

Get the Most From Your Digital SLR

Lesson One: Aperture and Shutter Speed

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Introduction

Digital SLR cameras are quite simple.

I can hear the cries of outrage right now, but this first statement is true. Let's compare operating a digital SLR to using your television set.

These days, TVs come with a wealth of options: memory scan, picture in picture, color correction, sound options. Do you have to use all of these features to watch TV?

Not at all.

In fact, you only need to know 3 things to watch TV:

1. How to turn it on
2. How to change channels
3. How to increase and decrease the volume

Here's the thing: with a digital SLR camera, you ALSO only need to know 3 things:

1. How to turn it on
2. How to change the aperture
3. How to change the shutter speed

That's it!

OK, you're right. You don't even have to know that much, since many people use their digital SLRs without ever changing aperture or shutter speed.

It's easy to use a digital SLR camera in AUTO or PROGRAM mode but this defeats the purpose of owning an SLR camera.

One of the benefits of an SLR over a compact point-and-shoot is that **you have control over every photo you take**.

YOU make the decision about how every photo is going to look NOT the camera. Why is this important?

Because your digital SLR is - in the end - just a small computer. While it excels at processing millions of colored dots of information, it makes pretty poor judgment calls about the artistic qualities of your photos.

Once you wrestle control of aperture and shutter speed away from the camera and make them your own, you'll see a remarkable improvement in all of the photos you take.

Before You Begin

Before you get too deep into this lesson, I'd like you to do something for me.

Go out and take a few shots with your camera.

The subject doesn't have to be anything special - just find something (or someone) you enjoy photographing.

You also don't have to go crazy, just 10 or 20 photos will do.

I'll tell you what this is all about when you're done with the e-course.

Definitions

Here comes the tough part of this week's digital SLR course - the definitions.

While I try to keep these as simple as possible, it's inevitable that some of the finer points won't be immediately understood.

Don't despair.

These definitions will become clear over time - the most important thing is that you practice a lot and **see for yourself** what effect each camera setting has on your photos.

We'll take care of the practice part in the Exercises, but those come later.

For now, it's time to define aperture and shutter speed.

Aperture

Here's the simple definition of aperture:

Aperture is the width of the opening in your camera's lens.

A camera lens works a lot like the pupils of your eyes. When you're outside in bright sunlight, your pupils are very small to limit the amount of light entering your eyes.

If you wake up in the middle of the night, your pupils are wide open which helps you to see in the dark (to some extent).

Let's say you were to measure the diameter of your pupils in the middle of the day. They would have an aperture of 22. In the middle of the night, your eyes might have an aperture of 2.8.

This brings us right smack into the most confusing part about aperture numbers: they're the inverse of what you'd expect.

The SMALLER the aperture number, the WIDER the aperture.

Read that one again, then repeat it to yourself until it sticks firmly in your head. Once you understand that 2.8 is wide open and 22 is narrow, everything else will fall into place.

Here's another trick: think of aperture numbers as FRACTIONS instead of whole numbers. For example, if I were to ask you if $1/4$ was larger than $1/2$, what would your answer be? If you think about it this way, it makes sense that an aperture of 16 ($1/16$) is SMALLER than an aperture of 8 ($1/8$).

Just like time (measured in seconds and minutes) and distance (measured in feet or meters), apertures are measured in f-stops. This is why aperture numbers start with the letter f, like this: f/2.8.

There is a common scale for apertures:

1.4	2.0	2.8	4.0	5.6	8.0	11	16	22	32
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From left to right the apertures are **decreasing** in size (it's reversed, remember?).

An aperture of f/2.8 is WIDE (letting in a ton of light) and an aperture of f/22 is NARROW (letting in a tiny amount of light). When a camera lens is set to a narrow aperture it is also called "stopped-down" and when it's set to a wide aperture it's called "wide-open".



Each full f-stop change either **doubles** or **halves** the amount of light that passes through the lens and lands on the camera sensor.

APERTURE	DOUBLE THE LIGHT OF	HALF THE LIGHT OF
f/2.8	f/4.0	f/2.0
f/4.0	f/5.6	f/2.8
f/5.6	f/8	f/4.0
f/8	f/11	f/5.6
f/11	f/16	f/8

Half Stops and Third Stops

If you're changing the aperture on your SLR, you'll notice that the camera is using more than just the standard set of f-stop numbers.

This is because your camera is set to use **half-stop** or **third-stop** increments.

When your camera is set to use half-stops or third stops, it just gives you more aperture numbers to play around with. *It does not change the relationship between the standard set of f-stops.*

Here's the **half-stop** scale (regular stops in bold):

2.8	3.5	4.0	4.5	5.6	6.7	8.0	9.5	11	13	16	19
------------	-----	------------	-----	------------	-----	------------	-----	-----------	----	-----------	----

And here's the scale with **third-stops**:

2.8	3.2	3.5	4.0	4.5	5.0	5.6	6.3	7.1	8.0
------------	-----	-----	------------	-----	-----	------------	-----	-----	------------

OK, take a breather.

Go for a walk, play with your camera for awhile - just do something to take your mind off all of these numbers.

When you're ready to get back into it, I'll talk about what **aperture priority** means (good news - it's easier to understand than aperture).

Aperture Priority

Aperture priority mode is available on all digital SLR cameras.

Your SLR will have a dial on the top of it with some program modes (landscape, portrait, night, etc.) and that dial will also have letters on it like "P", "A", "S", and "M".

Aperture priority mode is the "A" setting on your camera. It also sometimes appears as "Av".

In aperture priority mode you manually change the aperture, while the camera selects a matching shutter speed to ensure a good exposure.

Every photo you take is a relationship between aperture and shutter speed (I'll get more into this relationship later). When you change the aperture, the shutter speed must also change to compensate.

In aperture priority mode, you only have to worry about one variable - aperture - and the camera does the rest.

It's what I like to call a "baby-step" feature of digital SLR cameras. It lets you begin to experiment with using the manual settings on your camera without jumping into the deep end of the pool.

Depth of Field

We now come to the heart of why aperture is so important in photography.

While you can use the aperture of your lens to let in more or less light, you can also use aperture to change the **depth of field**.

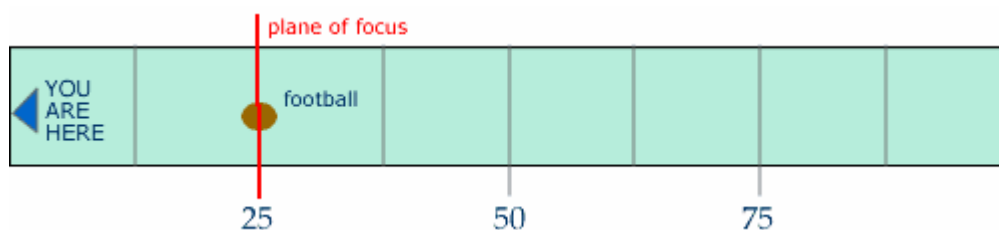
Before I talk about depth of field, let's talk about the **plane of focus**.

Hold your hand close in front of your face so that you can focus your eyes on your fingers. Notice that the background behind your hand is blurry. Now shift your eyes so that you're focusing on the background. Your hand is now out of focus.

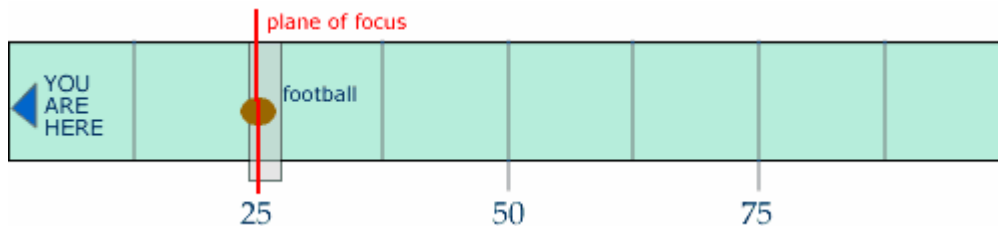
Your digital SLR camera focuses in a similar way. The object that the camera is focused on creates a plane of focus. Other objects in front of and behind the plane of focus won't be as sharp.

Here's the thing: you can set your aperture so that items in front of and behind the plane of focus **DO** appear perfectly clear.

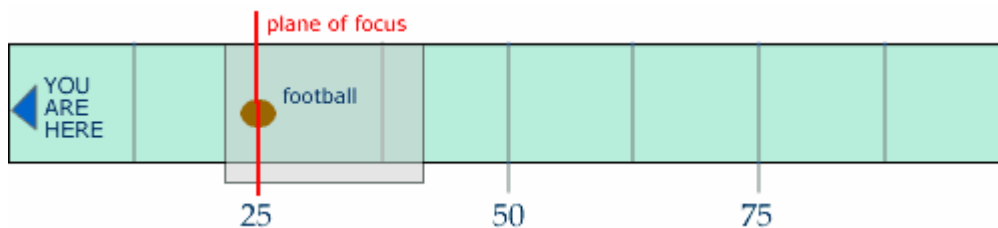
Imagine that you're standing on the zero yard line looking down the length of a football field. You focus on a football sitting on the 25-yard line. That's the plane of focus.



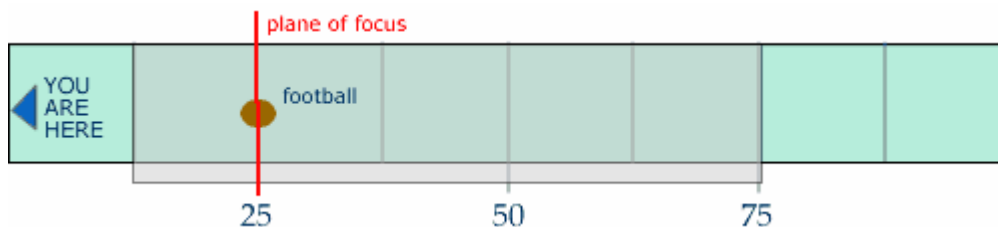
You have your camera aperture set to **f/2.8** (wide open). An aperture of f/2.8 creates a very **shallow** depth of field (shown by the grey box). In this case, only the football will be in focus. Everything in front of it and behind it will be blurry.



Now you set your aperture to **f/8.0** (somewhat open). Now the football is in focus on the 25-yard line, but objects on the 20-yard line and the 35-yard line are also in focus. You've increased the DEPTH of field.



Finally, you set your aperture to **f/22** (stopped down). Now everything from the 10-yard line to the 75-yard line is in focus.



This is all well and good if you're taking pictures of a football sitting in an empty stadium - but let's take a look at depth of field and everyday subjects.

Depth of Field in the Real World



A shallow depth of field (f/2.8 to f/4) is good when you are taking a portrait and don't want the background to compete with your subject. Wide apertures ensure that the entire background is blurry.

Now let's say that you're taking a group photo, with 2 rows of people. Do you really want the people in front to be in focus and the people in the back to look blurry?

Probably not.

In this case you'll need to narrow your aperture (and increase your depth of field) so that everyone in the photo looks crisp.

Landscape photographers use narrow apertures (f/11 to f/22) to ensure that everything from foreground to background is in focus.

This makes the landscape look natural - if you were standing there, your eyes could focus on the entire scene.

Landscapes taken with wide apertures and shallow depth of field just don't look the way you expect them to.

Adjusting aperture can also be an aesthetic choice.



Imagine that you are taking a shot of a flower in the desert. If the desert background is unappealing, then you can use a wide aperture (f/2.8) and shallow depth of field to blur the background and isolate the flower.

If the desert background has a lot of pattern and will really establish the location of the flower, then a narrow aperture (f/22) and a wide depth of field will capture the entire desert scene.

To sum up:

APERTURE	DEPTH OF FIELD	GOOD FOR
Open (f/2.8 to f/3.5)	Shallow	Portraits, flowers - anything where a blurry background will make the subject stand out
Narrow (f/16 to f/22)	Deep	Landscapes, architecture - anything where the subject should be clear from foreground to background

Depth of Field Control

Aperture is actually just one of three factors that allows you to control the depth of field in your photos. The three variables that you can manipulate are:

1. The aperture of the lens
2. The focal length of the lens (wide angle or telephoto)
3. The distance between the lens and the subject

And here's how each one of the factors affects depth of field:

FEATURE	SETTING	DEPTH OF FIELD
Aperture	Open	Shallow
	Narrow	Deep
Focal Length	Telephoto	Shallow
	Wide Angle	Deep
Subject/Lens Distance	Near	Shallow
	Far	Deep

Let's break this down a bit: wide angle lenses provide you with a LOT of depth of field naturally. Even if you use an open aperture (like f/2.8) on a wide angle lens, you're still going to see a lot of depth of field in the photos you take.

Conversely, telephoto lenses have naturally shallow depth of field. This means that even if you set a narrow aperture (like f/8) you'll still be working with a shallow depth of field.

These same principles apply to the subject-to-lens distance. Let's say that you're using a standard focal length lens of 50mm (neither wide angle nor telephoto). If you take that 50mm and get right up close to your subject, your depth of field will become quite shallow.

If you then take a few steps back, depth of field will increase *even if you haven't changed the aperture*.

Really want to experiment with depth of field? Take it to the extremes:

- **For immense depth of field:** use a wide angle lens, narrow the aperture and stand far away from your primary subject
- **For shallow depth of field:** use a telephoto lens, set a wide aperture and get right up close to your subject

Depth of Field Preview

Some digital SLR cameras include a feature called a depth of field preview.

This is a button somewhere on the camera body (typically located on the front near the lens) - when you press it, it sets the lens aperture to whatever aperture you've selected.

This means that by looking through the viewfinder you can see the depth of field in your photo BEFORE you take it.

For example, if you've chosen an aperture of f/16, pressing the depth of field preview will set the lens aperture to f/16.

The only problem with this feature is a natural side-effect: since narrow apertures allow less light to pass through the lens, the image that you see in the viewfinder can become quite dim.

The dim image in the viewfinder can make it hard to judge whether or not the image is in focus.

The depth of field preview is most useful for people who take macro photographs. Since you're very close to your subject when you take a macro photo, you don't have a lot of depth of field to work with.

If you want to ensure that both the flower and the bug in your macro photo are clear, you can use the depth of field preview to ensure that you're using an aperture narrow enough to capture the entire scene.



Aperture Wrap-up

You should now have a pretty good handle on what the aperture setting does:







1. Aperture can be wide or narrow
2. Aperture affects the amount of light that passes through the lens

3. Aperture helps you control depth of field

The best way for this to sink in is to go out and practice. Set your camera to aperture priority mode and take picture after picture, changing aperture for each one.

The nice part about digital photography is that it accelerates your learning curve. Since you can delete all of the photos that are duds, you have the freedom to take hundreds of shots without spending tons of money on film.

Aperture Examples

WIDE APERTURE (SHALLOW DEPTH OF FIELD)	NARROW APERTURE (DEEP DEPTH OF FIELD)
 <p data-bbox="315 982 456 1010">Aperture: f/5</p>	 <p data-bbox="824 982 966 1010">Aperture: f/8</p>
 <p data-bbox="305 1396 462 1423">Aperture: f/4.5</p>	 <p data-bbox="818 1396 972 1423">Aperture: f/11</p>
 <p data-bbox="315 1806 456 1833">Aperture: f/4</p>	 <p data-bbox="818 1806 972 1833">Aperture: f/22</p>

Shutter Speed

Next to aperture, shutter speed is a piece of cake.

Shutter speed is a measure of how long the shutter stays open.

Your digital SLR sensor is a lot like a vampire - it's very sensitive to light. Since it's so sensitive, it prefers to be in the dark until the moment a photo is taken. The sensor hides behind a light-proof door called a **shutter**.

A shutter is made up of two separate curtains, much like curtains on a theater stage. Every time you press the button on your camera to take a shot, one curtain opens and exposes the sensor to light, then the second curtain closes to block the light. In the case of very fast shutter speeds, the second curtain begins to close before the first is fully open.

Since the button that you press to take a photo sends a signal to the shutter curtains to open and close, it's also commonly called the "shutter release".

The amount of time that the shutter stays open is called the shutter speed.

Shutters are not lazy: they rarely stay open for very long. Most shutter speeds are measured in **fractions of a second**. A shutter speed of 500 actually means that *the shutter is only open for 1/500th of a second*.

Like aperture, there is a scale of common shutter speeds. In this case, the fraction is left out, and the shutter speed is just a single number (2000 = 1/2000th of a second).

4000	2000	1000	500	250	125	60	30	15	8	4	2	1
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These shutter speeds are getting slower from left to right. 1/4000th of a second is significantly faster than 1/4 of a second.

You can also set shutter speeds *longer than a second*. Once you cross over the second mark, shutter speeds are followed by a quote mark so that they are not confused with the fraction numbers. A shutter speed of 2 seconds will display as 2". A shutter speed of 20 seconds is 20".

Your camera might also have a shutter speed setting called "bulb". In this mode, you press the shutter release once to open the shutter and again to close it. In "bulb" mode, you can keep the shutter open for an hour if you like. It's practical for astrophotography, but of relatively little use otherwise.

Shutter Priority

On a digital SLR control dial, the shutter priority setting is often labeled as "S" or "Tv".

In shutter priority mode you can manually change the shutter speed, while the camera selects a matching aperture to ensure a good exposure.

Unlike aperture which you can manipulate to your heart's content, you can't always set ANY shutter speed you want in shutter priority mode.

The problem here is that apertures have a LIMIT: it's called the **maximum aperture** of the lens.

Without going into great detail about the aperture/shutter speed relationship (I'll cover that in the next lesson) I'll say this: getting a photo that is correctly exposed requires aperture and shutter speed to be balanced.

- As you slow down your shutter speed - letting **more** light onto the sensor - aperture will narrow to let less light pass through the lens
- As you increase your shutter speed - letting **less** light onto the sensor - aperture must open wider to let more light pass through the lens

Let's use the following example: you're using a 50mm lens with a maximum aperture of f/3.5 and you're trying to take photos on an overcast day. You set your camera to shutter priority mode, and select a shutter speed of 1/250th of a second.

The camera has no problem with this, and it picks a matching aperture of f/5.6 so that enough light hits the sensor to create a decent exposure.

Now you set the shutter speed to 1/500th of a second. Faster shutter speed = Wider aperture. The camera opens the aperture from f/5.6 to f/4 to balance the exposure.

Finally, you try to push the shutter speed up to 1/1000th of a second. The camera WANTS to open the aperture up to f/2.8 to get a proper exposure, but it CAN'T. The problem: **the maximum aperture of your lens (the WIDEST it can open) is f/3.5.**

Under these circumstances, your digital SLR will do one of two things:

1. It will let you take the photo, but the photo will be under-exposed (it will look too dark)
2. It won't let you take the photo, and will flash the aperture number in the viewfinder

If the second one happens to you, just slow down the shutter speed until the aperture number stops flashing, and then you'll be able to take photos again.

Shutter Speed in The Real World

Like aperture, shutter speed controls the amount of light entering the camera.

As shutter speed slows down, the camera's sensor is exposed to more light.

The amount of time the shutter must stay open is directly related to how much available light exists:

- Taking photos outside on a sunny day you can use a shutter speed of 1/1000, maybe even 1/2000th of a second - there is plenty of light to get a correct exposure
- Now you're outside on an overcast day: with less light to work with, the shutter must stay open longer (say 1/250th of a second) to take the same photo
- If you're taking photos indoors, the shutter may have to stay open closer to 1/60th of a second
- At night, you'll need to use shutter speeds that are 10 seconds or longer

So one aspect of shutter speed is the amount of light it allows onto the sensor. The second depends on how much motion you're trying to capture.

Fast shutter speeds freeze motion

Since the shutter is only open for a fraction of a second, you can catch a dog or a child in mid-leap, or you can show every drop of water falling into a pool.

Fast shutter speeds are used for action and sports photography, to freeze the motion of an athlete at a precise moment in time.

This first photo was taken with a shutter speed of 1/3000th of a second.

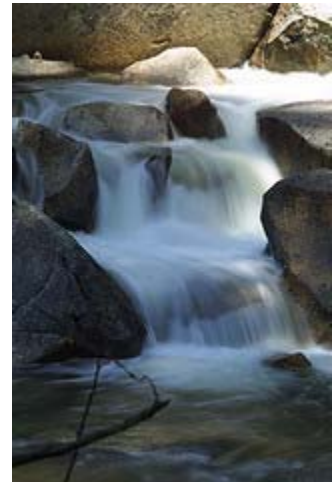


Slow shutter speeds blur motion

While the shutter stays open, objects that move in front of the camera lens appear blurry.

This is typically used by landscape photographers to make water look silky and smooth, but can also be used to illustrate motion when taking photos of bustling city streets.

This second photo was taken with a shutter speed set to 1/2 of a second.



There are many times when photographers deliberately choose a shutter speed to achieve a desired effect. However, shutter speed mistakes can cause blur in a photo where there shouldn't be any.

Shutter Speed and Focal Length

Before I get too far along here, let me introduce you to focal length.

Focal length is a measurement in millimeters from the optical center of the lens on your camera to the camera's sensor.

- Lenses with short focal lengths (14mm - 28mm) are called wide-angle lenses, and allow you to take in the entire scene in front of you
- Lenses with medium focal lengths (50mm - 100mm) are called standard lenses, and are ideal for taking portraits
- Lenses with long focal lengths (200mm - 600mm) are called telephoto, and are used to get right up close to a subject even when you are far away
- Prime lenses have a fixed focal length, while zoom lenses have a variable focal length

PHOTOGRAPHY GUIDELINE

If you're holding the camera in your hands and not using a flash, don't use a shutter speed slower than 1 over the focal length of the lens.

When you hold the camera in your hands it's unstable.

Slow shutter speeds enhance motion and cause blur. If your shutter speed is too slow when you're holding the camera in your hands, *your entire photo will turn out blurry.*

The following table illustrates a variety of focal lengths and the resulting shutter speed that you need to use in order to ensure clear shots:

FOCAL LENGTH	1/FOCAL LENGTH	CLOSEST SHUTTER SPEED
28mm	1/28	1/30 th of a second
50mm	1/50	1/50 th of a second
100mm	1/100	1/100 th of a second
300mm	1/300	1/300 th of a second
600mm	1/600	1/600 th of a second

This is why all sports and wildlife photographers use tripods to steady their cameras. When you've got a huge telephoto 600mm lens attached to your camera, *any shutter speed slower than 640 can result in a blurry photo.*

You may have read somewhere about digital SLR cameras and something called a **focal length multiplier**. If your camera has a multiplier of 1.5x, then your standard 50mm lens is going to capture photos more like a 75mm lens.

Key point: this multiplier DOES NOT physically alter the focal length of the lens.

Instead, the artificial zoom effect is created because the sensor inside a digital SLR camera is smaller than a standard frame of 35mm film ([read more here](#)).

Since this multiplier is not physically altering the length of your lens in any way, you don't have to do any fancy math in your head when you're trying to figure out if your shutter speed is faster than your focal length. Just use the guideline (and the table above) and you'll be fine.

The Effect of Image Stabilization

With the introduction of digital SLR cameras that include built-in image stabilization (IS), the rules have changed a bit.

The net effect of image stabilization (whether it is part of the lens or the camera) is that it renders the guideline above null and void.

The shutter speed/focal length guideline assumes that the camera is moving around when you hold it in your hands. Image stabilization counteracts this motion.

This causes a shift in the table above, because now you CAN use shutter speeds that are slower than 1/focal length and STILL get clear photos.

Don't get carried away though - this doesn't mean you can hand-hold the camera and take clear photos at 1/4th of a second. But it does change the numbers in the table in the following way:

FOCAL LENGTH	1/FOCAL LENGTH	STABILIZED SHUTTER SPEED
28mm	1/28	1/15 th of a second
50mm	1/50	1/30 th of a second
100mm	1/100	1/60 th of a second
300mm	1/300	1/160 th of a second
600mm	1/600	1/320 th of a second

Key point: image stabilization only works with STATIC subjects.

Let's say that you're using a 28mm lens and want to take a landscape photo while holding the camera in your hands. With the IS engaged, you can use a shutter speed as slow as 1/15th of a second.

But if your subject is a small child instead of a landscape, you'll have to use a faster shutter speed to freeze the motion. If you used a shutter speed of 1/15th of a second the BACKGROUND will be clear but the CHILD will be blurry.

Pushing Your Luck

I've presented you with both a shutter speed guideline for taking clear photos as well as the effect IS has on these shutter speeds.

Let me be clear though: *these are guidelines.*







There are many times where I have not had a camera with IS, and have tried to take photos at 1/30th of a second with a 50mm lens.

While the vast majority of these shots turn out blurry, every so often you'll capture a clear frame. The slower the shutter speed, the less non-blurry shots you'll get.

The point here is that you should not feel bound by the 1/focal length guideline. If your goal is to capture clear photos without blur, then always keep an eye on your shutter speed and pay attention to the focal length that you're using.

But there will come a time when you'll be faced with dim lighting conditions and a superb photo opportunity. In this case, your best bet is to set the camera to the fastest shutter speed it will allow, hold your breath, and hope for the best.

Shutter Speed Examples

SLOW SHUTTER SPEED	FAST SHUTTER SPEED
 <p data-bbox="272 638 496 667">Shutter Speed: 1/60</p>	 <p data-bbox="768 638 1015 667">Shutter Speed: 1/1000</p>
 <p data-bbox="272 1207 496 1236">Shutter Speed: 1/50</p>	 <p data-bbox="768 1207 1015 1236">Shutter Speed: 1/1600</p>
 <p data-bbox="272 1621 496 1650">Shutter Speed: 1/25</p>	 <p data-bbox="768 1621 1015 1650">Shutter Speed: 1/3200</p>

Conclusion

We've reached the end of your first lesson on digital SLR cameras.

I've introduced the concept of aperture and shutter speed, and how these two camera settings affect the photos you take.

Both aperture and shutter speed are used to control the amount of light let into the camera, but the former affects the depth of field while the latter affects motion capture.

Both aperture and shutter speed are going to be mentioned a lot in the coming lessons, so it's very important that these two settings are clear to you.

In the next lesson, we'll take a look at the relationship between aperture and shutter speed. I'll talk about exposure, and why you sometimes have to override your camera's automatic settings to get the best photo.

We'll set our cameras to manual mode, and become more comfortable with the metering scale of the digital SLR.

Exercises

EXERCISE 1 - DEPTH OF FIELD

This exercise should help you clearly see the effect aperture has on depth of field.

1. Go around the house and find 10 objects (all the same) that are pretty much the same size. Some examples: 10 tennis balls, 10 chairs, 10 batteries or 10 coins will all do.
2. Set up your camera so that it has a stable base. Use a tripod if you have one, otherwise just find a way to place the camera so that you're not holding it in your hands.
3. Place all of the objects in a line leading away from the camera. Don't crowd the objects together - add enough space so that you can at least fit your foot between each one.
4. Make sure that the distance between the first object and the camera is the same as the distance between each object.
5. Set your camera to **aperture priority mode**, and select the widest aperture your lens will allow.
6. Turn off your autofocus and manually focus on the 4th object in the line.
- 7. Do not enable your flash!**
8. Take a picture.
9. Without moving the camera, DECREASE the aperture by one number. For example, if your aperture was set to 2.5, change it to 3.5. Take another picture.
10. Keep decreasing the aperture and taking photos until you get to the smallest aperture setting your lens will allow.

Your end result should be a series of photos where the only thing changing in each photograph is the aperture.

At wide apertures, only the object you focus on and a small amount of space in front and behind the object are in focus. This is shallow depth of field.

At narrow apertures, almost all of the objects in the line should be in focus, unless one is really close to the camera. This is a wide depth of field.

EXERCISE 2 - SHUTTER SPEED

This exercise is trickier, since you can't use common household objects.

You need to go out and find a photographic subject that is in constant motion. Carousels, windmills and waterfalls are my personal favorites.

1. Set up your camera so that it has a stable base. Don't hold the camera in your hands.
2. Set your camera to **shutter priority mode**, and set it to the fastest shutter speed the camera will allow.
3. Turn off autofocus and manually focus on your moving subject.
4. Take a picture.
5. You probably know what's coming next...without moving the camera, decrease the shutter speed to the next setting.
6. Keep decreasing the shutter speed and taking photos until you've reached the slowest shutter speed your camera will allow.

I'll use the carousel example to illustrate what you should see. At fast shutter speeds, the motion of the carousel should be frozen in time. Even if the carousel is spinning around, it won't look like it in your photograph.

The motion of the carousel starts to blur as the shutter speed gets slower. Eventually the entire carousel will just be streaks of color. If you don't have a tripod, the entire photo will be streaks of color.