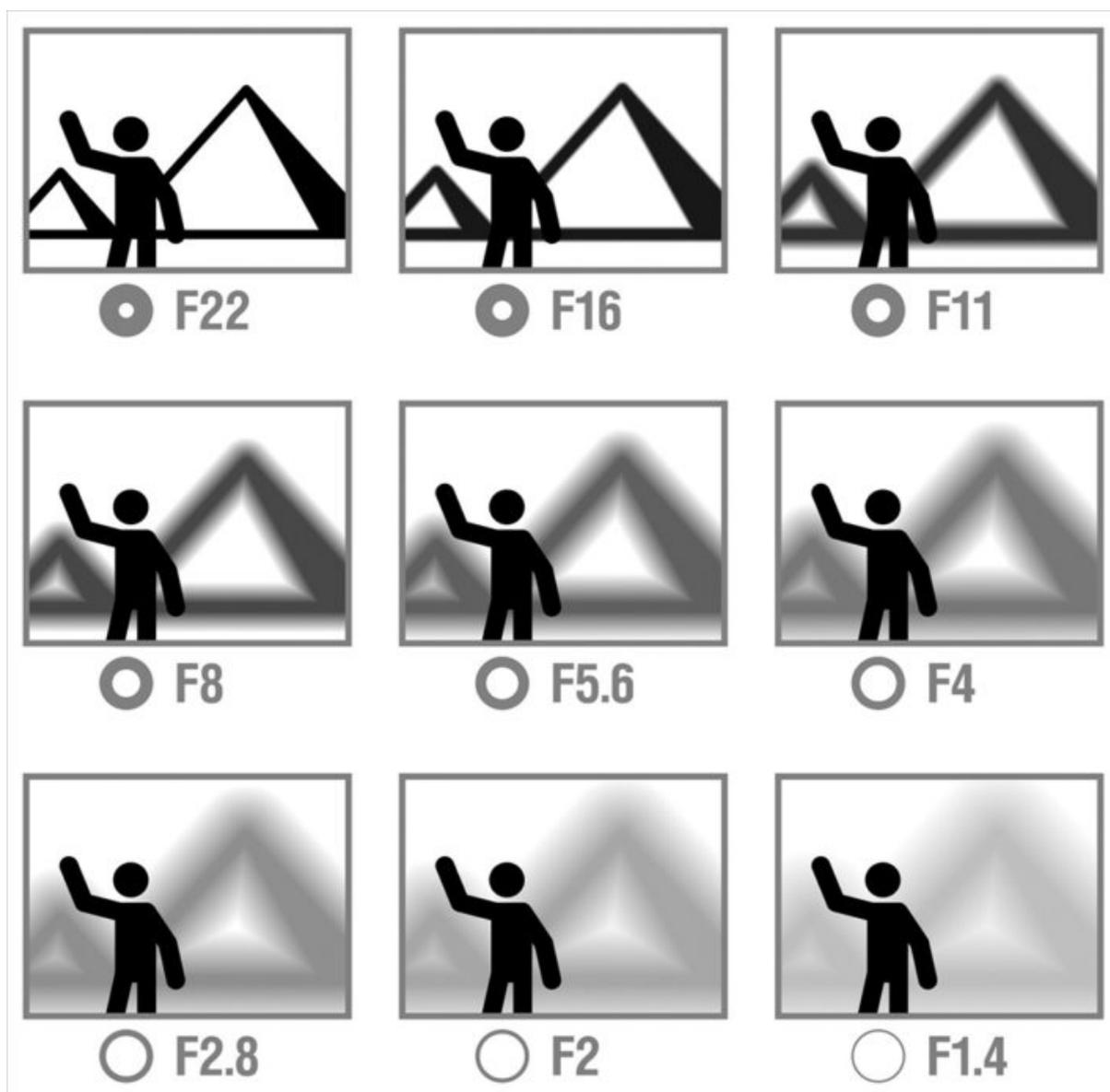


## Aperture Basics

It is difficult to take good pictures without having a solid understanding of ISO, Shutter Speed and Aperture – the Three Kings of Photography, also known as the “Exposure Triangle”.

While most new DSLRs have “Auto” modes that automatically pick the right shutter speed, aperture and even ISO for your exposure, using an Auto mode puts limits on what you can achieve with your camera. In many cases, the camera has to guess what the right exposure should be by evaluating the amount of light that passes through the lens.

Thoroughly understanding how ISO, shutter speed and aperture work together allows photographers to fully take charge of the situation by manually controlling the camera. Knowing how to adjust the settings of the camera when needed, helps to get the best out of your camera and push it to its limits to take great photographs.



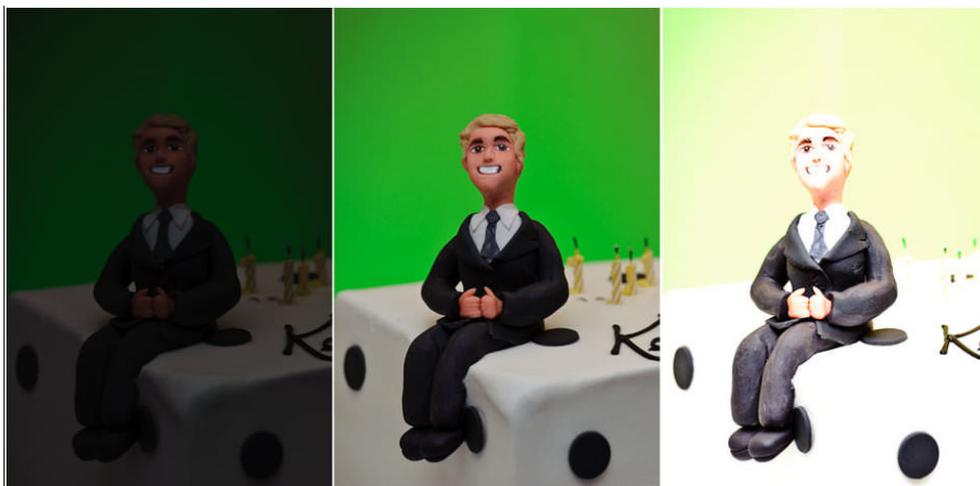
## How Do Shutter Speed, Aperture and ISO Work Together to Create an Exposure?

To have a good understanding about exposure and how shutter speed, aperture and ISO affect it, we need to understand what happens within the camera when a picture is taken.

When the light enters the lens, it passes through various optical elements made of glass, then goes through the lens “Aperture” (a hole inside the lens that can be changed from small to large). Once the light goes past the lens aperture, it then hits the shutter curtain, which is like a window that is closed at all times but opens when needed. The shutter then opens in a matter of milliseconds, letting the light hit the camera sensor for a specified amount of time. This specified amount of time is called “Shutter Speed” and it can be extremely short (up to 1/8000th of a second) or long (up to 30 seconds). The sensor then gathers the light, and your “ISO” brightens the image if necessary (again, making grain and image quality problems more visible). Then the shutter closes, and the light is completely blocked from reaching the camera sensor.

To get the image properly exposed, so that it is not too bright or too dark, Shutter Speed, Aperture and ISO need to play together. When lots of light enters the lens (let’s say it is broad daylight with plenty of sunlight), what happens when the lens aperture/hole is very small? Lots of light gets blocked. This means that the camera sensor would need more time to collect the light. What needs to happen for the sensor to collect the right amount of light? That’s right, the shutter needs to stay open longer. So, with a very small lens aperture, we would need more time, i.e. longer shutter speed for the sensor to gather enough light to produce a properly exposed image.

Now what would happen if the lens aperture/hole was very big? Obviously, a lot more light would hit the sensor, so we would need a much shorter shutter speed for the image to get properly exposed. If the shutter speed is too low, the sensor would get a lot more light than it needs and the light would start “burning” or “overexposing” the image, just like magnifying glass starts burning paper on a sunny day. The overexposed area of the image will look very bright or pure white. In contrast, if the shutter speed is way too high, then the sensor is not able to gather enough light and the image would appear “underexposed” or too dark.



## Effects of Aperture: Depth of Field

The other critical effect of aperture is something known as depth of field. Depth of field is the amount of your photograph that appears sharp from front to back. Some images have a “thin” or “shallow” depth of field, where the background is completely out of focus. Other images have a “large” or “deep” depth of field, where both the foreground and background are sharp.

One trick to remember this relationship: a **large** aperture results in a **large** amount of background blur.

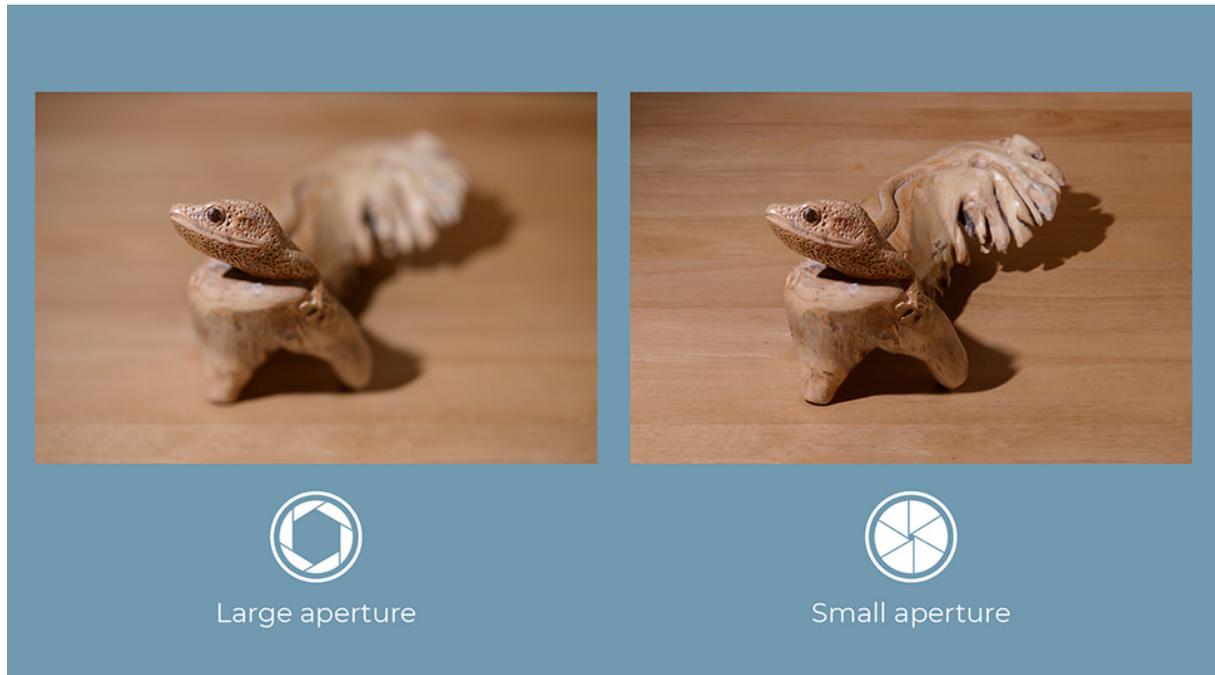
This is often desirable for portraits, or general photos of objects where you want a blurry background.

For example, one reason why the photo on the right works well because it has a blurry background and foreground elements (and pleasing bokeh). **Bokeh** ( BOH-kay — also sometimes pronounced as BOH-kə)

Japanese: [boke] is the aesthetic quality of the blur produced in the out-of-focus parts of an image produced by a lens. **Bokeh** has been defined as "the way the lens renders out-of-focus points of light".



On the other hand, a **small** aperture results in a small amount of background blur, which typically is ideal for things like landscape and architectural images. In the landscape photo on the left, a small aperture was used to ensure that both the foreground and background were as sharp as possible from front to back.



## What Camera Mode Should I Be Using?

I recommend using “Aperture Priority” mode for beginners. In this mode, you set your lens aperture, while the camera automatically guesses what the right shutter speed should be. This way, you can control the depth of field in your images by changing the aperture (depth of field also depends on other factors such as camera to subject distance and focal length). There is absolutely nothing wrong with using “Auto” or “Program” modes, especially considering the fact that most modern DSLRs give the photographer pretty good control by allowing to override the shutter speed and aperture in those modes. But most people get lazy and end up using the Auto/Program modes without understanding what happens inside the camera, so I highly recommend learning how to shoot in all camera modes.

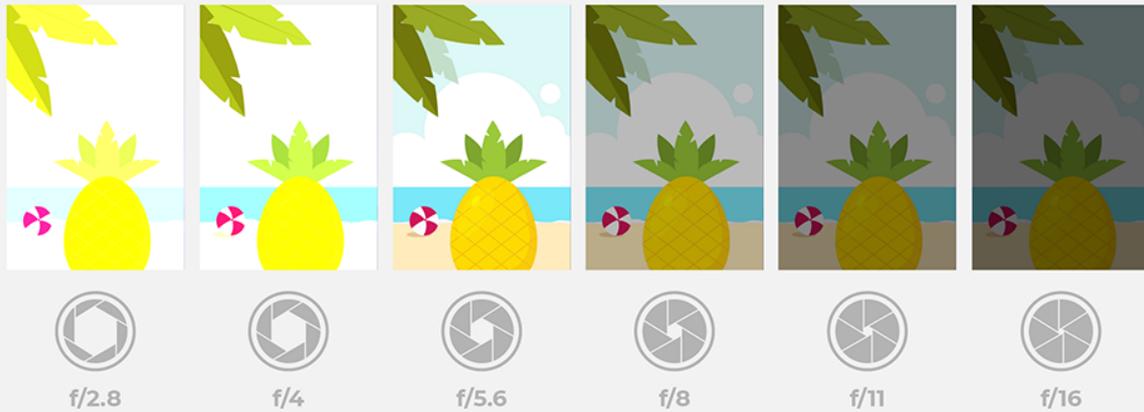
## What are “Full Stops”?

Have you ever heard of a term “**full stop**” in photography? Each of the increments between ISO numbers is called “a full stop” in photography. For example, there is one full stop between ISO 100 and ISO 200, while there are two full stops between ISO 100 and ISO 400. How many stops are there between ISO 100 and ISO 1600? That’s right, four full stops of light.

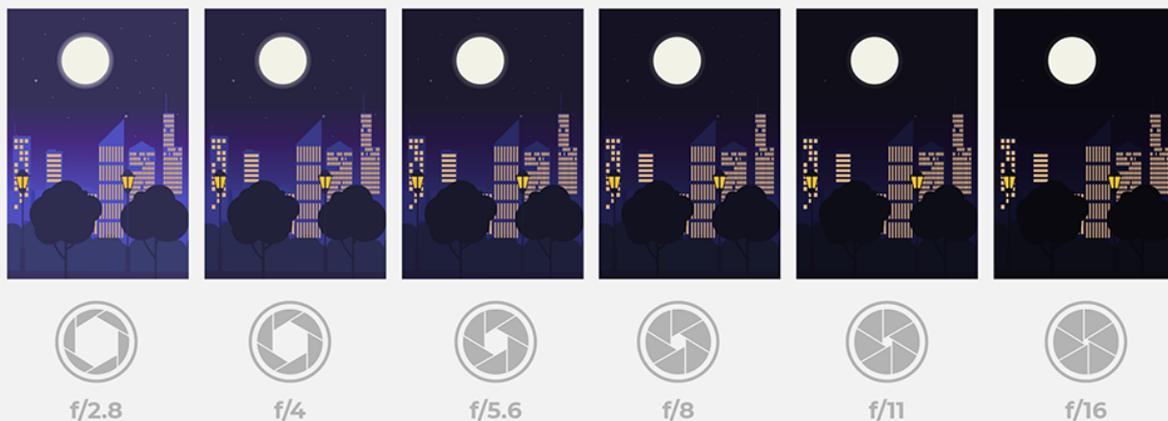
Why do you need to know about stops? Because you might see it in photography literature or photographer might mention stops and it is sometimes confusing to understand what it truly means. But the term “full stop” does not just apply to ISOs – the same concept is there for shutter speed and aperture. It is easy to remember full stops between shutter speeds, because you just start from one and divide the number by two: 1, 1/2, 1/4, 1/8, 1/15, 1/30, 1/60, 1/125, 1/250, 1/500, 1/1000, etc.

Obviously, the numbers are rounded (starting from 1/15, which should be 1/16) to make it easy for photography. It is harder to memorize stops in apertures, because the numbers are computed differently: f/1, f/1.4, f/2, f/2.8, f/4, f/5.6, f/8, f/11, f/16, etc.

## HOW APERTURE CHANGES EXPOSURE



## USING LARGER APERTURES AT NIGHT



### Lens Limitations: Which Apertures Are Available?

Every lens has a limit on how large or how small the aperture can get. If you take a look at the specifications of your lens, it should say what the maximum and minimum apertures are. For almost everyone, the maximum aperture will be more important, because it tells you how much light the lens can capture at its maximum (basically, how dark of an environment you can take photos). A lens that has an aperture of  $f/1.4$  or  $f/1.8$  as the maximum aperture is considered to be a “fast” lens, because it can pass through more light than, for example, a lens with a “slow” maximum aperture of  $f/4.0$ . That’s why lenses with large apertures usually cost more.

The minimum aperture is not that important, because almost all modern lenses can provide at least  $f/16$  as the minimum aperture. You will rarely need anything smaller than that for day-to-day photography.

With some zoom lenses, the maximum aperture will change as you zoom in and out. For example, with the Nikon 18-55mm f/3.5-5.6 lens, the largest aperture shifts gradually from f/3.5 at the wide end to just f/5.6 at the longer focal lengths. More expensive zooms tend to maintain a constant maximum aperture throughout their zoom range, like the Nikon 24-70mm f/2.8. Prime lenses also tend to have larger maximum apertures than zoom lenses, which is one of their major benefits.

## Setting Your Aperture

If you want to select your aperture manually for a photo (which is something I highly recommend), there are two modes which work: *aperture-priority* mode and *manual* mode. Aperture-priority mode is written as “A” or “Av” on most cameras, while manual is written as “M.” Usually, you can find these on the top dial of your camera.



In aperture-priority mode, you select the aperture, and the camera automatically selects your shutter speed. In manual mode, you select both the aperture and shutter speed manually.