Exposure

What follows is a breakdown of the mechanical features within the camera which work together to create accurate exposures.

- Sensor Sensitivity (ISO)
- Shutter Speed
- Aperture

These three components work together in order to record an EXACT amount of focused light that will create an image. Light initially enters the camera through a series of lenses. These glass elements play a roll in focusing light, and their position in relation to the image sensor (focal plane) determines just what is visible within a given frame, but they do not variably limit light and are not part of the exposure equation.

ISO (International Standards Organization)

The ISO rating indicates light sensitivity. To shoot in a variety of lighting conditions when shooting with film the photographer must carry an assortment film stocks; each with a set ISO rating. As lighting conditions change so must the film being used. One advantage of digital photography is that instead of having to shoot an entire roll of film with the same ISO, the photographer can continually change the image sensor's ISO setting as the lighting conditions change. This provides a lot more exposure flexibility. The camera in fact does this for you automatically unless you specify otherwise (shoot manually).

The rating system works on a numeric scale. Small numbers (50, 100) represent lower sensitivity, but higher picture quality. With film there is a trade off between image quality and Sensitivity in that lower ISO films, say ISO 50, or 100 produce very finely detail (due to their very small silver crystals (grain)) images, but required more light to produce a correct exposure. Higher ISO films, say 400 or 800 are much more sensitive because they are made with much larger silver crystals which require less light to be exposed correctly. Because of the larger crystals however these films produce images that are grainy and less detailed.

In digital imaging the problem of "grain" has been replaced with "noise". Image sensors have a set sensitivity to light. In order to increase this sensitivity each pixel on the sensor must have its electrical signal amplified. When signal amplification takes place, the likely-hood that little electronic misfirings will occur increases dramatically. You may have noticed that digital images taken under low light often look terrible when compared to the quality of an image taken with adequate light. Not only are they dark but they look splotchy and pixilated – often with little errant flecks of color here and there. That

terribleness in a nutshell is NOISE, and it is to be avoided at all cost. If nothing else, remember this: Low ISO = Less Noise, Good. High ISO = More Noise, Bad.

Shutter Speed

Shutter speed is one way to control the amount of light reaching the image sensor. Shutter speeds are measured in fractions of a second. 1/60, 1/80, 1/100, 1/125, 1/160, etc. A very fast shutter speed effectively freezes motion, producing a very crisp, sharply detailed image, which is often what photographers are trying to achieve. However it is sometimes desirable to capture motion in a more emotional, fluid way, by intentionally blurring it. In this case setting a slow shutter speed (1/60 of a second or less if the camera is hand held) will produce the desired result.

Assuming that clean detail is what you are aiming for it's a good idea to use as high a shutter speed as the lighting conditions will allow. With film it was generally agreed that if a camera was hand held the very slowest shutter speed acceptable was 1/80 sec. (using a standard 50mm lens) Anything below that, and no matter how steady ones hands were, some motion blur would be detectable. With digital I would say the number is even higher. I don't know of an exact rule, but I would say that 1/125 sec or more is necessary in order to minimize motion blur. Not only does digital image capture seem to lend itself to blurring, the fact that cameras are getting smaller and lighter makes the problem of shaky hands worse still.

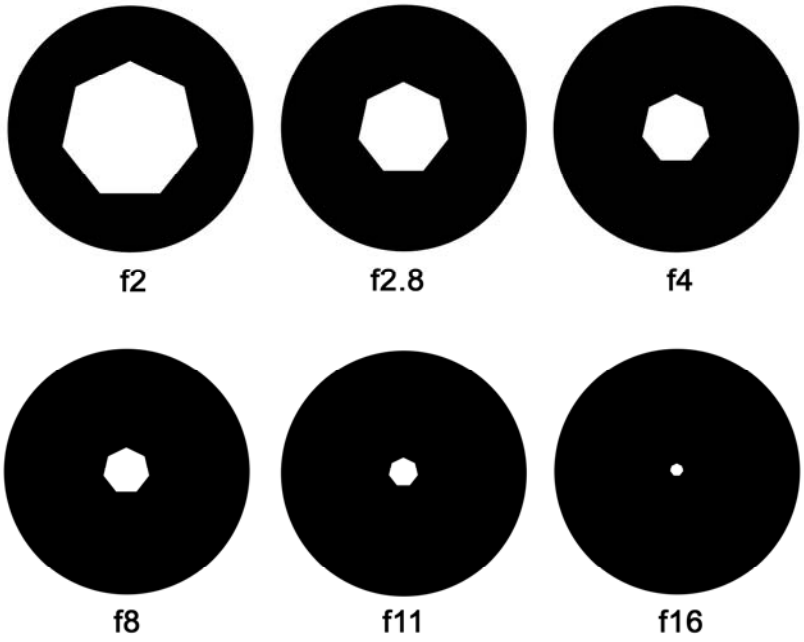
*Each shutter speed either halves, or doubles the amount of light that reaches the image sensor.

**In order to maintain acceptable image clarity choose a shutter speed with a fraction denominator that's larger than the focal length of the lens being used. For a 50mm lens a shutter speed of 1/60 sec or greater should be used. However if using a 300mm (zoom) lens a shutter speed of 1/300 sec would be required as a minimum to preserve sharp detail.

Aperture

The Aperture is the Yin to Shutter's Yang. Aperture and shutter speed work in tandem to create the proper exposure in a given lighting situation. Together they control the amount of light that while reach the image sensor and make an exposure. The aperture is an internal part of the lens that can be opened or closed in order to increase or decrease the amount of light that passes through it. Aperture settings are referred to as F-Stops. F-stops can be confusing. When an aperture is wide open (allowing a lot of light to pass through it) the f-stop number that corresponds to it is small, for example, f2. As the aperture is closed down (allowing less light to pass), the f-stop number increases f2.8, f4, f8, f11 etc. To confuse things further f-stop numbers vary because they refer to the ratio of a lens's focal length (distance from the lens to the image sensor) to the diameter of the opening in the aperture. Depending on the scale of individual cameras this ratio will be different.

The f-stops I've listed here are standard for 35mm, and many digital SLRs.



*Like shutter speed, each change in f-stop either halves, or doubles the amount of light that enters the lens.

The same exposure can be created in a number of ways by varying both the shutter speed and aperture. If the shutter speed is increased one fraction, the aperture can be decreased by one f-stop and the amount of light reaching the sensor remains the same. However that does not mean that the resulting image will remain the same. As mentioned before varying the shutter speed will have a pronounced effect on the amount of blur caused by movement. The aperture also has a influence on the amount of sharp detail present in the image. Aperture controls the depth of field in an image. **Depth of Field** refers to the area of the image that is within an acceptable range of focus from foreground to background. A shallow depth of field means that less of the image is in focus. The larger the aperture (the smaller the f-stop) the shallower the depth of field (less is in focus).

A small aperture =a big f-stop # =a greater depth of field = a greater area of clear focus.

Exposure Modes

Automatic (Auto)

Automatic mode does everything for you short of actually take the picture. In this mode you most likely don't have access to any of your exposure settings.

Program Mode (P)

Program is similar to automatic except that you are able to adjust the settings such as aperture, shutter speed and ISO – the camera then makes the necessary adjustments to other settings to insure a correct exposure. On SLRs this easy usually easily done by dialing a control wheel (without taking your eye off the view finder). On compact models this mode is most likely more cumbersome because accessing setting involves so many buttons and submenus that a degree in computer engineering is most likely required.

Aperture Priority (A)

This mode allows you to set your aperture however you see fit and the camera will adjust the shutter speed as needed. Aperture priority would be used if you were primarily interested in controlling the depth of field (amount of the image that will be in sharp focus).

Shutter Priority (S)

This mode allows you to set your shutter speed and the camera sets the aperture. Shutter priority would be used when your subject is in motion and you want creative control over how that motion is depicted. A slow shutter blurs motion (trail of taillights crossing the golden gate). A fast shutter freezes motion (running back diving over the goal line).

Manual (M)

As you might guess, manual mode makes you do ALL the work. The camera doesn't take anything for granted. The photographer makes all the decisions and is responsible for all the outcomes. This mode is generally there in order to allow the photographer to creatively break the rules.

Scene Modes

Many cameras come with specific scene modes – exposure solutions for some of the more common point and shoot scenarios.

Portrait

This mode generally tries to soften the focus of the background while keeping the subject sharply focused. The results vary depending on available light and the camera's parameters, but basically it is an aperture priority mode. The camera is using as large and aperture as possible (small f-stop) in order to create a shallow depth of field.

Night Portrait

This mode combines a flash with a long exposure (slow shutter speed) in an attempt to expose both the subject as well as a bit of the background. Generally when the flash goes off it illuminates the subject and anything within a short distance form the camera but

does nothing to expose the image beyond the flashes range. Whether or not you use a tripod in this mode drastically affects the outcome of your image.

Landscape

Landscape is another aperture priority mode. However in this case the camera is trying to maximize the depth of field. It selects an aperture diameter that is as small as possible (large f-stop #) in order to put as much of the image as possible into sharp focus. Some cameras also add extra sharpening to the processing of the image as well as contrast and saturation adjustments.

Beach/Snow

This mode tries to compensate for the trick that these bright environments play on the camera's light meter. If you have ever taken photos while skiing or sun bathing at the beach you may have noticed that the camera underexposed the images. The camera will always try and find a happy medium, not to light and not to dark when determining exposure, but some times this assumption needs to be overridden.

Sports/Kids & Pets

This mode is a shutter priority mode. In "point and shoot" models, the shutter speed is set as fast as conditions permit in order to freeze motion. In more advanced cameras functions such as auto focus speeds, motion tracking focus, variable focus sensors and the continuous-shooting drive combine with a generally fast shutter speed to optimize the exposure. The results vary with each model and its capabilities.