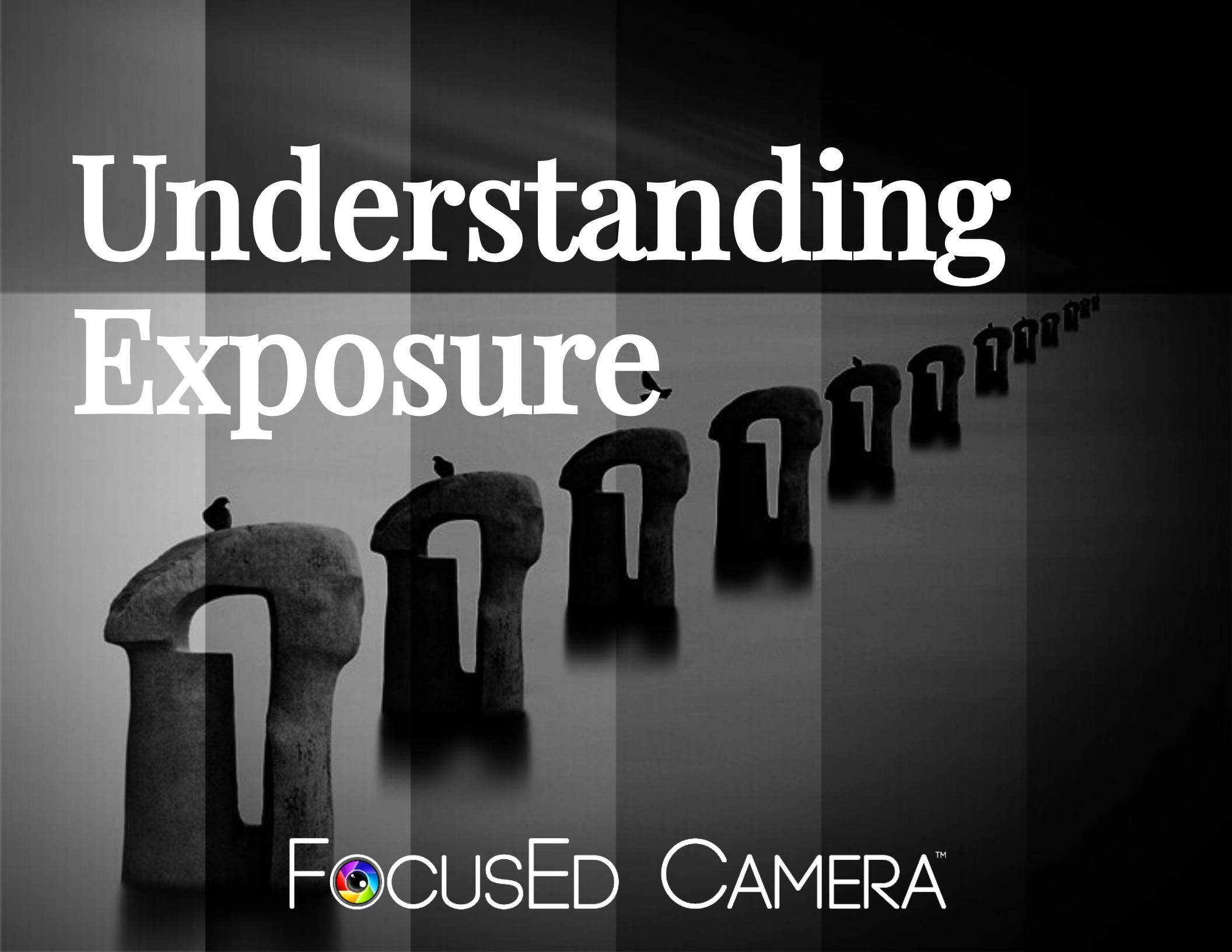
Understanding Exposure



FocusEd Camera™

Introduction

This concise e-book will demystify the exposure triangle. You will learn the fundamentals of aperture, shutter speed, and ISO, empowering you to control light and achieve the image you envisioned. Whether you're a novice or a hobbyist, this guide unlocks your camera's potential; you can't use manual mode without an understanding of the exposure triangle. By mastering the components that create proper exposure, you can create visuals that leave an impression and elevate your photography.


MENU
INFO.
[2487]
Av
WB

If you are a beginner at photography, there is no rush to jump into manual mode. However, if you want to take on the challenge, you will need to understand exposure first. Exposure is a bit complicated, but it is a critical aspect of great photography that can be mastered if you learn the three elements (ISO, aperture, shutter speed) and how these settings are related to one another.

Let me start by saying, that understanding exposure and using it to create beautiful images are two totally different things. Just like understanding the concept of time travel and actually time traveling would be two different things! Simply understanding the concept won't improve your photography unless you practice, practice, practice!

Similarly, reading your car manual does not make you a good driver. Therefore, reading your camera manual does not make you a good photographer. It will help you learn how to make the adjustments to exposure by showing you which dials or buttons control each component, but it will not show you how to then use that information to create better images.

Likewise, the information in this e-book is only part of what you will need to create compelling images. You will also need knowledge of lighting or finding the best lighting, composition and other artist tools, an interesting subject and "story" to tell, and more.

In my beginner groups, I am often asked questions similar to “What are the best manual settings for my kid’s soccer game?” My students will request basic settings for different scenarios and the answer “it depends” doesn’t exactly build confidence in my teaching skills. What this demonstrates is a beginner’s limited understanding of what manual mode does, what exposure is, and that when using manual mode you can use countless combinations of settings to get the exact same exposure. By the end of this article, you will understand why "it depends" is the correct answer!

So let's get started...

First of all, what is exposure?

The term comes from film photography. When light strikes film it starts a reaction and the amount of time the film is “exposed” to the light affects the final image. With digital cameras, exposure is the amount of light reaching your camera’s sensor.
If you overexpose, it means the film or sensor received too much light and your results are much brighter than they should be. Images that are overexposed may have bright white or “blown out” areas. Details in these areas are lost.

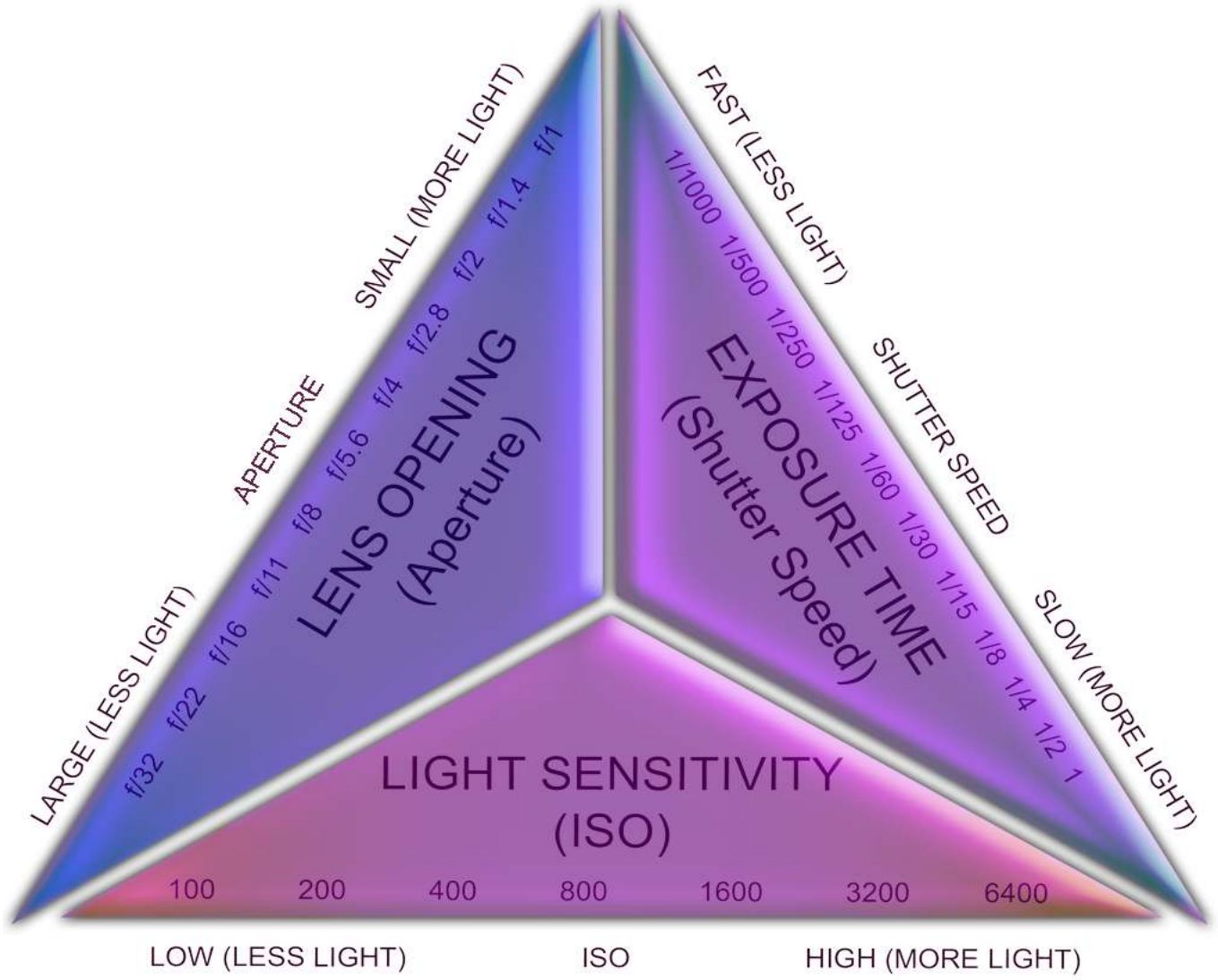
When you underexpose, it means the film or sensor did not receive enough light and your final image will be too dark. There will be areas that are completely shadowed and no details can be seen in those areas.

Both overexposure and underexposure can be fixed (somewhat) with editing software. Underexposed images can usually be corrected more easily than overexposed images. Either way, the editing process can result in a loss of quality. It is much better if you can get the exposure correct in the camera by using the proper settings to control exposure.

In the examples above, the image on the left has proper exposure. In the center the image is underexposed. Details are lost in the areas of black and shadow. On the right, the image is overexposed. The areas of bright white also have a loss of detail.

How do we control exposure?

This is where the “exposure triangle” comes in. There are three settings that interact and work together, often visualized on a triangle diagram connecting the three terms. The settings are aperture, shutter speed, and ISO.


LENS OPENING
(Aperture)
APERTURE
SMALL (MORE LIGHT)
LARGE (LESS LIGHT)
f/1 f/1.4 f/2 f/2.8 f/4 f/5.6 f/8 f/11 f/16 f/22 f/32
EXPOSURE TIME
(Shutter Speed)
SHUTTER SPEED
FAST (LESS LIGHT)
SLOW (MORE LIGHT)
1/1000 1/500 1/250 1/125 1/60 1/30 1/15 1/8 1/4 1/2 1
LIGHT SENSITIVITY
(ISO)
100 200 400 800 1600 3200 6400
LOW (LESS LIGHT)
ISO
HIGH (MORE LIGHT)

These three settings are responsible for how much light hits your sensor and therefore control exposure.

Think of the trio as a three-way see-saw. When you change one, you will have to adjust one or both of the other two to keep your exposure correct, or balanced.

We will get into this in more detail further on and I have some tools to help you, but first, we need to learn a little about each element of the triangle. In the following sections we will discuss:

- Aperture
- Shutter Speed
- ISO

What is Aperture?

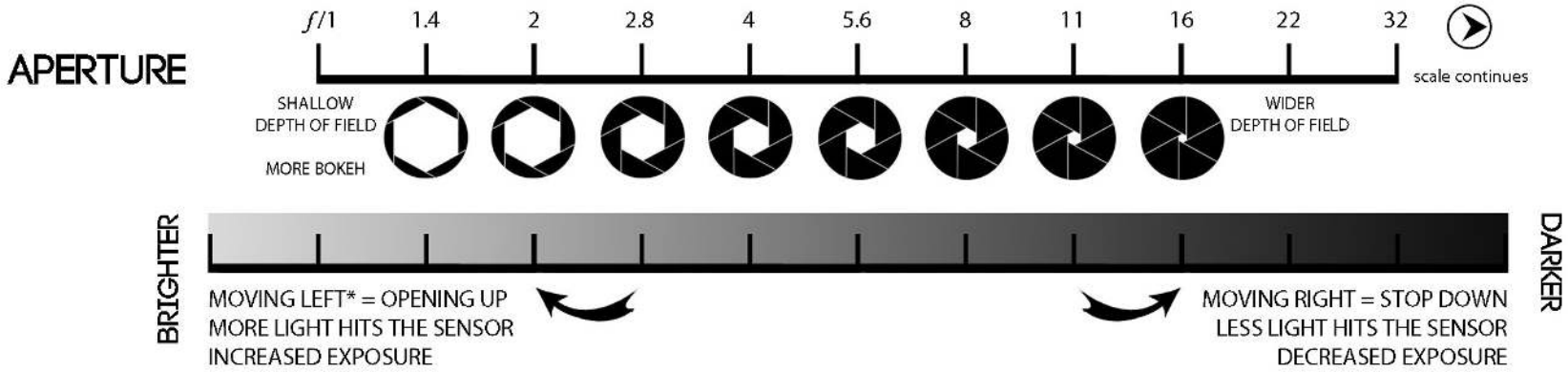
The aperture is the opening inside the camera lens. The aperture setting is how big the opening is. The wider open it is, the more light gets into the sensor. The more closed it is, the less light gets into the sensor. Take the lens cap off your camera and look into the lens (from the front of the camera). You should be able to see this opening and some curved-looking pieces that are spaced around it. These are the aperture blades. They are what move inside the lens to make the opening wider or more closed. The aperture blades work in a similar way to the human eye. Our pupils will become smaller when the light is bright to keep our vision from becoming "overexposed." The pupil will become more open (larger) when the lights are dim or dark to try to let more light in so we can see into those shadows and areas that are "underexposed."

The aperture scale is probably the most difficult part of understanding exposure because the numbers include decimals and the scale numbers are not intuitive. These numbers are often shown with the letter f, such as f/5. The f/ stands for f-stop (for now that is all you need to know).

The basic aperture scale is 1, 1.4, 2, 2.8, 4, 5.6, 8, 11, 16, 22, and 32.

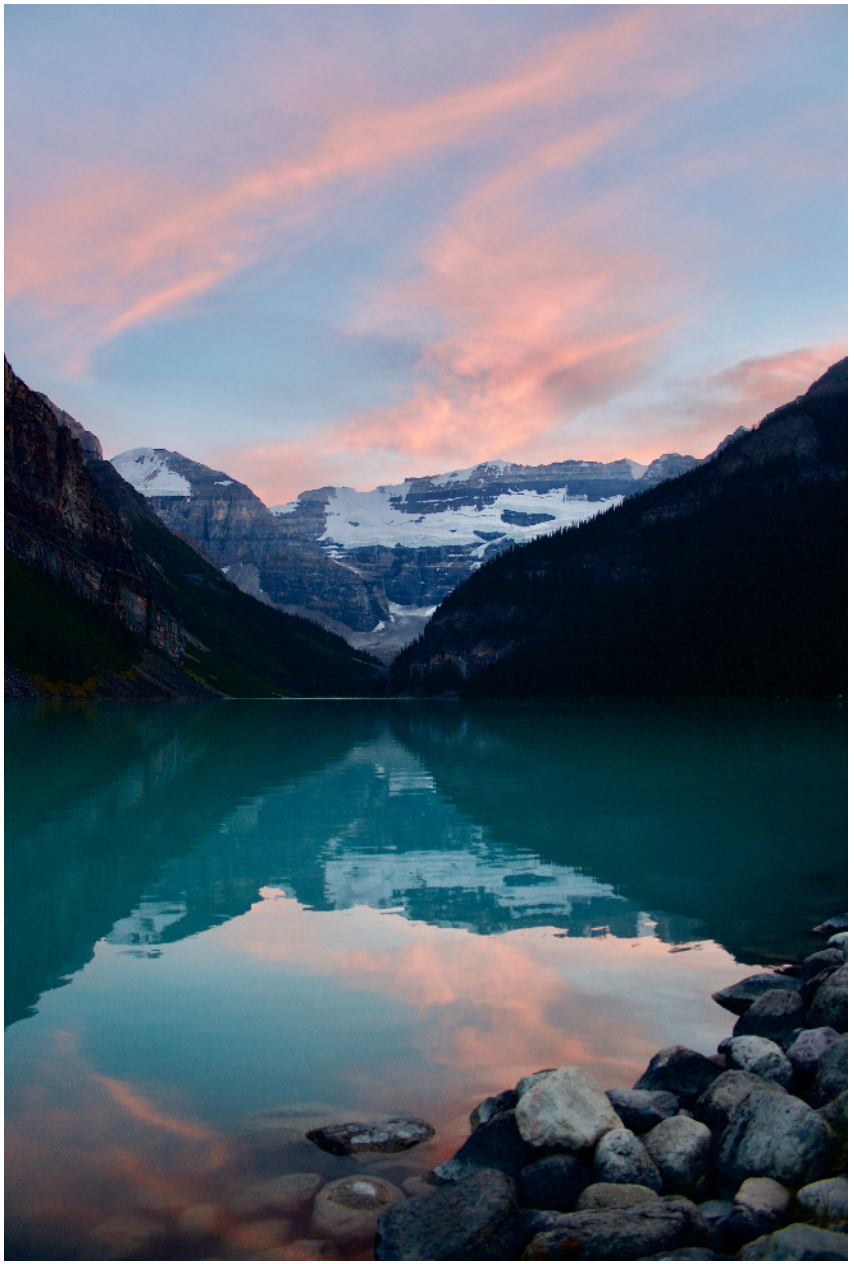
The reason it is confusing is because smaller numbers, like f/1 are wider apertures and larger numbers like f/16 are narrow apertures. It is counter to how most people think about number scales. We usually think of larger numbers being related to larger things. Once you understand that this scale is the reverse of what we normally "think" then you will be on your way! You do not need to memorize the scale numbers.

Each step along the aperture scale (and the scales for shutter speed and ISO) represents a halving or doubling of light. So going from f/2 to f/2.8 lets in half the light. Moving the other direction from f/11 to f/8 opens the lens for twice the light.



In addition to letting in light, the aperture also affects the depth of field. Depth of field is how much of your scene is in crisp or sharp focus. Wider apertures create a shallow depth of field. Narrow apertures create a larger depth of field.

More of a scene is in focus with an aperture of f/22 than at f/4. Narrow apertures (big f/#s) are great for landscape photos like the image shown here on the right.



Less of a scene is in focus with an aperture of f/2. Wider apertures (small f/#s) create beautiful blurred backgrounds behind people, pets, or flowers, as well as other subjects. This blur is called bokeh. If the aperture is too wide you can “miss focus” more easily because the depth of field may be so shallow that the front part of a subject is in focus but the back part of it is not.

As an instructor, I usually recommend my students begin with Aperture Priority mode. Learning Aperture Priority mode is a great first step to getting into full Manual Mode. We offer additional e-books and lessons that go into much further detail on our website.

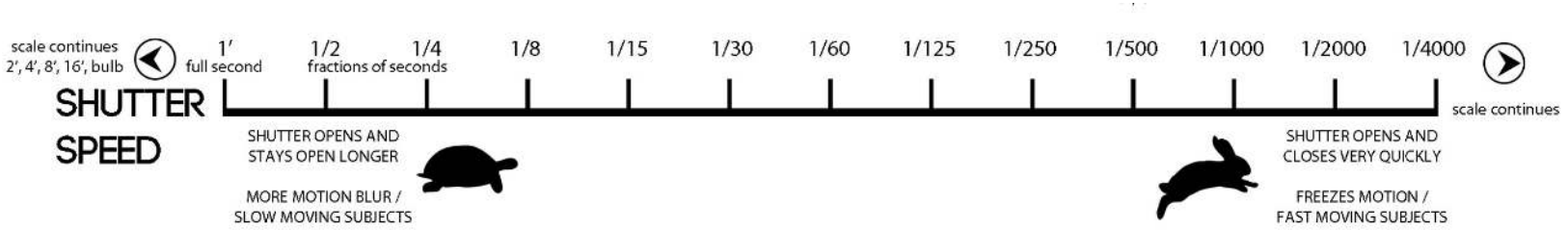
What is Shutter Speed?

The shutter is inside the camera body. If you have a DSLR it is behind the mirror. If you have a mirrorless, you can see it right in front of your sensor. I don't recommend poking around inside the camera body to find these as you could damage something or introduce dust inside.

The shutter is like a curtain. When the curtain is closed, no light is hitting the sensor (or film). When the curtain is open, it is letting light in. The shutter speed is how long we leave the curtain open. We can open the shutter (curtain) for fractions of a second, or we can leave it open for minutes.

In low light scenarios we want to allow more light to hit the sensor, so we can leave the shutter open longer to accomplish this. If your shutter is too fast (not enough time to let light in), the image will be underexposed. When it is very bright outside using a fast shutter speed will make the shutter open and close quickly so we don't overexpose the image.

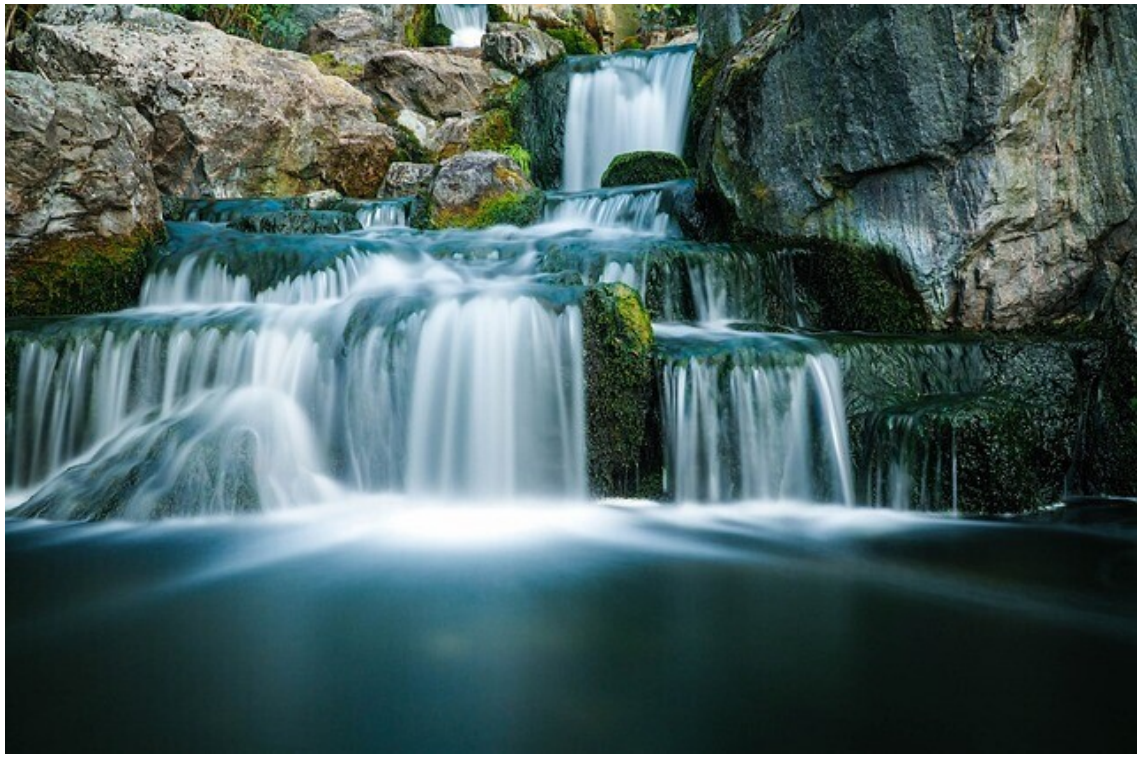
The basic shutter speed scale is 1/8000th, 1/4000th, 1/2000th, 1/1000th, 1/500th, 1/250th, 1/125th, 1/60th, 1/30th, 1/15th, 1/8th, 1/4th, 1/2, 1 second, 2 seconds, etc. Changing the shutter speed from 1/125 to 1/500 (faster) lets in half the light because it is open for half as much time. Going the opposite way from 1/30 to 1/15 lets in twice as much light because the shutter is open twice as long.



When using slower shutter speeds you may need a tripod and a shutter remote/ release to avoid camera shake. If the shutter is slow and you move, your entire image will have camera shake and be blurry. I recommend a shutter speed of 1/250 or faster for handheld and a good general rule is to use a shutter speed that is at least as fast as the length of the lens. For example, if using a 200mm lens use a shutter speed of 1/200 or faster. The longer and heavier the lens is the more likely you will have camera shake.

In addition to controlling light, shutter speed also affects motion or blur. A fast shutter speed will freeze motion, such as a hummingbird in flight. A slow shutter speed will allow your images to have motion blur like the soft blurry waters of a waterfall (see the image below). Shutter speed's ability to stop motion or allow motion blur to show is often used for creative effect.

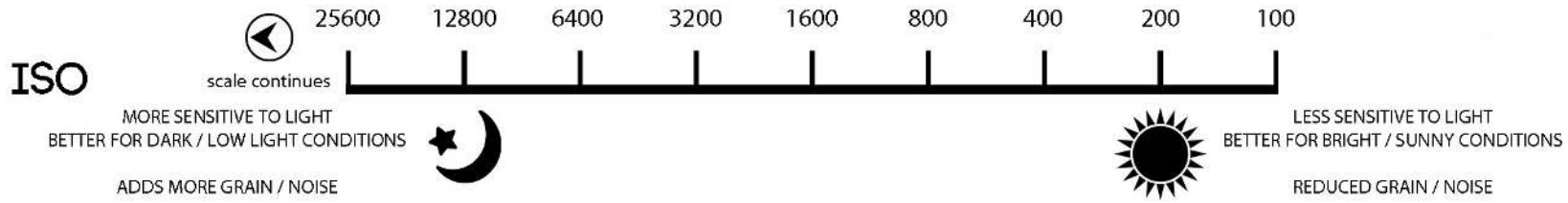
When I give lessons, I usually recommend my students work in Shutter (Time) Priority mode right after they have mastered Aperture Priority. These two modes are great stepping stones to getting to full Manual Mode.



What is ISO?

ISO is the camera sensor's sensitivity to light. In the days of film, this sensitivity was related to the amount of silver grains embedded in the film. With digital cameras, it is electronic sensitivity. As we "turn up" the electronic sensitivity we increase the amount of light or brightness of an image.

The basic ISO scale is 100, 200, 400, 800, 1600, 3200, 6400, 12800, 25600, and on.



On most cameras, the lowest ISO is ISO 100. The sensitivity or brightness is low. We would use this setting when we already have bright light such as outdoors on a sunny day. When we move indoors and away from windows, or into a heavily shaded forest, we need to increase the sensitivity or brightness, so we turn the ISO up.

If we double the ISO from 100 to 200 we are doubling the light (energizing the sensor to collect more light). Unfortunately, higher ISO settings add digital noise or “grain” to your images. Editing programs can help remove some of that grain. In most cases, grain is considered undesirable. However, it can be used for artistic effect as in the example seen here.

How do we put the three together?

Exposure is determined by these three elements. Proper exposure requires a correct combination of these three which you can accomplish in many different ways. Once you have proper exposure, if you change one element, then you must adjust at least one other element or both to keep proper exposure. Think back to the see-saw when you were a kid. If you change the one side you have to change the other to keep balance. Exposure is a little more tricky because we are balancing three things.

Look at the photo on the next page. The camera was set to Auto so the camera chose my settings for me. The camera selected ISO 400, Shutter 1/80th, and Aperture f/5.6. The camera will always try to select settings somewhere in the “middle.” This is where Auto mode fails. It doesn’t know what you want and the “middle” settings may not be a fast enough shutter to capture the action or a small enough aperture to get the huge depth of field you want for a landscape photo.

We can take the Auto settings and make adjustments in Aperture Priority, Shutter Priority, or Manual Mode to keep proper exposure ***and*** get the image we want. The examples that follow will look at how to balance exposure in Manual Mode.

In the example above, if there was wind and I wanted to stop the motion of the plant swaying in the breeze, I would need a faster shutter. If I increase the shutter speed, I am opening and closing the “curtain” faster so less light gets in. If I don’t change anything else, my settings would be ISO 400, Shutter 1/250th, and Aperture f/5.6.

My image will end up underexposed like the one shown here. By selecting a faster shutter speed, I reduced the amount of light, but I didn't increase the light with any other settings.

To keep the exposure balanced I will have to adjust one or both of the other elements – ISO and aperture – to make up for the lost light from the faster shutter.

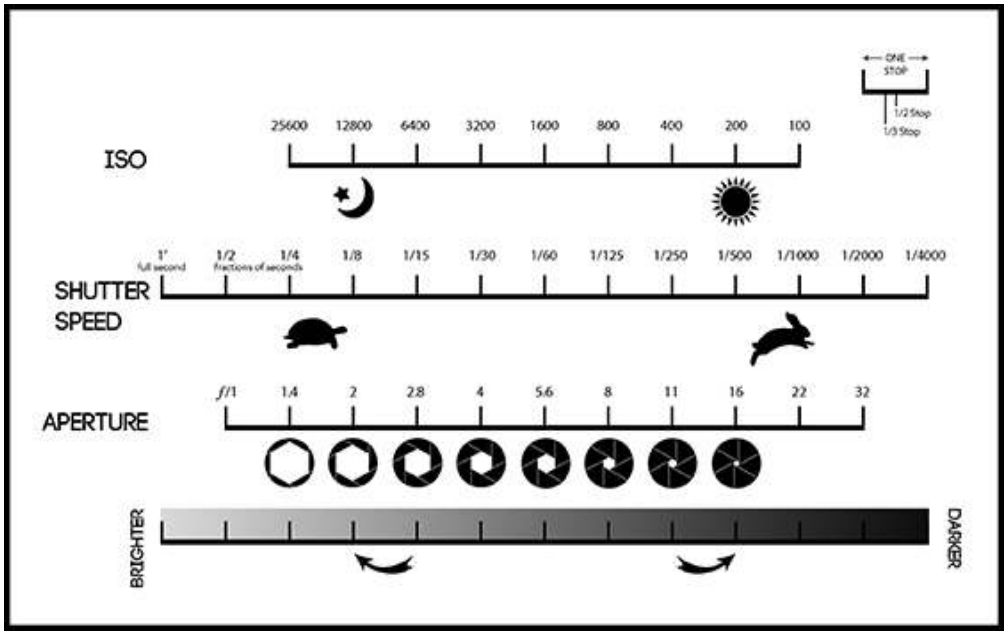
In an underexposed image, I need to balance the exposure by increasing the light using my other two settings. I can increase the ISO to make it brighter. Or I could open the aperture wider to let more light through the lens.

In the image here, I changed the ISO and the exposure is now balanced again. The final settings were ISO 1600, Shutter 1/250th, and Aperture f/5.6.

How do you know how much to move to keep the balance?

On each of the scales, one movement left or right is equal to halving or doubling of light. The increments along the scales are called "stops." So if you move one element one stop, you must balance another element with one stop. If you move one element two stops, you must balance by moving one element two stops, or by moving both of the other elements but only by one stop each.

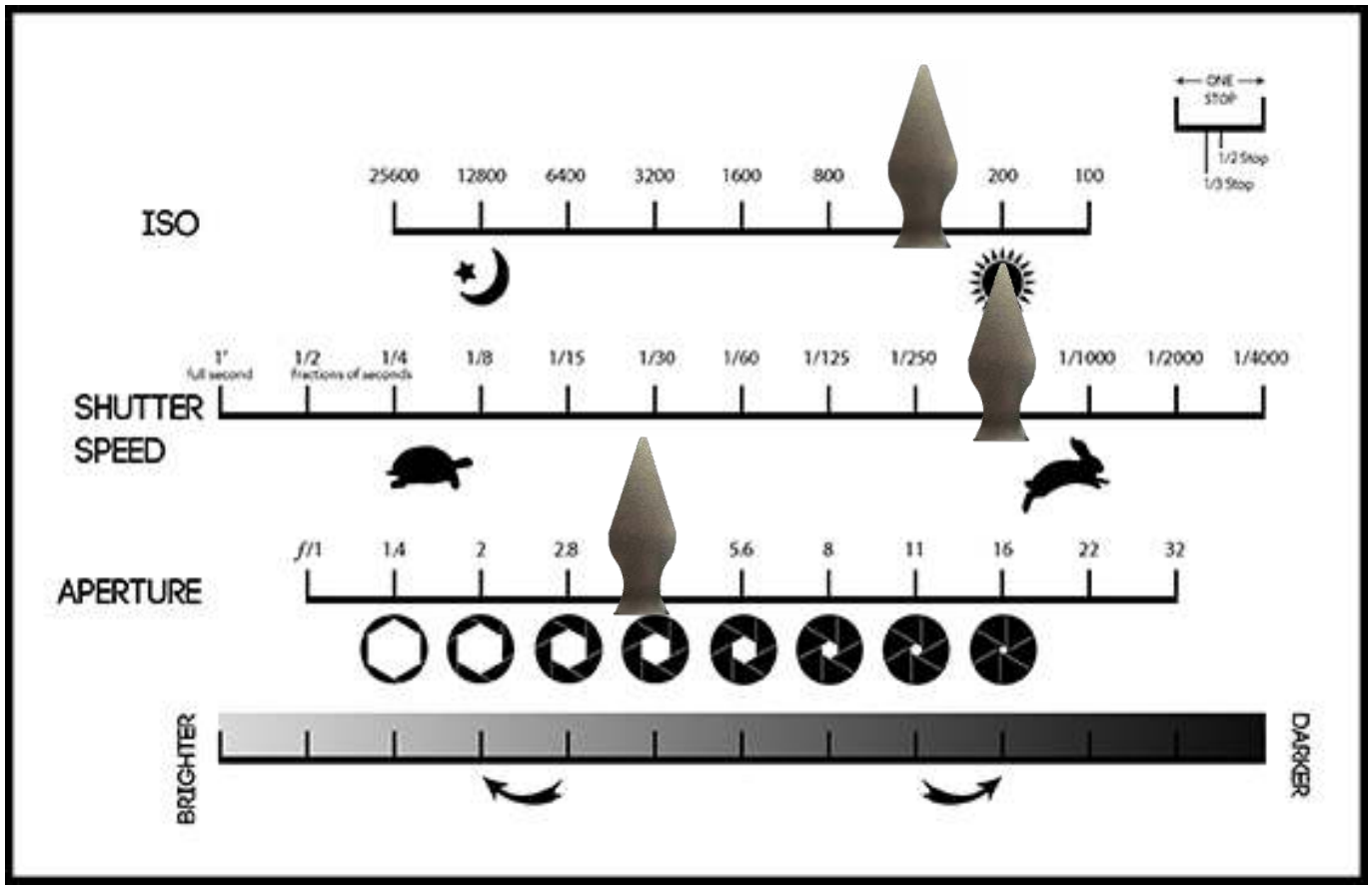
We have designed a hands-on tool you can use to practice making exposure adjustments (we sell these on our website), but you can always make your own or use photography apps designed for this purpose. I personally learn better with a physical tool and I use these with my students.



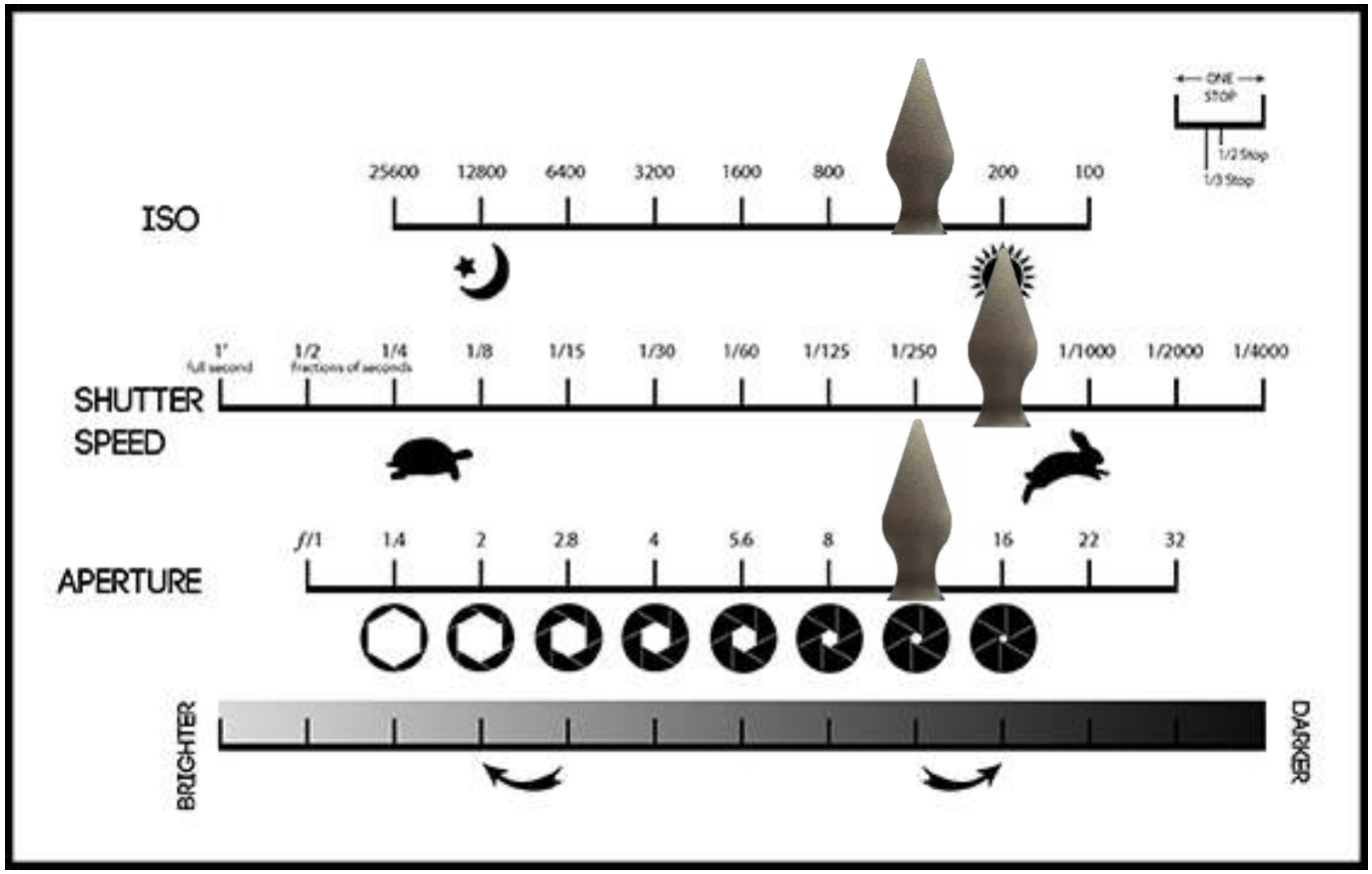
This is a simplified version. The version we sell has more detail and information on it.

Here's an example of how it works:

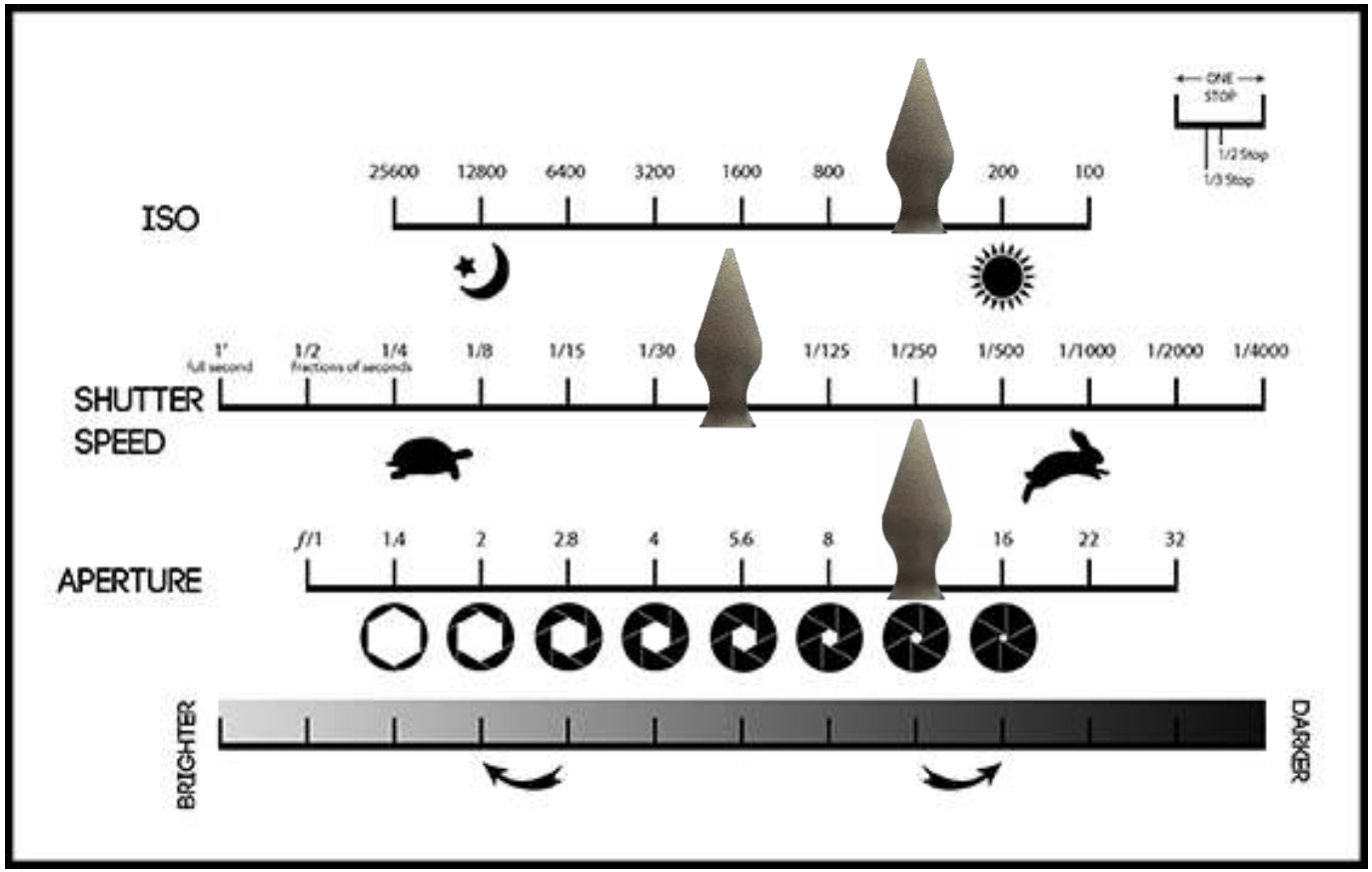
Let's say proper exposure is achieved at ISO 400, Shutter 1/500th, and Aperture f/4. We get this reading by checking the settings the camera chooses when in Auto mode. In the picture below I have moved the sliders to these settings on the scales.



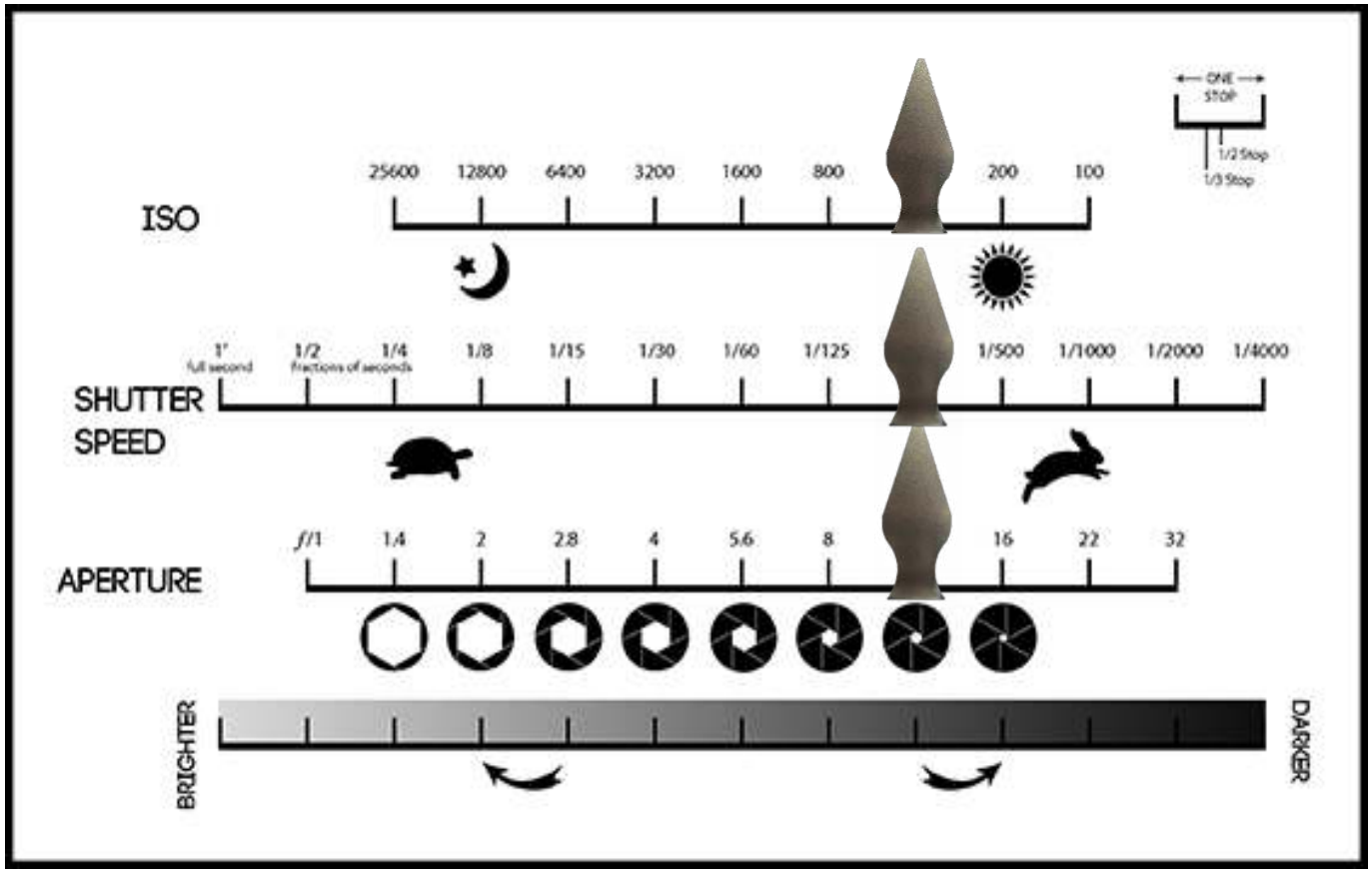
If I want a larger depth of field because I am taking a landscape photo I will need to change the aperture to make it smaller (larger f/#). This will reduce the light entering the camera. If I change the aperture to f/11 that is three stops along the scale from f/4, to f/5.6, to/f8, to f/11. This will decrease my light because the aperture is getting smaller. In the image below I have moved the aperture slider 3 stops to the right.



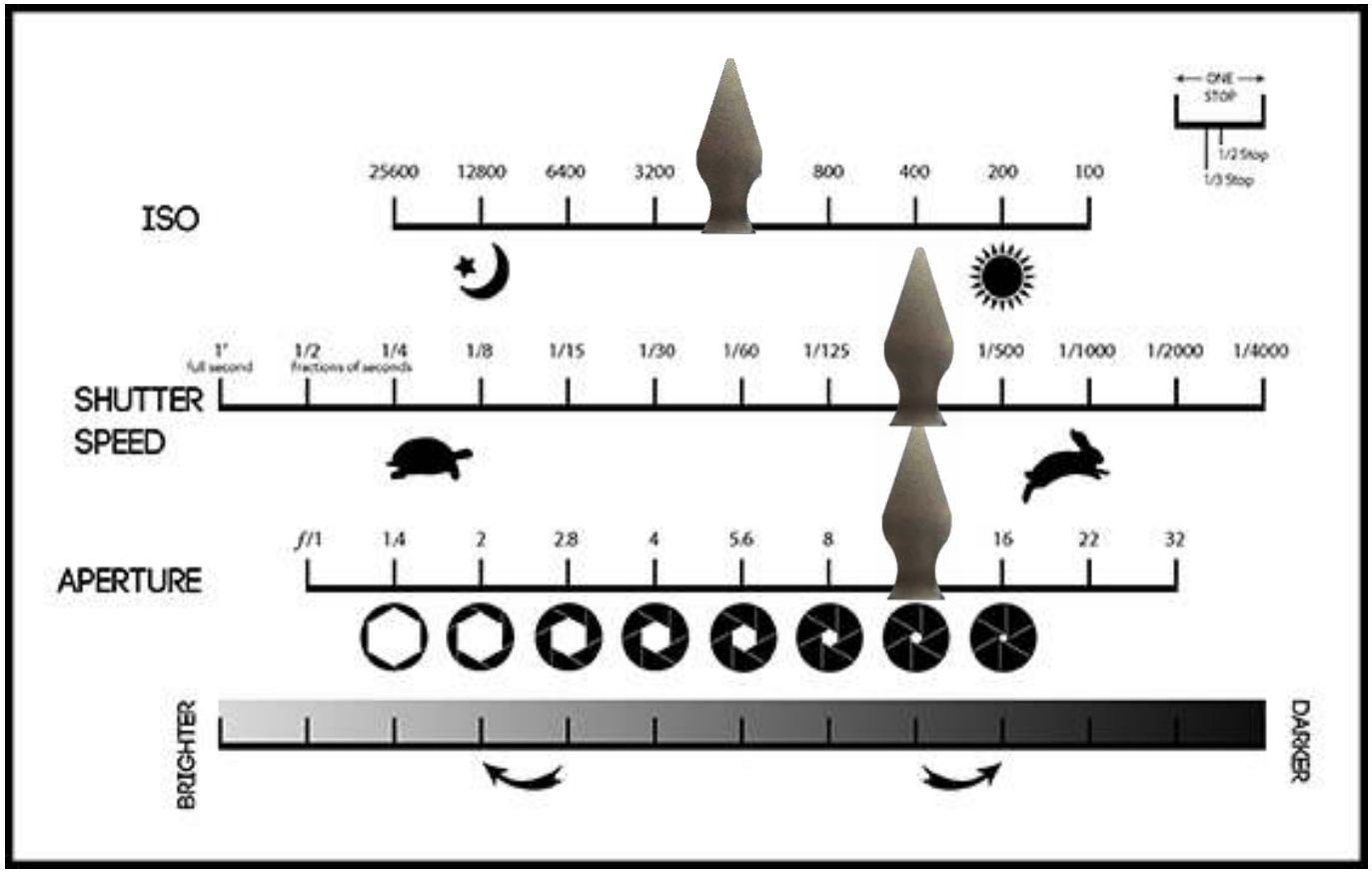
Since this is a landscape and I don't need to stop motion, I can balance the exposure by changing the shutter speed. If I leave the shutter (curtain) open longer I let in more light. How much longer do I need? Three stops (to the left, opposite the direction I moved aperture)! I then change my shutter from 1/500th, to 1/250th, to 1/125th, to 1/60th on the slider for shutter speed. This balances our exposure settings.



But uh-oh! I forgot my tripod! I cannot hold the camera still enough at 1/60th so I am getting too much camera shake. I decide to move the shutter speed setting back two stops to the right to 1/250th to be faster. However, then I am out of balance again. I must change either the aperture or adjust the ISO by two stops to the left. I am trying to get more light to balance that faster shutter speed.



Since I already have the aperture where I want it for my depth of field and the shutter speed is now set to handle camera shake, I would have to make the change to the ISO (the only element of the three I have remaining). I would increase the ISO by two stops to 800 and then to 1600. I make these changes to my sliders by moving the ISO slider two stops to the left to equal it out.



My new settings are now:

ISO 1600, Shutter Speed 1/250th, and Aperture f/11 and I still have proper exposure! Now I can enter these settings into manual mode and my image will have the correct light and it is also adjusted for what I needed to accomplish.

As you can see I could have used a lot of different combinations to make this exposure work.

ISO 800, Shutter Speed 1/125th, and Aperture f/11 would also balance our exposure.

Which Mode to Use?

It depends! Even professionals don't use full Manual Mode all the time. In some types of photography taking the time to fiddle with all these settings means missing the shot. For example, with war/conflict, street, auto racing, or wildlife photography the action can happen quickly.

I always recommend starting in Auto Mode. Pay attention to the settings the camera selects. This will start to train you to see how these settings are related. You can get really good at this and even start to predict what settings the camera will use. Then you will be ready to learn semi-automatic modes (aperture priority and shutter priority).

Aperture priority is best when the depth of field is the most important element of the image. In aperture priority, you set the aperture and the camera will balance the other settings, usually by adjusting shutter speed, but sometimes also ISO.

Shutter priority is best when the action or motion is the most important element of the image. In shutter priority, you set the shutter speed and the camera will balance the other settings, usually by adjusting the aperture, but sometimes also ISO.

We offer additional guides for learning these modes on our website.

Use full Manual Mode after you have had lots of practice and in scenarios where you have time to adjust all of the settings without any pressure.

Learn where the exposure compensation buttons are for your camera (check the user guide, if you don't have one get it here). With the exposure compensation feature, you can override the camera's settings to quickly make the image darker or brighter. Some cameras also offer exposure bracketing. The camera will take a series of shots typically using three or five different exposure levels.

If all else fails, you can correct the majority of issues in editing (except camera shake – that one can't be fixed in post!).

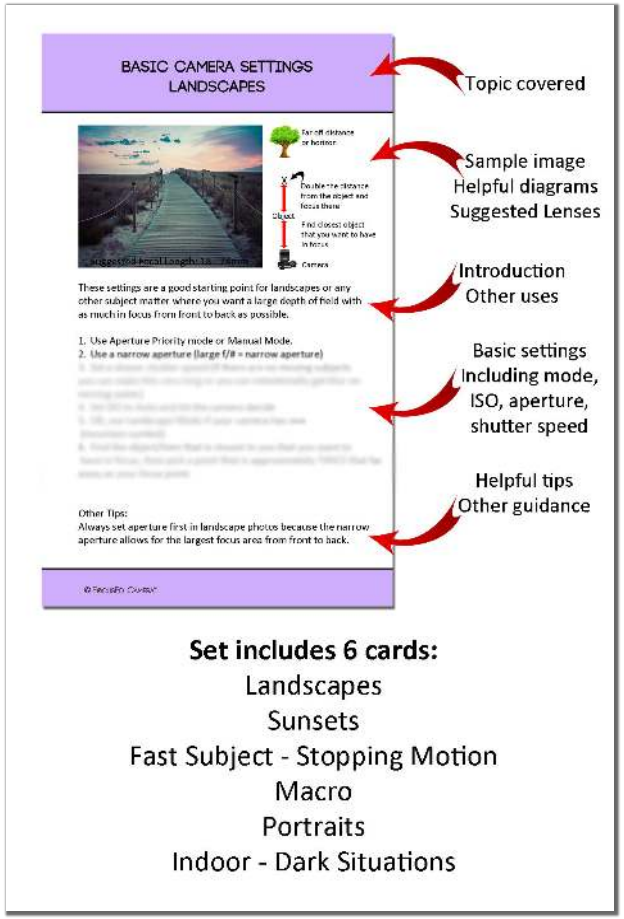
The Takeaway...

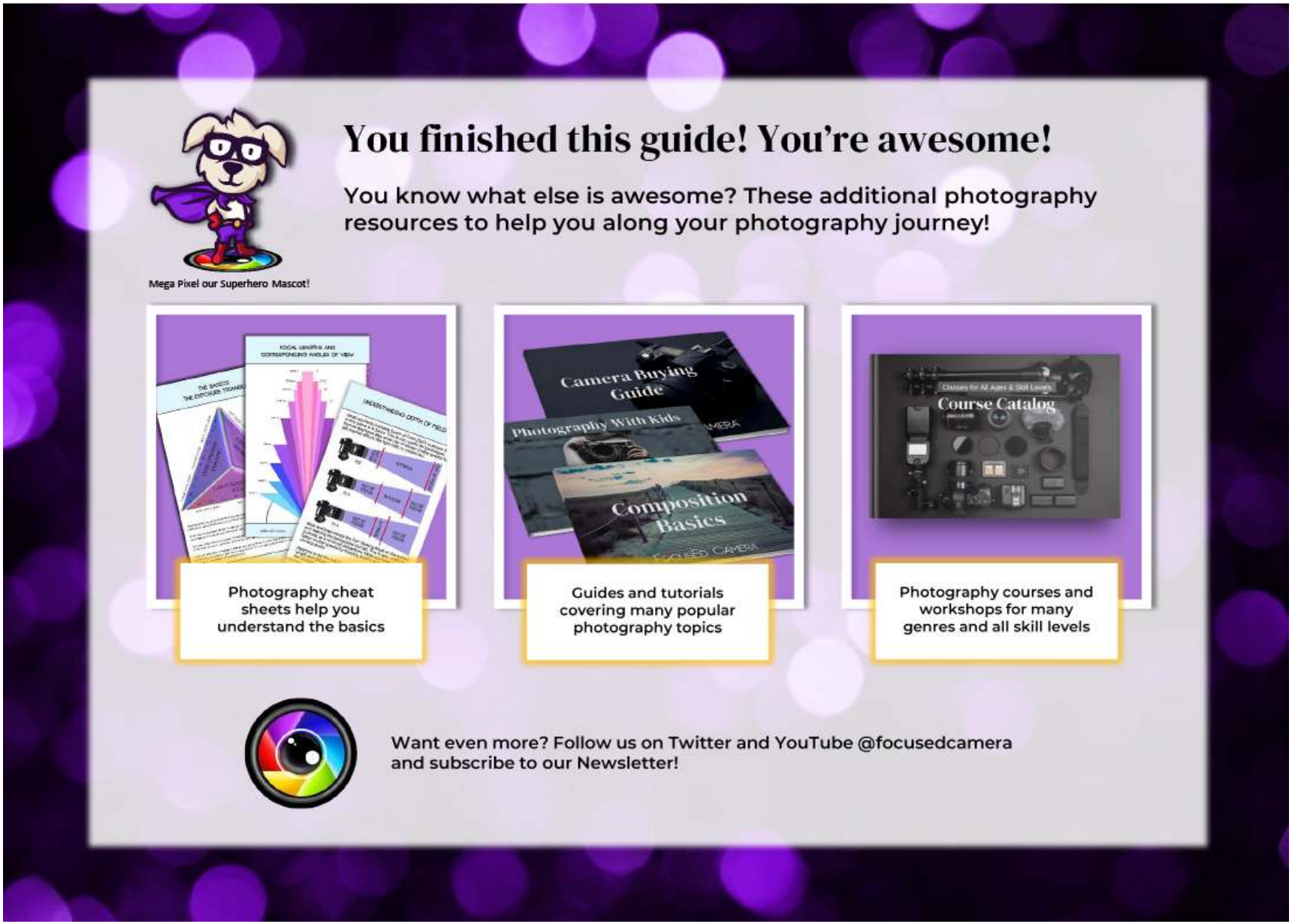
Understanding the exposure triangle as a concept is much different than putting it into practice. The best tip that will 100% improve your photography more than anything else is daily practice. You will have to experiment with different settings and shooting modes and over time you will gain more and more control over your camera. Your images will improve and your brainpower won't be spent on settings. You will able to put your mind to work more creatively and work on composition and exploring your artistic vision.

Now you know that what mode and what settings you use will "depend" on what you want to accomplish. You can balance the exposure using the three elements of the exposure triangle with many different combinations all "depending" on the light, the subject, and the scene. There are no settings that will work all of the time.

For more practice with balancing exposure, visit our YouTube channel and watch our Exposure videos, Part 1 and Part 2.

If you are interested in some basic starting points for 6 common photography scenarios, we offer a Basic Settings set of cheat sheets on our website along with other photography tools. These cards provide a sample image, basic lens focal lengths and/or diagrams, suggested shooting modes, settings for ISO, aperture, and shutter speed to use as a starting point, and helpful tips and guidance for getting started.




Mega Pixel our Superhero Mascot!
You finished this guide! You're awesome!
You know what else is awesome? These additional photography resources to help you along your photography journey!
Photography cheat sheets help you understand the basics
Camera Buying Guide
Photography With Kids
Composition Basics
Guides and tutorials covering many popular photography topics
Course Catalog
Photography courses and workshops for many genres and all skill levels
Want even more? Follow us on Twitter and YouTube @focusedcamera and subscribe to our Newsletter!

About the Author

Cheryl Ritzel, founder of FocusEd Camera, is an esteemed instructional coach. Her exceptional talents have garnered recognition and accolades throughout her career. Cheryl's company and her remarkable work have been featured in prestigious publications such as ICM Magazine, Business Insider, Dogster, Spectrum News, and Yahoo News, and on the social media channels of Lensbaby, Canon, and Adaptalux.

Demystify the Exposure Triangle...

Learning the fundamentals of aperture, shutter speed, and ISO, will empower you to control light and achieve the images you envision. Whether you're a novice or a hobbyist, this guide unlocks your camera's potential. You can't effectively use manual mode without an understanding of the exposure triangle first. This e-book will guide you step-by-step through the process of balancing exposure. By mastering the components that create proper exposure, you can create visuals that leave an impression and elevate your photography.

FocusEd Camera™