Exposure

ISO, Aperture, and Shutter Speed Explained

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In photography, exposure is a critical element that determines what is actually recorded on a camera's image sensor.

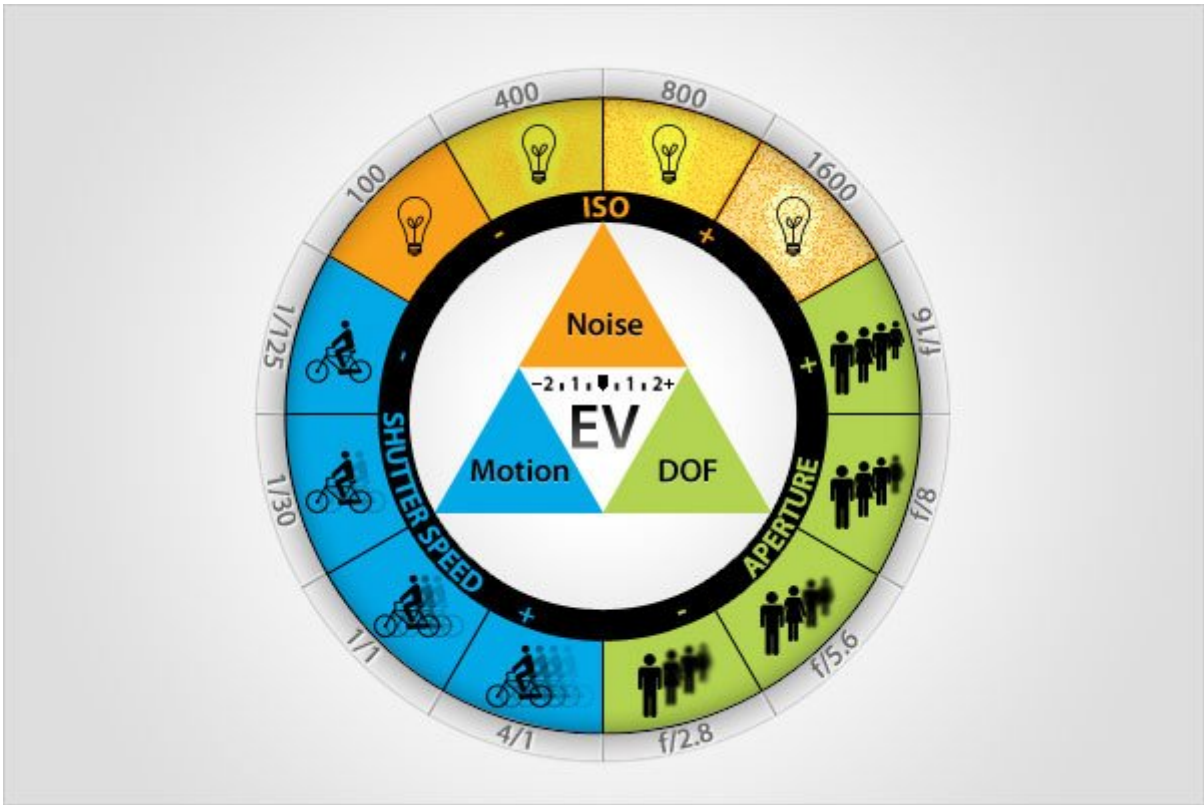
There are three adjustable elements that control the exposure - ISO, Aperture, and Shutter Speed.

1 The Exposure Triangle

ISO Speed is how sensitive your camera's sensor is to light, each value of the rating represents a "stop" of light, and each incremental ISO number (up or down) represents a doubling or halving of the sensor's sensitivity to light.

Aperture controls the lens' diaphragm, which controls the amount of light traveling through the lens to the film plane. The aperture setting is indicated by the f-number, whereas each f-number represents a "stop" of light.

Shutter Speed indicates the speed in which the curtain opens then closes. This is essentially how long light is permitted to hit your camera's sensor once you hit the shutter-release button. Each shutter speed value also represents a "stop" of light. The shutter speed is measured in fractions of a second.



When these three elements are combined, they represent a given exposure value (EV) for a given setting.

Any change in any one of the three elements will have a measurable and specific impact on how the remaining two elements react to expose the film frame or image sensor and how the image ultimately looks.

For example, if you increase the f-stop, you decrease the size of the lens' diaphragm thus reducing the amount of light hitting the image sensor, but also increasing the *DOF* (depth of field) in the final image.

Reducing the shutter speed affects how *motion* is captured, in that this can cause the background or subject to become blurry. However, reducing shutter speed (keeping the shutter open longer) also increases the amount of light hitting the image sensor, so everything is brighter.

Increasing the ISO, allows for shooting in lower light situations, but you increase the amount of digital *noise* inherent in the photo. It is impossible to make an independent change in one of the elements and not obtain an opposite effect in how the other elements affect the image, and ultimately change the EV.

ISO Speed

ISO is actually an acronym, which stands for International Standards Organization, which is the organization that standardizes sensitivity ratings for camera sensors.

The ISO rating, which ranges in value from 25 to 3200 (or beyond), indicates the specific light sensitivity.

The lower the ISO rating, the less sensitive the image sensor is and therefore the smoother the image, because there is less digital noise in the image.

The higher the ISO rating (more sensitive) the stronger the image sensor has to work to establish an effective image, which thereby produces more digital noise (those multi-colored speckles in the shadows and in the midtones).

So what is digital noise?

It is any light signal that does not originate from the subject, and therefore creates random color in an image. The digital camera engineers have designed the image sensor to perform best at the lowest ISO (just like with film).

On most digital cameras this is ISO 100, although some high end DSLRs have a mode that brings the ISO down to 50 or even 25.

A Aperture

A lens's aperture is the opening in the diaphragm that determines the amount of focused light passing through the lens.

At a small f-stop, say f/2, a tremendous amount of light passes through, even at a fraction of a second; but at f/22, when the diaphragm is perhaps at its smallest, only a tiny amount of light is let in (even at longer shutter speeds).

An interesting thing about the aperture and the f-numbers is that it doesn't matter the focal length of the lens as long as the f-number is held constant. This is because the arithmetical equation that determines the f-number indicates that the same amount of light passes through the lens on a 35mm lens as on a 100mm lens, with a shutter speed of 1/125s.

The size of the diaphragm is unquestionably different, but the amount of light passing through is the same.

S Shutter Speed

Shutter speed is measured in fractions of a second, and indicates how fast the curtains at the film plane open and close.

The shutter speed controls how long light enters the lens and hits the image sensor or film plane. The shutter speed enables you to capture the world in split seconds, but it can also absorb the world at speeds upwards of three and four seconds (or remain continually open up until the photographer wants to close the curtain).

Snapping the shutter in a fraction of a second, also gives you control on how motion is recorded. If the shutter speed is faster than the object or background, then the image will be tack sharp. If the shutter speed is slower, then you'll get blurred objects.

Think about the rain in a rainstorm, how fast is that water falling? Well, at 1/30th the raindrops are streaks of indistinguishable white. But at 1/250th, the raindrops hover in mid air and you can see the full swell of each water drop.

2 What is "Auto Bracketing"?

Auto Bracketing is an exposure technique whereby you can ensure that you have the optimal exposure by taking at least three (3) exposures of the exact same composition with one at the metered EV, one at 1/3 of a stop below the metered EV and one at 1/3 of a stop above the metered EV.

So, "Auto Bracketing" is a function in which you set the EV value then release the shutter and the camera automatically makes the necessary up and down adjustments to the EV to give you the bracketed exposures. Then you can review

the three (or more) exposures, see the subtle but critical differences in the images, and decide which one is the best image for your purposes.

In the three images in the above example, you might prefer the overexposed (by 2 stops) image because the setting sun is most brilliant.

Bracketing was a technique that was popularized from shooting slide film, due to the limited ability to correct the image in the darkroom. Many photographers still use the technique today, so they have the exposure that they want.

Having the three bracketed images lowers the amount of post-processing time that they might have to spend.

3 Overexposure & Underexposure

How do you define overexposure and underexposure, since we said that “correct” exposure is subjective?

Simply put, overexposure is when the information in the highlights is effectively unreadable. When there is this type of excessive loss of image information there is no way to “retrieve” that missing information in the digital darkroom.

Underexposure is pretty much the same concept; except in this case there is no image information contained within the shadows. This non-existent information cannot be retrieved through post processing either.

In digital photography, once that image information is gone, there’s no way to retrieve it.

This is not always the case in the photochemical world of film photography. With film (as opposed to digital) processing, it is possible to “find” image information in an excessively underexposed frame, and perhaps “find” image information during the printing process for seriously overexposed images as well.

4 AE LOCK (AEL)

Auto Exposure Lock is a camera setting in which the exposure value is locked in (when you’re shooting one of the semi-automatic or fully automatic modes, i.e. Shutter-priority).

In this mode, no matter what changes there are to the lighting in the scene, the camera locks in the ISO, Shutter, and Aperture settings, so you can continually achieve the same EV without having to re-meter the scene.

C Conclusion

One highly practical advantage to digital photography is that it costs nothing to experiment with the camera’s controls, so go out there and shoot away.