the autofocus system becomes confused

Is autofocus always better and faster?

- It is really up to the person using the camera to determine if the subject is in focus. The camera merely assists you in making this decision.

Your eye has a fast autofocus! Try this simple experiment: Hold your hand up near your face and focus on it, and then quickly look at something past your hand in the distance. The distant item will be clear, and your hand will not be as clear. Look back at your hand. It will be clear, while out of the corner of your eye the same distant item will not be as clear. Your camera is not nearly this quick or this precise, so you often have to help it.

Manual focus controls are still available on most SLR cameras and can come in very useful sometimes. When taking a picture of an animal behind bars in a zoo, the autofocus camera might focus on the cage bars instead of the animal but manual focus will solve the problem.

Another use for manual focus is for studio shots of small products - at most distances, the depth of field extends about a third in front and two thirds behind the subject, so the photographer really needs to focus about 1/3rd of the way back to get the maximum depth of field. The autofocus can't always be pointed at a point 1/3rd back, so manual focus is better in this situation.

Shutter lag

Shutter lag is the length of time between pressing the button and the camera actually taking the picture. Cheap digital cameras are notorious for having very long shutter lags and you'll need to spend serious money on professional/semi professional digital cameras to avoid shutter lag, or at least to reduce it to the level of film cameras.

Whether or not shutter lag is a problem for you'll depend on the type of photography you do - if you're taking photos of a landscape it won't matter at all, if you're taking photos of a toddler running towards you you'll find that the delay will completely spoil the picture!

Exposure modes

Exposure modes are settings on the camera that calculate the correct exposure for you. On some cameras you have

1. P (programme)
2. A or AV (aperture priority)
3. S or TV (shutter priority)
4. M Manual

1. **P**. Programme mode is a sort of an average setting, the camera will use a shutter speed and a lens aperture that works, and will choose an average shutter speed and an average aperture to suit it. The shutter speed will be neither very slow nor very fast, and the aperture will be neither very large nor very small. 'P' can be useful, but you'll be delegating all control to the camera. 'P' is a good setting for people who know nothing and who want to know nothing about photography - it will always produce some sort of result.
2. **A**. On aperture priority you set the aperture you want to use and the camera will measure the light falling on the subject and set a shutter speed to suit the aperture.
The advantage of this is that you control depth of field by using either a large or a small aperture. For most people, most of the time, this is probably the most useful setting.*
3. **S**. Shutter priority is exactly the same as aperture priority, but in reverse — you set the shutter speed and the camera works out and sets the aperture needed to produce a good exposure for that shutter speed.

Perfect for action shots, where you need a fast shutter speed, or for shots where you want movement to be blurred. *

4. **M**. Manual means that you set both the shutter speed and the aperture, and the camera meter goes to sleep.
Use this mode when using studio flash, or when using a separate, hand-held meter.

*Setting either the shutter speed or the aperture only works if the camera is able to set the corresponding aperture or shutter speed that will produce a correct exposure. If it can't do that it can't take the shot, or will be incorrectly exposed if it does take it. For example, if you set the shutter to 1/8000th and it needs to set the aperture to f1.4 on a lens that doesn't have f1.4 then you get a warning in the viewfinder instead of a picture, or you get a dark (underexposed) picture!

Other cameras use a range of icons instead of P, A, S or M. They work in similar ways, for example an icon showing an action shot will set a fairly high shutter speed to freeze the action and an icon of a flower will set a small aperture for maximum depth of field.

FPS

FPS stands for frames per second, and indicates how many pictures you can take per second. This figure is a maximum, and can only be achieved at normal shutter speeds — for example if you're using a shutter speed of ½ second the camera can't quite take even 2 shots per second.

On digital cameras you'll also be limited by the size of the memory buffer and by the speed that the camera writes to the memory card, as well as by the write speed of the card — this won't affect how quickly you can take one shot after the other, but it will affect how long you can take them before the camera can clear enough space in its memory to allow you to take another shot. If it runs out of buffer it has to stop taking the shots until it's caught up with itself.

On a 35mm film camera, of course you'll be limited by the amount of film left in the camera.

MLU

Mirror lock up is fitted to some SLR and DSLR cameras.

The action of the mirror rising at speed and crashing to a halt causes camera shake.

This is always present although often not noticeable, but at slow shutter speeds it can be a real problem, so some cameras have a facility that allows the mirror to be raised manually a few seconds before the shot is taken, or raised electronically with the actual exposure taking place once the vibrations have had time to subside.

This feature is only used when the camera is mounted on a stand or tripod and the subject isn't going to move.

Synch speed

This is the fastest shutter speed that will work with flash. Any camera will work at 1/30th second, most will work at much higher shutter speeds. The limitation is that the camera shutter needs to be fully open at the time the shot is taken.

Cameras fitted with focal plane shutters (Most SLR cameras) have a blind that totally uncovers the film or digital sensor at slower speeds but which turns into a narrow slit at higher speeds, so at higher speeds the film or sensor isn't all uncovered at the same time.

Digital cameras with the smaller APS-size sensors can generally use flash at higher shutter speeds than cameras that use full frame digital chips or film.
The reason for this is the shutters (which work from top to bottom or bottom to top) have to uncover a larger area with a larger film or chip size. With full frame or 35mm, it has to uncover 24mm, with smaller sensors it only has to uncover (about) 15mm.

You'd think that at higher shutter speeds (when only a part of the film or digital chip is uncovered at any given point) flash would only illuminate part of the picture - but there are some clever flashguns that get around this problem by flashing repeatedly (and very quickly) so that the flash is firing for as long as the shutter slit is travelling across the film or sensor.

Some medium format cameras don't have focal plane shutters, instead they have shutters that fit inside the lens (between lens shutters) and they work at any shutter speed.

Point and shoot digital cameras normally don't have mechanical shutters at all, the shutters work electronically and will work at any speed.

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