



## Understanding the relationship among **SHUTTER SPEED, APERTURE, AND ISO** in Photography

Alton Vance

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# How do ISO settings affect the exposure of your photograph?

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### **Introduction** [\(menu\)](#)

Aperture, shutter speed, and ISO settings are the three adjustable elements that most cameras provide for controlling exposure. All three must be in balance to provide the right amount of light to the film or sensor. There are specific reasons for controlling each elements. Those reasons will be the topic of this article. I will take each element seperately.

### **Understanding Aperture** [\(menu\)](#)

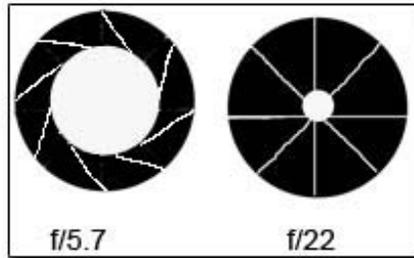
There are several things you should know about aperture.

#### **The physical characteristics** [\(menu\)](#)

Every camera lens has a piece of glass on the front that covers a hole in the lens that lets light into the body of the camera. In the barrel of the lens is a set of blades that make that hole larger or smaller. The size of that hole is called the aperture. The smaller the hole the less light comes through at once. The larger the hole the more light comes through. It's like turning on your water faucet at home. If you turn it just a little a small amount of water comes out at once. If you turn it all the way a lot of water comes out at once. This is the aperture setting.

The size of the aperture is designated by numbers called f stop settings. Usually those numbers will be settings in the range somewhere between 1.4 to 32. The smaller the number the larger the aperture. As the f stop number increases the aperture decreases. (The reason for this is a mathematical explanation which is very complicated and is different for every type of lens. It has something to do with lens size and its proportions. The explanation is not relevant to this article.)

The picture below illustrates the relationship between aperture size and f stop number. The f/5.7 setting shows that it is a much larger hole than f/22.



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Aperture is measured in a scale called "stops." Here is a scale of full stop increments for a very fast lens that has an f/stop rating of 1.4. Many lenses will start with 4.0 or less.

1.4  
2.0  
2.8  
4.0  
5.6  
8.0  
11  
16  
22

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Many camera have settings at 1/2 stops and even 1/3 stops in between each of the setting above but to keep things simple I'll not cover that chart in this article.

Most of our electronically controlled cameras will automatically detect the f/stop limits of the lens installed.

## Two Important Reasons for controlling Aperture Size

**Number One: *It allows control of the volume of light that comes into the camera at one time.*** When your subject is bright you need to use a smaller aperture setting (larger numbers - f/8, f/11, f/16, f/22). When the light on your subject gets dim you will need to set a larger aperture (smaller numbers - f/5.6, f/4, f/2.8).

**Number Two: *Aperture settings control another very important element in photography called "depth of field."*** "Depth of field" is the term used to describe how much of your photograph will be in focus. Here is how it works. The smaller the aperture (the hole in the lens) the greater the depth of field. That means that f/16 or f/22 will provide a photograph that has almost everything in focus from the foreground to the background. An aperture setting of f/1.4 or f/2.8 will cause some portion of your photograph to be out of focus. There are times when this is very advantageous, for instance if the background is distracting it is a good time to use a large aperture, focus on your subject and let the background be out of focus. ([menu](#))

Here is an illustration of using a larger aperture to blur the background that would otherwise have been very distracting if a small aperture had been used.



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Now let's talk about the shutter speed.

## Understanding Shutter Speed

Shutter speed also affects the exposure of your picture. A shutter is a window or door in front of the film plane or image sensor that opens either vertically or horizontally to let in light and then closes to block out light. The longer that door is open the more light comes in. Shutter speed times are a little easier to understand. For normal everyday photography a shutter will stay open for about 1/250 th of a second. If the shutter stays open for 1/100 th of a second then more than twice as much light comes in. If the shutter stays open for 1/500 of a second only half as much light come in. Shutter speeds can be as fast as 1/8000 of a second.

Shutter speeds are also referred to in the scale of "stops." Stops in the shutter speed category is easy to remember. Every time you double the speed you have step down by one stop. I.e. from 1/100 to 1/200 is a one stop down in the amount of exposure, 1/200 to 1/400 would be one more stop down, etc.

The faster the shutter speed the more accurately you can freeze the action of a moment but it lets in only half as much light with each "stop down". ([menu](#))

Here is an example of three pictures taken at different shutter speeds.



Taken at 1/500 of a second



Taken at 1/40 second

Panning was employed to blur the cluttered background  
This shot also has a much different feel than the one above  
The movement of the rider and horse is emphasized in this shot

There are creative times that you may want to take an action picture with a slower shutter speed to emphasize the action allowing the picture to blur as in the bottom picture above. There are also times you may want to stop the action and freeze the subject so that it is crystal clear as in the shot below. Perhaps a slice of history frozen in time would be the theme of the shot below.



This shot was taken at 1/2000 of a second

That is the creative side of using various shutter speeds. In order to employ these techniques you must set your camera on either "shutter priority mode" or "manual mode." Using "shutter priority mode" will allow the camera to automatically set the aperture value. If you use "manual mode" you will have to set the aperture value yourself. There are times that manual mode is very valuable but that will be a discussion for a future article. ([menu](#))

## The limitations and technical side of shutter speed

Now, if slower shutter speeds let in more light it would seem logical that you might let in too much light if you continue to lengthen the shutter speed? Yes that would be true however when you lengthen your shutter speed you should always reduce the size of the aperture to keep the proper amount of light in balance. It might be compared to filling a gallon bucket with water from a faucet. There are two ways to do it (with many variations in between). You can turn the

water on very slowly and let out just a trickle of water but it will take longer to fill the gallon bucket. Or you can turn the water on full blast. This will take a shorter time to fill the bucket but it will still be the same amount of water when the bucket is full. Two different speeds, two different amounts of flow, but still the same amount of water. **The aperture** is compared to how wide open you turn the faucet on. **The shutter speed** is compared to the amount of time it takes to fill the bucket. **The bucket** is the measure of the amount of light it takes to expose the picture correctly.

For those of us who began in photography when there was no truly automatic cameras, we had to remember to set all of this manually everytime we took a picture. We had to use external meters to measure how much light was needed for each situation and then set each of these settings manually. Or we tried to make a lucky guess (which was more often wrong than right).

Today's world of automatic cameras allow us to avoid thinking about much of this mechanical stuff when we shoot a picture. The reason many more people take pictures today than they did in the 50's, 60's, 70's and even the 80's is because they don't have to bother with setting anything on the camera.

But the more you know about APERTURE and SHUTTER SPEED and ISO settings the more creative you can become with your camera. **The knowledge and use of these three things is what separates the world of the snap shot shooter from the creative photographer.** This is true whether you shoot with film or a digital camera.

Now for the last controllable element of creative photography. ([menu](#))

## Understanding ISO

If all films and digital cameras had the same sensitivity to light the information above would become constant and easy to learn. But there is a third element for creative control of your photographic exposure. It is this third element that changes the shutter speed and aperture settings. It is called ISO

ISO is an acronym for International Organization for Standardization. In photography is

designates the sensitivity of film to light. For digital users it designates the sensitivity setting of the image sensor to light.

When you buy film you should be concerned about its ISO rating. The most popular films are rated as ISO-100, ISO-200, ISO-400. Some film is rated at ISO-800. Why?

Number one if you are shooting in bright light you'll want a low ISO rating i.e. ISO-100. If you are shooting in low light, perhaps indoors or an evening setting, you'll want film with a high ISO rating i.e. ISO-400. Once you have inserted that roll of film into your camera you will have to use it up or take it out mid-roll before you can change to another ISO rated film.

Walla, the wonderful world of digital photography! You can change the ISO setting on your camera at anytime you want. Wow! What a difference that has made to my photography experience. ([menu](#))

## How do ISO ratings affect the exposure of your photograph?

Some digital cameras have ISO settings that range from 50 to 6400 and higher. 50 to 6400 is a range of 7 stops in the exposure category. It works this way. Every time you double the ISO rating you essentially add one full stop of exposure. I.e. 50 to 100 is one full stop of exposure, 100 to 200 is one full stop, 200 to 400 is one full stop, 400 to 800 is one full stop, etc.

What does that mean in the practical sense? If you have your ISO setting at 100 and your light meter informs you that your camera should be set at f/4 and 1/60 second then you can take a well exposed picture at those settings. But what if your subject is moving or your lens only opens to f/5.6? 1/60 of a second will not stop the motion of a moving object and if your lens only opens to f/5.6 you are likely to have an under exposed and blurry photograph. Now is the time to step up the ISO setting. If you step up to ISO-200 then you can move one of the other elements one full stop. Your setting would now be f/5.6 and 1/60 or f/4 and 1/125. Only one setting can be increased by a full stop. If your camera allows for 1/2 stops you could increase both the aperture and the shutter speed by 1/2 to equal 1 full stop.

But in the case above we'll probably need more than one stop to freeze the motion so we will set our ISO to at least ISO-400. This will give us the ability of setting our aperture at f/4 and the

shutter speed at 1/250. This will really help out the end result of our photograph. ([menu](#))

## Limitations of ISO settings

There is one limitation to setting your ISO at the higher settings. In the film world we called it "grain" which sometimes was employed very creatively but usually was considered a degradation in the quality of a print, especially for a large blow up. In the digital world we call it "noise." "Grain" and "noise" are, in a practical sense, the same thing. They each have a different quality about them but they both are essentially a degradation in the quality of the photograph.

Higher ISO ratings tend to create more grain or noise in your image. I.e. ISO-100 will have much a smoother finish than ISO-800. So the rule of thumb is to use as low ISO rating as possible and still have enough light to obtain a proper exposure. ([menu](#))

## The Commercial Side of the digital Story

The advertising world of digital photography emphasizes the importance of megapixels in the quality of a print. But there is more to the story than megapixels. The other part of the story is how well a camera produces a picture with the lack of "noise." There are high quality 10 or 12 megapixel cameras that can produce much higher quality printed pictures than other less expensive 10 or 12 megapixel cameras because the higher quality cameras produce them with much less "noise" and better color gradation. It is in this area that you get what you pay for in the world of digital cameras today.

In most cases more expensive cameras will produce higher quality (less noise and better color) images at ISO-800 than less expensive cameras will at ISO-100.

That all said is is true that the less expensive digital SLR cameras made today can take much better pictures than the expensive SLR's of just a few years ago. Advancements in digital photography continue to progress at a very rapid rate. Today's SLR's not only take very high quality stills they also take very high quality video.

There is much more to learn and experience with the world of photography but I'll leave those subjects to future articles. For now have fun shooting and if you have questions about my articles please don't hesitate to E-mail. ([menu](#))

Alton Vance  
alvance@charter.net

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