# Understanding Photography

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## Lesson Two: Controls and Their Effects

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We've begun by looking at how a photograph is created, the basic controls nearly every camera has and some of the factors that determine exposure. This lesson will continue by looking at another factor that determines exposure. After that we'll start to look at how camera controls affect the resulting photograph visually.

After this lesson, you'll want to take your camera and get out and take some photographs. Look at the results and start to see what is happening. Look at what is in focus, and what is not. See if you can stop the action of moving objects so that they look like they are standing still. Reread your camera's instruction manual to learn how to use the different settings available on your camera.

## Let's Continue!

# What We've Learned

## Two basic controls are needed to create a photograph:

1. Control over how much light strikes the media
2. Control over how long the light strikes the media

## Two basic camera controls are used to create a photograph:

1. The aperture controls how much light strikes the media
2. The shutter controls how long the light strikes the media

## Aperture Reminder

**Smaller number = Larger aperture**

**Larger number = Smaller aperture**

## Shutter Speed

**The length of time that the shutter is open to admit light into the camera**

Aperture and shutter speed work together to create perfect exposure.
A change in aperture requires a change in shutter speed in order to maintain perfect exposure.

**10 x 10 = 100**

| Aperture Value | Shutter Speed Value | Perfect Exposure |
|---|---|---|

# Expanding on Exposure

We've talked about aperture and shutter speed and represented that relationship with a simple mathematical equation.

**10 x 10 = 100**

| Aperture Value | Shutter Speed Value | Perfect Exposure |
|---|---|---|

We've also shown that aperture and shutter speed are related and that there are many combinations available to achieve perfect exposure.

**5 x 20 = 100**

| Aperture Value | Shutter Speed Value | Perfect Exposure |
|---|---|---|

or how about...

**2 x 50 = 100**

| Aperture Value | Shutter Speed Value | Perfect Exposure |
|---|---|---|

We now need to look at adding one additional element to fully complete our look at what factors make up exposure.

# Light Sensitivity

As mentioned in lesson one, a photograph is made when light strikes a light sensitive material, whether it be film or a digital sensor. We've discussed how the camera's aperture controls how much light strikes the media, and how the shutter speed controls how long the light strikes the media. The third aspect that determines exposure is how sensitive the media is to light. The measure of light sensitivity in modern photography is referred to as the ISO rating. (See sidebar.)

***ISO?***

ISO is the acronym that stands for the International Organization for Standardization. This body sets standards for science, engineering, industry and other areas including photography.

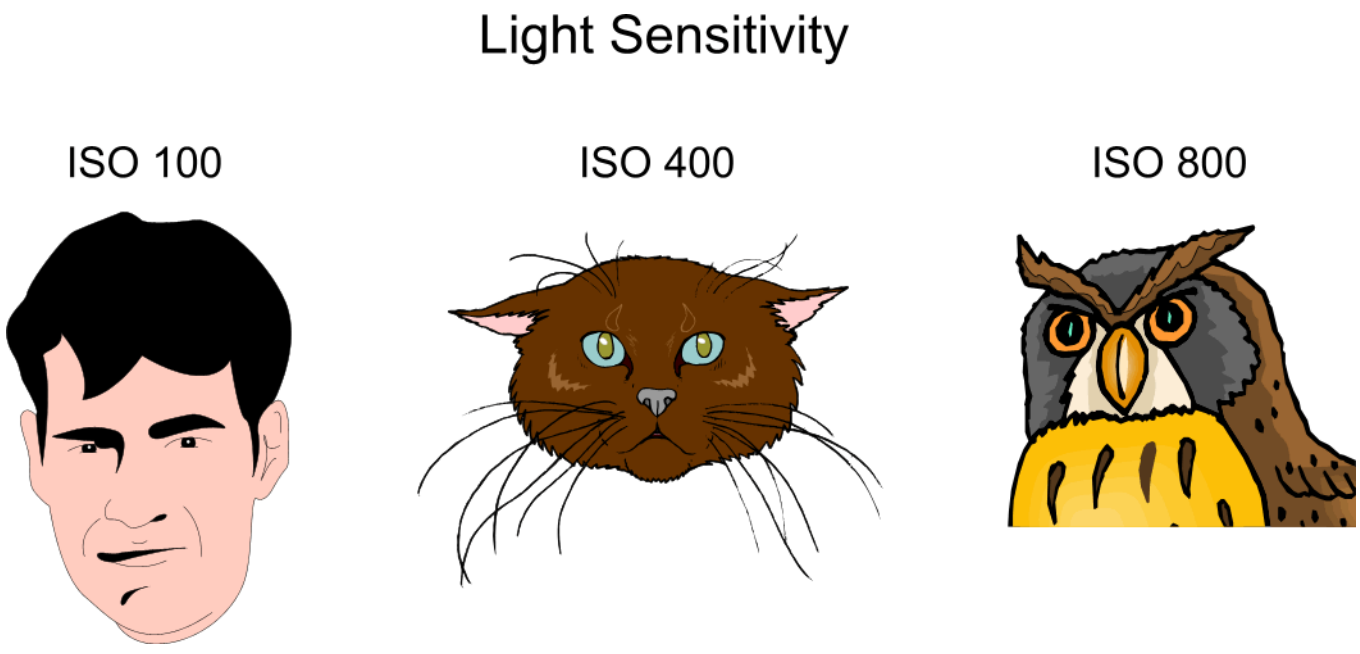
ISO numbers apply to both film and digital photography. The higher the ISO number, the more sensitive the media is to light. Let's go back to our example from lesson one of the human eye. The human eye requires a certain amount of light in order to properly see objects. Too little light, and the eye sees only darkness, too much light and the blinding brightness causes us to shield our eyes.

A cat, on the other hand, can see in light much dimmer than a human can see. Cats often hunt and forage at night where there vision allows them to pick out objects and detail that the human eye cannot.

Even more sensitive, are the eyes of an owl. An owl can see small objects on the ground at night while flying high overhead.

These examples from nature are similar to the various ISO ratings of films and digital sensors. With film, you purchase different types of film each with its own ISO rating. In a digital camera, the ISO rating is set in the camera either by the computer or the user and it can typically be changed from photo to photo if desired.

Let's see how the ISO rating affects the exposure equation.



# Light Sensitivity and Exposure

We'll make our exposure equation slightly more complicated so that we can consider the third variable of light sensitivity. As you can see, we've changed the value of a perfect exposure to 1000 just so that we can keep the values of our imaginary aperture, shutter speed and ISO rating simple.

**10 x 10 x 10 = 1000**

| Aperture Value | Shutter Speed Value | ISO Rating | Perfect Exposure |
|---|---|---|---|

Even though we have added light sensitivity to the equation, everything still works as before. If we change one variable, at least one other variable must change in order to preserve perfect exposure. We can leave the ISO setting alone and simply work with the aperture and shutter speed as previously discussed, but we now also have the option of changing the ISO setting.

Typically, the ISO setting is used to allow the camera to take photographs that would otherwise exceed its mechanical or the photographer's physical capabilities. For instance, if you attempted to take a photograph in a dimly lit room using a camera with ISO 100 film (or a digital camera set to ISO 100), the shutter speed required by the camera to obtain perfect exposure would be so slow that the photographer would not be able to hand hold the camera without shaking and blurring the photograph. If a higher ISO setting (film or digital) is used, the camera is more sensitive to light and so a faster shutter speed (not as much light needed) can be used to avoid blurring.

For now, you need to remember that the ISO number or rating indicates how sensitive to light the media is. The higher the ISO number, the more sensitive the media is to light. Higher ISO numbers are referred to as faster film or digital sensor. When you buy film, it has a fixed ISO rating. Most digital cameras have variable ISO ratings and they can typically be changed to adapt the performance of the camera to various lighting conditions.

## ISO Reminder

**Smaller number = Slower, less sensitive to light**

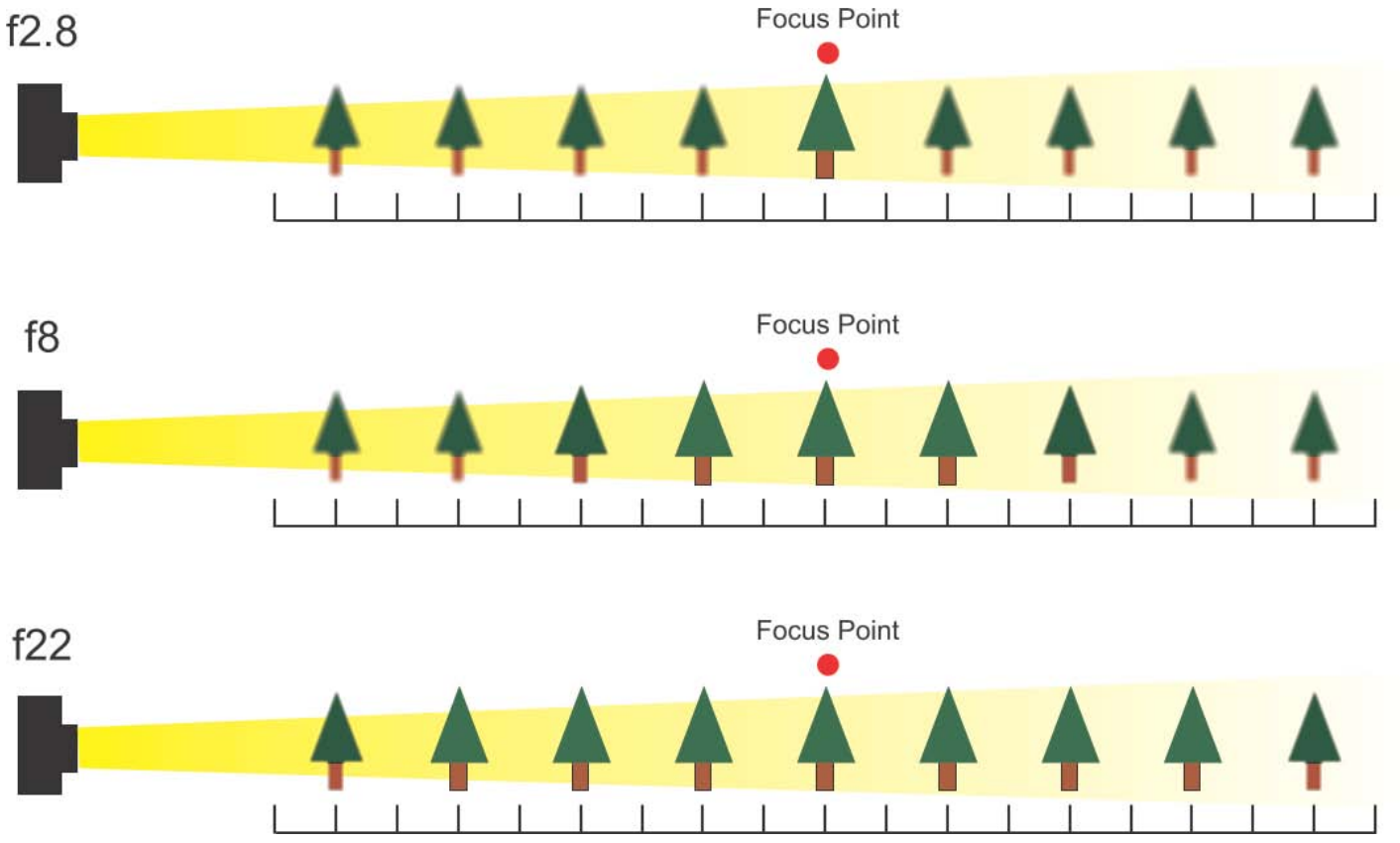
**Larger number = Faster, more sensitive to light**

In a later lesson, we will discuss when to change the ISO rating and its potential effects on your photographs. For now, let's move on and discuss some of the interesting optical effects that different aperture and shutter speed settings can have on your photographs.

# Depth of Field

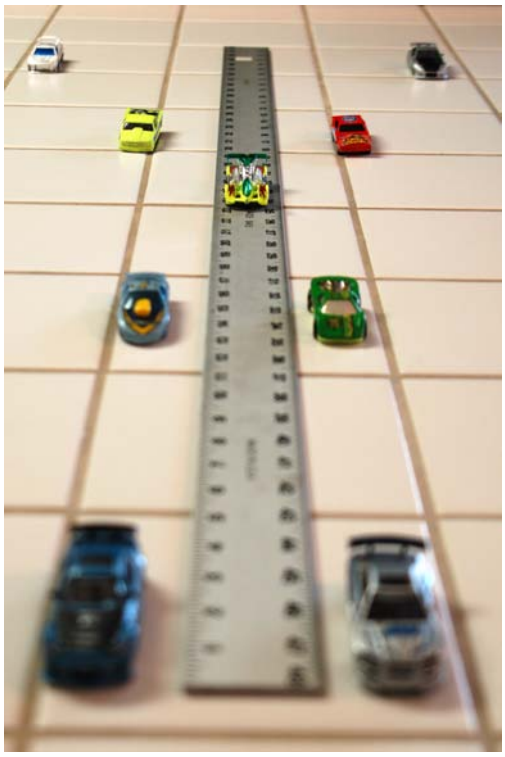
When you take a photograph, you typically focus on a particular object that you want to be clear and in focus when your photograph is produced. The distance in front of and behind that object of focus is known as depth of field. In addition to controlling how much light enters the camera, changing the aperture setting has the effect of changing the depth of field.

Look at the diagram below.

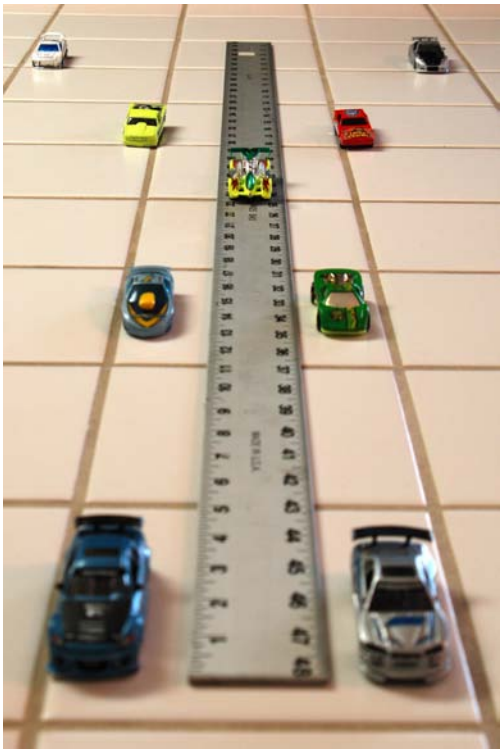



In the diagram above, you can see that the camera is focused on the center tree. With a large aperture (f2.8), only the center tree is in focus. This is known as shallow or small depth of field. As the aperture is closed down, the depth of field expands and more trees come into focus in front of and behind the central tree. This is known as deep or greater depth of field.

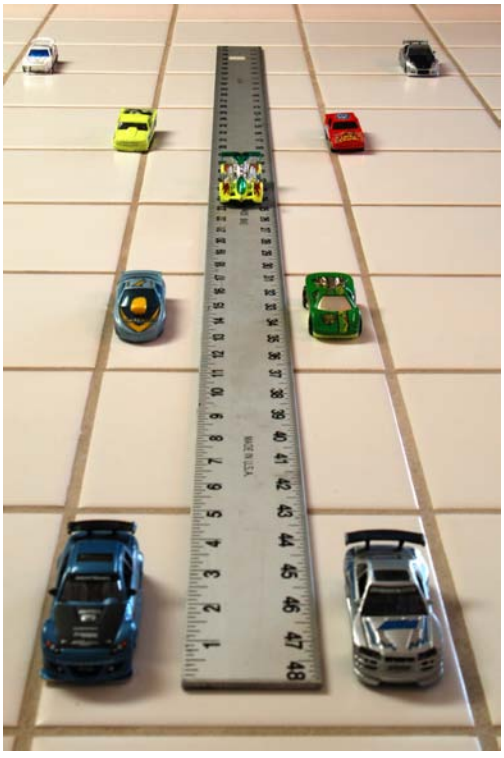
The photos on the next pages illustrate depth of field as you might see it in your photographs.



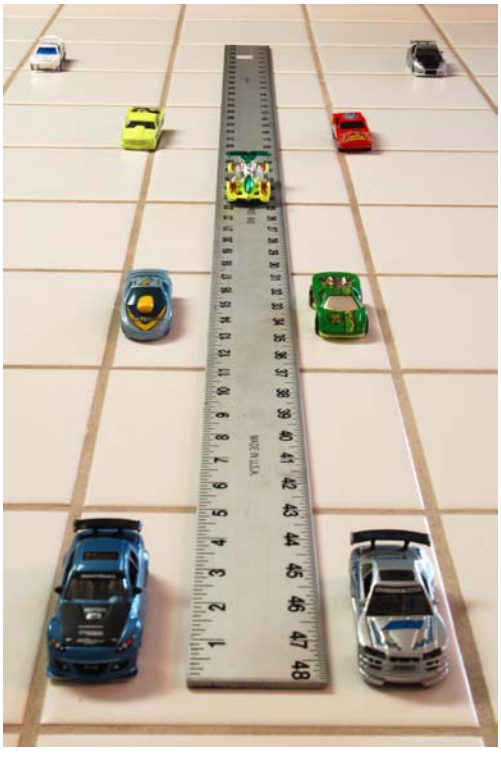
F4.2 - A larger aperture produces a shallower depth of field. The car in the center is in focus. Those in front and behind are not as sharp.



F8 - The depth of field starts to increase a bit. The car in the center is still in focus. Those immediately in front and behind are now in focus.



F11 - The depth of field has increased a lot. Only the front cars show signs of being slightly out of focus.



F29 - The depth of field has increased enough so that all of the cars are now in focus.

This photo demonstrates shallow depth of field. Only one of the flowers is in focus.

This photo demonstrates greater depth of field. All of the flowers and the immediately surrounding leaves are all on focus.

## Depth of Field Reminder

**Larger aperture = Smaller depth of field**

**Smaller aperture = Greater depth of field**

As you practice your photography, you will learn to purposely use depth of field to improve your photographs and draw attention to what you want the viewers to see.

# Expressing or Freezing Motion

In addition to controlling how long the light entering the camera strikes the media, changing the shutter speed setting has the effect of expressing motion through blurring on the photograph, or freezing motion to capture a split second frozen in time.

Slower shutter speeds are used to express motion. Faster shutter speeds are used to freeze motion. The shutter speed needed to obtain the effect you want depends upon the speed of the object you are photographing.

Look at the examples below.

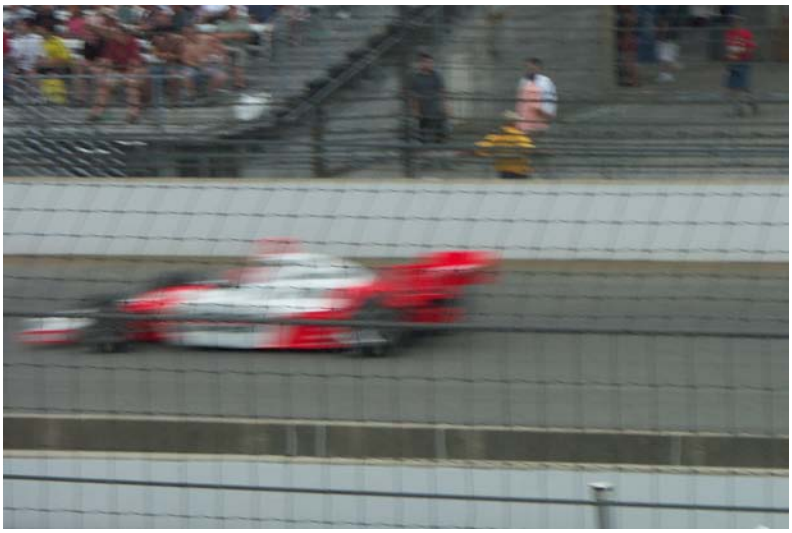
The photograph above was taken using a 1/30th of a second shutter speed. You can see that the jumping boy is blurred because he moved while the shutter was open taking the photograph.

The photograph above was taken using a 1/160th of a second shutter speed. You can see that the jumping boy is now frozen floating above the floor. The shutter was able to open and close fast enough to capture this one portion of his overall jump.

The photos on the next page illustrate expressing and freezing motion as you might see them in your photographs.

This photo was taken with a shutter speed that was slow enough so that the motion of the water results in this silky flowing effect.


It’s hard to believe that this car was moving at about 180 miles an hour. By freezing the motion, it almost looks like it is standing still.



The blurring in this photo really gives you a sense that the car is moving by really fast. A slower shutter speed was used to achieve this effect.

# Expressing/Freezing Motion Reminder

**Slower shutter speed = Expresses motion through blurring**

**Faster shutter speed = Freezes motion**

Study what you have learned in lesson one and lesson two. Reread your camera manual and start taking photos. See what happens on your camera if you use the different settings that are available to you.

# Next Lesson...

***Focusing using an auto focus camera***

***The different ways that your camera's light meter can read light***

***Using different sizes of lenses***