Introduction to Photography – Cameras, Aperture, and Shutter Speed

Unit 1: 01: Introduction to Photography

What is the last photograph that you saw? Photographs are all around us. We see them in magazines, in textbooks, on our bedside tables, on our refrigerators, and posted to sites like Facebook and MySpace. In today's society, it is likely that you encounter numerous photographs each day. We see photographs in ads, on websites, and in our homes.

It is hard to overemphasize the effect that photographs have had on our lives. We use photographs to remind us of people or places, to learn new techniques or activities, and to navigate our daily lives.

Photographs may entice us to buy something, teach us something, or warn us about something. Whatever their use, photographs have become an important part of our lives, and many of us enjoy taking our own pictures to display in our homes or online.

In this unit, we will begin our exploration of photography. To better understand how to improve the photographs that we take, we must first understand how cameras work. This will help us make those adjustments that take our photos from ordinary snapshots to great photographs.

02: Introduction to Photography

How Cameras Work

To take great photographs, it is important to have a basic understanding of how cameras work. This will help you better navigate the many features and controls of your camera because you'll know how cameras commonly function. Surprisingly, the basic operation of a camera isn't particularly complex or difficult. The principle of photography is actually fairly simple.

In general, all cameras work in a similar way. A photograph is taken by letting light fall on a light-sensitive medium, which then records the image onto that medium. How light or dark a photograph is depends on how much light was allowed to fall on the light-sensitive medium. In other words, a **camera** is a light-tight box that contains a light-

sensitive material or device and a way of letting in a desired amount of light at particular times to create an image on the light-sensitive material.

A traditional still film camera has three different components. First is the mechanical element, which is the camera body and the parts associated with it. Next is an optical element. This is otherwise known as the camera lens. Finally, we have the chemical element, which is the film. These three different elements make up a film camera (we'll discuss digital cameras a bit later).

A biconvex lens showing the inverted image.

The optical element of a camera consists of a lens. A **lens** is "a ground or molded piece of glass, plastic, or other transparent material with opposite surfaces, either or both of which are curved, by means of which light rays are refracted so that they converge or diverge to form

an image.” In other words, a lens can simply be a curved piece of glass. This glass takes the light bouncing off an item and redirects the light so that it forms an image of the item. It is able to do this because light changes speed as it moves from one material to another. The glass of the lens slows the light down from its speed in air. Since the light waves enter the glass at different times, the lens will bend the light in one direction. A **converging or convex lens** will bend the light toward the center of the lens, since one or both sides of the glass curve out. It also takes the various rays of light and bends them toward the same point, which ultimately allows an image to form. Not surprisingly, various factors influence how the convex lens bends the light. The distance from the object to the lens is one of these factors. As the object is moved closer to or farther away from the lens, the angle of light entry changes. When the item is close to the lens, the light enters at a sharper angle than when the item is farther away. The angle of light entry then affects the distance to the real image that is formed. If an item is farther away from the lens, the real image that forms will be closer to the lens, and vice versa. In practical terms, an item that is farther away will produce a smaller real image since the light has a more obtuse angle, as opposed to a sharp angle producing a larger real image.

To see this for yourself, you can take a lit candle and put a magnifying glass between the candle flame and the wall. The real image of the candle will appear upside down, and it will grow larger or smaller depending on how close or far away you hold the magnifying glass. This process is essentially what you do when you turn the lens of a camera.

While all of this can be done with a single piece of curved glass, camera lenses typically involve several lenses within the same unit. This is partly due to the need to exactly line up the colors of an item so that there are no issues with the real image. To compensate, cameras use multiple lenses to realign the colors of the object.

Sabrina Day from Beaufort, S.C., uses a 400mm fixed telephoto lens to photograph daily activity aboard the aircraft carrier.

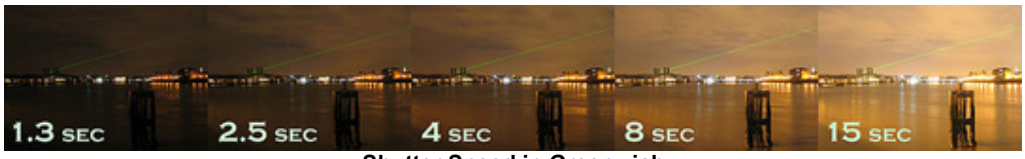
You may also be familiar with another aspect of lenses: magnification. The magnification of a lens is also called the **focal length**. The focal length of a lens is the distance between the lens and the film, when the lens is focused at an infinite distance. So the focal length is really the distance to a far image. In theory, a 300mm lens would be 300 millimeters away from the film, if you decided to measure it. In practice, however, the lens is smaller because the multiple lenses allow the lens to act as if it were longer than it is. You may be more familiar with the term telephoto. **Telephoto lenses** are those that magnify an image or make an object seem closer than it really is. In contrast, a **wide-angle lens** shrinks the object in front of it, by way of a shorter focal length.

03: Introduction to Photography

Creating the Image

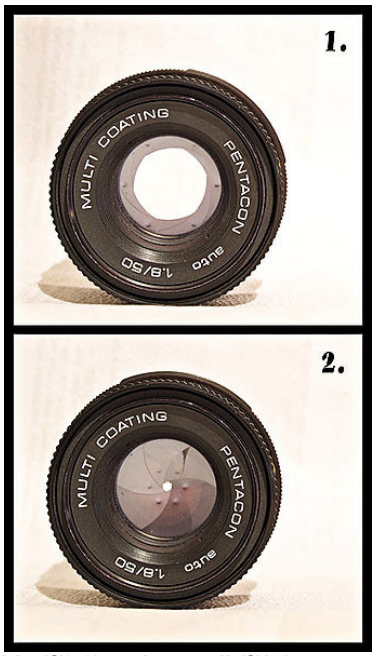
A camera uses either a light-sensitive device (film) or a digital sensor to capture an image. In traditional film-based cameras, the film becomes a chemical record of the pattern of light on an object. Once this pattern of light has been recorded, we then need to process the film to see the image. The film is developed by exposing it to other chemicals. Color film normally has three light-sensitive layers that react to the colors blue, green, and red. In developing, the chemicals dye the film, and when the layers are combined, a full color image is the result.

For the camera to record the pattern of light on an object or scene, the camera has to have several different features that help control how much light enters the camera and when light enters the camera. Have you ever tried to create an image with film alone? If you laid film out in the sun or pointed the film at an object, you wouldn't end up with a usable photograph because too much light would reach the film. Instead, the camera has to limit the amount of light that reaches the film, although this too can have its problems from time to time. Maybe you've already experienced problem photographs that result when too much or too little light enters the camera. If too much light enters the camera, the photograph will appear washed out or will be a big spot of light. If too little light enters the camera, the photograph will be dark or even completely black.



Shutter Speed in Greenwich

To ensure that the right amount of light enters the camera for a particular photograph, cameras use several different mechanisms to control when and how much light enters the light-tight camera body to record the image on the film. A **shutter** opens and closes between the film and the lens, letting light in only when you have told the camera to do so. The **shutter speed** is the length of time that light is let into the camera in order to expose the film. Letting light in is only one part of the equation, though, as we also need to control how much light enters the camera. Aperture refers to the lens opening that allows us to control the amount of light that reaches the film or digital sensor. The aperture is controlled by the **iris diaphragm**, a set of overlapping metal plates that expand out to allow more light or fold in on each other to reduce the amount of light.



Diaphragm giving a big (f/2.8) and a small (f/16) aperture in the camera lens

The film itself also plays a role in how much light is needed for the ideal photograph. Traditional film has light-sensitive grains in it. The larger the grain of the film, the more quickly it will absorb the light. You can tell the size of the grain in film by looking at the film's **speed**. You may have seen canisters of film labeled as 100 ISO film or 400 ISO film. These numbers refer to the speed or size of the grain. 100 ISO film is typically used for outdoor photography where the sun is bright; 1600 ISO film, in contrast, is best suited for photography where the light is very dim. In digital cameras, you will find reference to **sensitivity** settings, which are the equivalent of film speed.
To create an optimal image, the photographer and camera have to balance the film speed, shutter speed, and aperture. This can take some practice, but it can produce images that show better lighting than simply pointing the camera and shooting.

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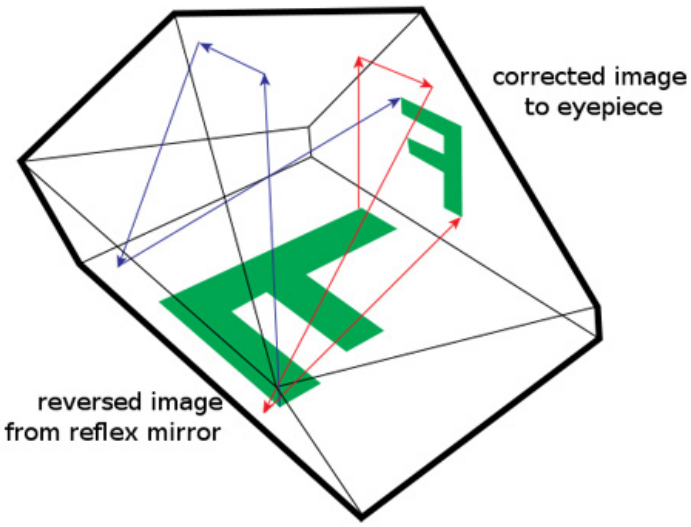
Taking the Photograph

What happens when you push the button on the camera to take a picture? Let's pretend that you've seen a bear and you want to take a picture of the bear. How does the bear go from an object in your viewfinder to an image on your film?

When you point the camera at the bear, light that bounces off the bear enters the camera. The light passes through the lens and onto a mirror, which is located between the lens and the shutter. This mirror

reflects the light upward to a **pentaprism**, which is a five-sided mirror. The light from the image then bounces off this mirror and into the viewfinder, where you see the image. The job of the pentaprism is to flip the light from the image so that the image appears right side up rather than shows the inverted image that first occurs. Imagine what it would be like to have to take a picture if you were looking at the object or scene upside down!



SLR Pentaprism

You line up your photograph of the bear in just the way you want it and push the button to take the picture. When you push the button, the mirror that just gave you the image on the viewfinder moves out of the way. This allows the light bouncing off the bear to reach the film behind the open shutter. The mirror and the shutter operation are connected, so that the mirror stays out of the way for as long as the shutter is open. When the shutter closes, the mirror flips back into place. This is why your image in the viewfinder goes dark for a period of time before it reappears. As long as the viewfinder is black, you know that the shutter is open inside the camera, allowing the light to hit the film. With the shutter open, the light hits the light-sensitive

film, where the image of the bear is recorded. Now you've taken the photograph of the bear and are ready to take another.

05: Introduction to Photography

Types of Cameras

The process that we discussed above comes from an SLR camera. An **SLR, or single lens reflex, camera** has a semiautomatic movement of the mirror, which produces an exact image in the viewfinder. SLR cameras exist in both digital and traditional film forms. Since the 1970s, most professionals use SLR cameras. We often refer to SLR cameras when we talk of cameras where we can exchange one lens for another, but not all SLR cameras have the ability to change lenses. A **dSLR** is a digital version of the traditional SLR camera. **Point and shoot cameras** are those that use an optical viewfinder, rather than having the semiautomatic mirror. This means that the image the photographer sees through the viewfinder is not the exact same image that will be recorded. Rather than having a mirror within the camera that reflects the image, point and shoot cameras have a viewfinder that goes directly through the camera, giving the photographer a slightly different angle on the scene than what the shutter will open to capture. There are still many point and shoot cameras on the market today, most often used by casual photographers. While these cameras can still take good photographs, it is important to recognize how the slightly different view from the viewfinder might affect the resulting photographs. Point and shoot

cameras get their name from the fact that these cameras do almost everything for the photographer, who only has to "point and shoot."

Canon SD200 point and shoot camera

Large and medium format cameras use a negative film size that is greater than the usual 35mm. These types of cameras are typically used by professionals or by enthusiastic amateurs who enjoy using different types of cameras. Hasselblad is a Swedish manufacturer of medium format cameras—these cameras are some of the more widely used in this category.

One of the earliest cameras made was a **pinhole camera**. Pinhole cameras do not use a lens and they have a very small aperture. Essentially, pinhole cameras are light-tight boxes that have a small hole, through which light passes and creates an inverted image on the opposite side of the box as the hole. These cameras may have been used as long ago as the fourth century BC.

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Digital Cameras

You may be most familiar with digital cameras. Over the last few decades, digital cameras have become the most popular choice for many people. **Digital cameras** use an electronic image sensor to digitally record an image. Some digital cameras can also be used to create video in addition to still photographs. Today, the technology for digital cameras is being used not only in traditional-looking cameras but also in cellular phones and other electronic devices. Rather than storing the image taken on traditional film, digital cameras record the image to a memory device, or card. In other ways, the digital camera works in much the same way as a traditional film camera, except that it uses electronics rather than chemicals to record the image.

Nikon D5000

Digital cameras do have several differences from traditional film cameras, particularly in the recorded image. Digital cameras create photographs that are made up of pixels. A **pixel** is the smallest unit of the picture that can be controlled. A single pixel would give us very little information about what a photograph is about, but if we combine the pixels, we see the image that was photographed. Digital cameras in use today create pictures made up of millions of pixels. In fact, we often abbreviate the number of pixels as MP (or million pixels). In other words, a 2MP camera takes photographs that contain two million pixels, and a 5MP camera takes photographs that have five million pixels in each picture. We often refer to digital images by the arrangement of pixels as well. For example, a 2048x1536 display is the arrangement for a 3.1MP image. This image will have 2048 pixels from side to side on the image and 1536 pixels from top to bottom. Image format is another part of digital cameras that is different from traditional film. When a digital camera takes a picture, it saves the picture in a particular file format. These image file formats organize and store the information from the photograph so that you can retrieve the image. Generally, each pixel in an image creates three bytes of data. So, with a 3MP camera, the image would be three million pixels and nine million bytes (9MB) of data. Let's look at some common ways of storing this information:

• **JPEG:** JPEG (pronounced "jay-peg"), which stands for "Joint Photo Experts Group," is the default file format in many digital cameras on the market today. This is because the file format compresses the image to decrease the size of the image. Typically, this allows you to put more images on your photo memory card. However, JPEG has an important drawback to this space-saving advantage—it is compressed

in a lossy manner, which means that some of the data is lost. The more the image is compressed (the smaller the size of the file), the more information from the image is lost. With a high compression, the image may begin to look blurry and lose some of the sharp detail that was present in the full-sized version. Some cameras allow you to choose how much compression will occur to the JPEG file.

• **TIFF:** The Tagged Image File Format, or TIFF, is a lossless file format. A lossless file format keeps all of the information in the picture, but it means a much larger file size than a compressed file. TIFF files can be compressed, but the size difference really isn't a great one.

• **RAW** or **NEF:** RAW, or NEF, is a file format that is offered on some cameras, particularly higher-end cameras. This file saves the actual data, which are not processed by the camera. RAW files can be compressed without losing information, and their compressed size tends to be between a TIFF and a JPEG file. Many photo editing software programs can convert RAW files to TIFF or JPEG files. The advantage of RAW files is that because they retain all of the information, some aspects such as white balance can be more easily changed in editing than with other files.

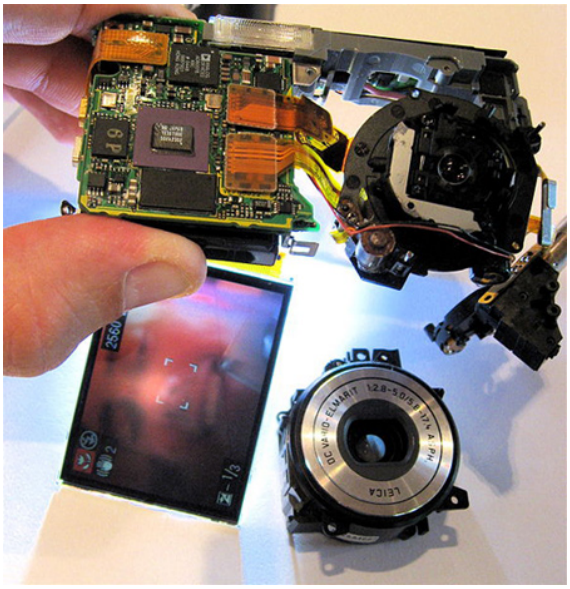
Understanding these different file formats can help you determine which option you should choose for different applications. For example, if you are just taking a snapshot and don't plan to enlarge the photo beyond a standard snapshot size, a JPEG file would probably be fine. However, if you are shooting professional images that might be blown

up to larger sizes, you would probably want to choose a lossless file format like TIFF or RAW.

07: Introduction to Photography

Camera Features and Controls

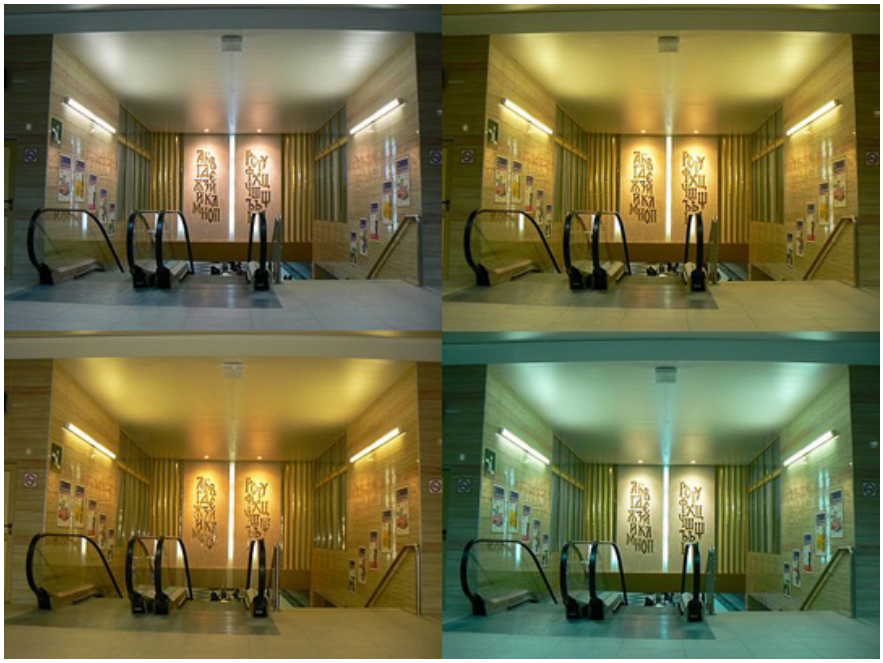
To get the most out of your camera, it is important to understand the features and controls that your particular camera has. We'll cover some of the more common features and controls in this section, but you may find that your camera has more than what we discuss, or it may not have all of these features. For example, some point and shoot cameras will not have all of the features we cover. Our discussion will focus primarily on digital cameras, although some of the controls can also be found on traditional film cameras.



A partly disassembled Panasonic Lumix digital camera, with the front lens removed, but still functioning (see display).

Most digital cameras on the market today (as well as most point and shoot cameras) have a fixed zoom lens that cannot be replaced. On these digital cameras, you may find reference to optical and digital zoom. **Optical zoom**works like a telephoto lens; the image quality remains the same as the image is magnified. **Digital zoom** crops the image and enlarges the cropped image to fill the frame of the camera. This means that the digital zoom generally results in a loss of quality in the image.

Another feature that appears on some cameras is the white balance. **White balance** is simply an adjustment that can be made to the color so that whites will appear white in the photograph, and not yellow or blue. The light source for the photograph is often a cue about the white balance; some cameras have settings for shade, sunlight, fluorescent lighting, and so on.



Collage of 4 images of Metrostation, Sofia University, Sofia. The image illustrates the differences in the white balance setting. Up left: auto WB, up right: sun, down left: flash, down right: wolfram bulb

Some cameras also have image stabilization or vibration reduction. These features essentially adjust for any movements that the camera may make during exposure to reduce blurry images. This adjustment might include moving a lens group or the sensor in the camera if movement is detected. Although it is not foolproof, this feature can help reduce some camera movement issues.

Many digital cameras have different modes, which basically give the camera a hint about the type of picture you want to take so that it can adjust accordingly. In older cameras, manual mode, or one in which the photographer has to make all adjustments, was the only choice. Some cameras still have this option (although others are included as well). Automatic modes control the features of the camera for the photographer. For example, a camera in automatic mode will determine whether the flash is needed or if it will need to set the aperture.

Other common camera modes may be found on your camera, such as macro, action, night, portrait, and so on. These modes adjust the camera even more for the type of picture that you want to take. For example, using the portrait mode tends to result in a less-focused background, putting the emphasis on the person whose portrait you are taking. An action or sports mode will use the highest shutter speed possible to best capture movement.

Did You Know?

You can create your own simple pinhole camera using items commonly found in homes. To create a pinhole camera similar to those created

before the age of modern photography, you'll need a round oatmeal box, wax paper, and heavy tape (preferably black tape).

To start, you'll want to cut the round oatmeal box (or other cardboard type tube or round container) in half, leaving the bottom of the container in place, so that you have two short round pieces or tubes. Place a piece of wax paper over one of the open ends of the round container and tape it in place. Once you have this done, put the oatmeal tube back together again so that the wax paper is in the middle of the tube. Wrap tape around the middle of the tube where the two pieces join together, making the tube as lightproof as possible. Finally, create a small pinhole in the bottom of the container. Now you're ready to try out your pinhole camera.

Take your pinhole camera outside on a sunny day. Hold your eye to the open end and let some light come through the pinhole. You should see the small inverted image of what your pinhole camera is pointing at on the wax paper inside. You've created a pinhole camera that is fairly similar to those that were created hundreds of years ago! You can also create simple cameras that will actually record photographs, although the process is slightly different and a bit more complicated than creating the simplest pinhole camera.

In this unit, we learned more about the basic operation of cameras. We discussed how a camera is able to capture a photograph on film or through a digital sensor. In addition, we learned about how aperture and shutter speed affect our ability to take and record a photograph. We discussed some of the different types of cameras and examined

some of the different features and controls that are found on many of today's cameras.

UNIT ONE: Photography Text Questions

Answer the questions in the Google Form:

Introduction to Photography: Cameras, Aperture, and Shutter Speed: Unit 1 Text Questions

The answers to the Review & Critical Thinking questions are worth **10 points**.

Unit One: Text Questions – *Answer these questions in the Introduction to Photography: Cameras, Aperture, and Shutter Speed: Unit 1 Text Questions Google Form.*

Review & Critical Thinking Questions

1. What is a camera?

2. What is a convex lens?

3. What three components make up a film camera? Define each part.

4. What is a pentaprism? What job does it do in the camera?

5. What are point and shoot cameras? How do they differ from SLR cameras?

6. What is JPEG? What considerations have to be kept in mind with JPEG?

7. What is the difference between optical and digital zoom?

8. What are the steps you can take to create a pinhole camera? Have you tried to make one?

9. What are some of the differences between film and digital cameras? Which one do you prefer?

10. What are some advantages of being able to see an image right after you've taken it (such as with an instant camera or being able to review the image on a digital camera)?

UNIT ONE: Photography Lab Questions

The answers to the lab questions are worth **10 points**.

Unit One: Lab Questions: Answer these questions in the *Introduction to Photography: Cameras, Aperture, and Shutter Speed: Unit 1 Lab Questions* Google Form

The Beautiful Nano Details of Our World ***<- your first lab link: https://www.ted.com/talks/gary_greenberg_the_beautiful_nano_details_of_our_world***

1. How are the photographs taken with a 3D microscope different than those taken with a regular camera? How are they similar?

2. How can photography allow us to view the world around us in different ways?

3. How did the grains of sand from the moon differ from the grains of sand from the earth?

4. Of the micro photographs in the video, which one did you like the best? Why?

5. If you were given a 3D microscope to use for photography, which object(s) would you most want to photograph? Why?

David Griffin on How Photography Connects Us ***<- your second lab link: https://www.ted.com/talks/david_griffin_on_how_photography_connects?language=en***

1. What is your favorite photograph in the presentation? Why?

2. What is special about photographs?

3. What does someone need to be a great photojournalist?

4. The title of the video is "How photography connects us." What do you think is meant by this? How does photography connect us?

5. If you could photograph any event, place, animal, etc. in order to tell a story, what would you choose to photograph? Why?

Unit 3: 01: Aperture & Shutter Speed

"Light makes photography. Embrace light. Admire it. Love it. But above all, know light. Know it for all you are worth, and you will know the key to photography." -George Eastman

The one necessary element to make a photograph is light. Light is what exposes the film or creates an image on a digital sensor. Without light there is no photograph. At the same time, too much light can ruin a photograph, leaving the photo overexposed or washed out. You've probably seen the result of this at some point: a photograph that is white instead of showing the image.

Ginkgo Leaves

In this unit, we will discuss some of the different ways that we can harness light and manipulate it to create perfectly exposed photographs. We will examine how aperture and shutter speed can be used to control the amount of light that enters the camera and the amount of time that the light enters the camera. Learning to adjust and control these two aspects can help you create great photographs in a wide variety of light settings.

02: Aperture & Shutter Speed

Aperture

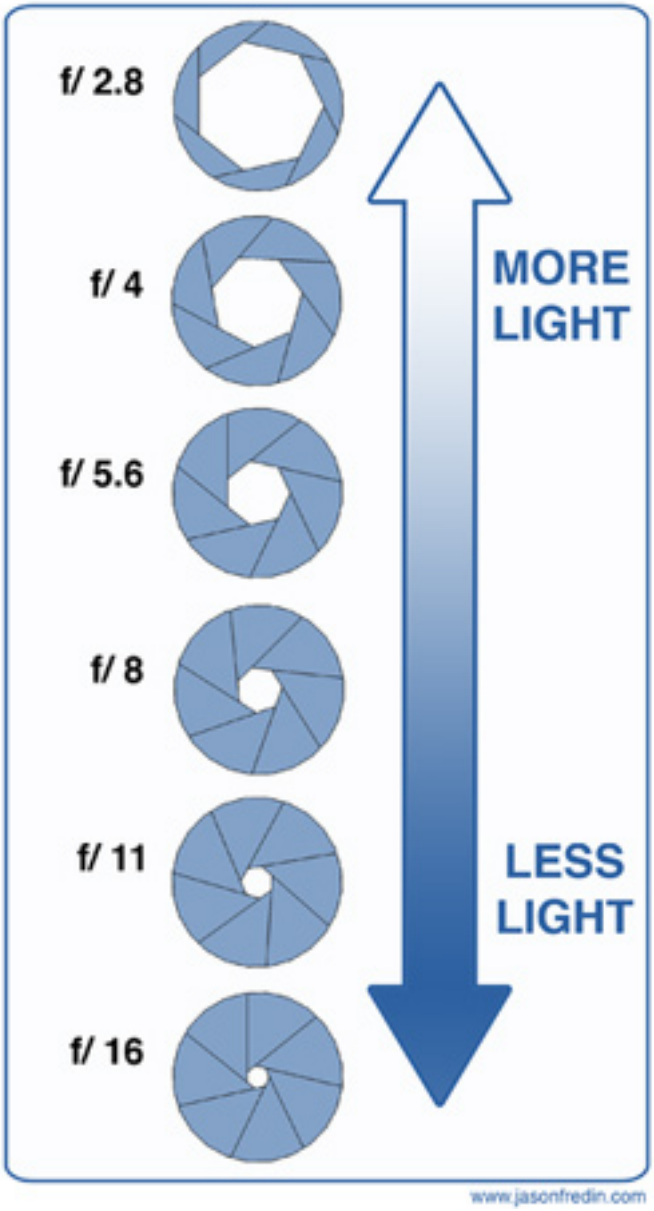
In Unit 1, we learned that **aperture** refers to the lens opening that allows us to control the amount of light that reaches the film or digital sensor. The wider the opening is, the more light enters the camera. The smaller the opening is, the less light enters the camera. Understanding the aperture settings and how they impact the size of this opening can mean the difference between a photograph that is over- or underexposed and one that has the perfect lighting.

Lens Aperture

Aperture is measured in **f-stops**. The f-stops are typically expressed as f/number, such as f/2.8. Sometimes they are also expressed as F2.8. Some common f-stop numbers are:

- **f/1.8**
- **f/2.8**
- **f/4**
- **f/5.6**
- **f/8**
- **f/11**
- **f/16**

The smaller the f-stop, or f-value, the larger the opening is. In other words, f/1.8 lets in more light to the camera than f/16. This may seem a bit confusing at first, since we would expect a larger number to correspond with a larger opening. However, you can think of the aperture numbers like a funnel. At the bottom (the smaller numbers), the funnel is wider, letting in more light. At the top of the funnel (the larger numbers), the funnel is smaller, letting in less light. As we move up and down the f-stops, the aperture opening opens or closes. For each higher f-stop (say from f/2.8 to f/4), the opening becomes half as large. For each lower f-stop (say from f/2.8 to f/1.8), the opening doubles.



Aperture Measurements

Changing the aperture affects a photograph in a number ways. Obviously, the amount of light that enters the camera changes. Another impact involves depth of field. Essentially, **depth of field** refers to the amount of your picture that will be in focus. A large depth of field means that most of your picture will be in focus, including both the objects close to your camera and those farther away

from your camera. A shallow (or small) depth of field means that only a portion of the photograph will be in focus. The rest of the photograph will appear blurry or fuzzy. So, how does aperture affect depth of field? A smaller f-stop (larger aperture) will produce a shallower depth of field. A larger f-stop (smaller aperture) will produce a larger depth of field.

03: Aperture & Shutter Speed

Shutter Speed

Like the aperture settings, shutter speed also influences the light entering the camera. While aperture determines how much light enters, shutter speed determines for how long light will enter the camera. In other words, **shutter speed** is the amount of time that the shutter remains open or the amount of time that the digital sensor "sees" the image. In a traditional film camera, the shutter speed indicates the amount of time that the image was exposed to the film.

Shutter Dial

Shutter speed is usually measured in seconds and fractions of seconds. For example, you may see shutter speeds of 1/1000 and 1/30 (with the larger denominator indicating a faster shutter speed). A 1/1000 shutter speed means that the shutter stays open for 1/1000 of a second. A shutter speed of one means that the shutter stays open for one second. Typically, most photographs will be made using a shutter speed of 1/60 or faster. This freezes the action, allowing for a clear picture regardless of the motion. Shutter speeds slower than 1/60 can be blurry if there is any camera shake or movement while the picture is being taken. With slower shutter speeds, you'll need to use a tripod or other stable location to reduce camera shake and the problems that come with it. Slower or longer shutter speeds (such as one second, ten seconds, etc.) are generally used in low light settings, like those taken at dusk or at night.

Shutter speeds approximately double with each setting. For example, your camera may have shutter speeds of 1/8, 1/15, 1/30, 1/60, 1/120. Each increasing shutter speed also doubles the amount of light that enters the camera. Changing the shutter speed occurs in several different ways, depending on the type of camera. Traditional film cameras often have a dial on the outside of the camera (often on top) with the different shutter speeds written on it. Many digital cameras that allow for manual shutter speed changes display the shutter speed options within the LCD display. Point and shoot cameras may not have a manual option to change the shutter speed. In some cameras, you'll need to understand the different modes available to choose the ones that will change the shutter speed (we'll discuss the common modes later in the unit).

Action or motion photographs involve shutter speed. In other words, we can adjust the shutter speed to help us catch motion in different ways. You've probably seen a photograph where a person or object is blurry because it moved when you took the picture. Adjusting the shutter speed to a faster speed can help capture a moving object without blur. This is useful for taking pictures of people participating in sports, sliding down a slide, or any other motions that we might want to capture a photograph of.

At the same time, there are circumstances in which we'd like to have some blur in the photograph to convey motion within the photograph. For example, you might want to blur the lights of cars moving on a freeway or blur the motion of a train behind the people you are taking a photograph of. This motion blur can create a unique effect within the photograph.

Sparklers at a slow shutter speed

When taking a photograph, it is important to note whether anything is moving in the photograph. If there is, you'll need to decide whether you want to capture the movement clearly or whether you'd like to allow some blurring to occur. Your decision will affect the shutter speed that you will use. To clearly capture the motion, you'd choose a faster shutter speed; to allow some blur in the photo, you'd choose a slower shutter speed.

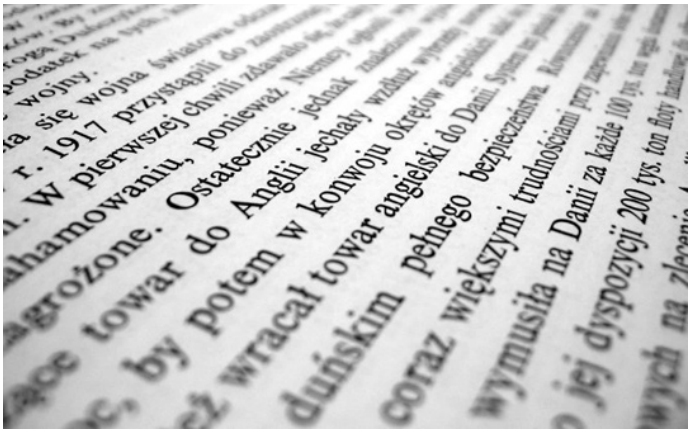
04: Aperture & Shutter Speed

Bringing Shutter Speed and Aperture Together

Since both aperture and shutter speed influence the light entering the camera, it is important to consider their effect on each other when taking photographs. When you adjust one of these aspects, you will usually need to also adjust the other. This will even out the exposure so that you don't end up with photographs that are underexposed or overexposed.

The exact combination of the aperture and shutter speed will depend on the lighting conditions in which you are taking the picture. This is one reason practicing with different combinations can help you learn how to best set the shutter speed and aperture together. Let's take a look at one example and say that we are taking an ordinary photograph in normal lighting conditions.

If you set the shutter speed to 1/30, would you set the aperture to a small f-stop (F4.5) or a large f-stop (F22)? Most likely, you'd want an aperture setting of F22. This is because a slow shutter speed will let in more light, while the larger f-stop will reduce the amount of light. Remember that the larger the f-stop, the smaller the opening is in the aperture. What if you set the shutter speed to 1/1000? In this case, you'd want a smaller aperture (such as F4.5) to let in more light, since the faster shutter speed would be letting in less light.



Depth of field

There are several different ways to think about the relationship between shutter speed and aperture that may help you learn how to best use these two aspects in combination with each other. One way is to think about a water faucet. Imagine for a moment that the water faucet is the aperture and a timer on the faucet is the shutter speed. The water coming from the faucet is light, and a full bucket is the proper exposure. If you turn the faucet on all of the way (a large aperture), you need to use a short timer (fast shutter speed) because the bucket will fill up quickly. If you turn on the faucet just a little bit (a small aperture), you'll need to use a long timer (a slow shutter speed). Either arrangement will let the water (light) fill up the bucket

to just the right amount. Adjusting aperture and shutter speed is just like adjusting the water out of the faucet.

Another way to look at this relationship is to think of shutter speed and aperture as a seesaw or teeter-totter. As one side of the seesaw goes up, the other side goes down. In terms of aperture and shutter speed, think of them as the position of the seesaw.

f/8 1/250
f/5.61/125
f/4 1/60
f/2.8 1/30

If one side of the seesaw is at f/4 (aperture), the other side will be at 1/125 (shutter speed). If the aperture becomes larger (f/2.8), the shutter speed has to get faster (1/250) for the perfect exposure. As the changes happen, the exposure will remain optimal as long as the movements mirror each other (one goes up, one goes down). However, the depth of field will change, as will the ability to capture movement with or without blurring.

Many digital cameras today measure the light and will adjust the aperture and shutter speed accordingly. If this is the case, why bother learning how to adjust the aperture and shutter speed? One reason is that learning to adjust these aspects allows you to adjust the depth of field and your ability to catch motion, with or without blur. A fully

automatic setting on your camera generally will not allow you to capture these changes.

Another reason knowing how to adjust these settings is important is that your light meter may not always get it right. Sometimes it will be fooled by something in the photograph, and you will end up with a photo that is over- or underexposed if you rely on the automatic setting. For example, imagine that you are taking a picture of a mountain and the sun is quite bright. You may find that the sky in your photograph will appear white, since your camera will adjust the light in order to expose the mountain. Similarly, if you are taking a picture with snow in it, parts of your photo may appear underexposed because the light off the snow is so bright that the camera adjusts for that.

Bullfight at San Marcos Fair, Aguascalientes, Mexico

While your camera can do a great job of figuring out the lighting conditions in many situations, there will be situations in which your adjustments will create a better photograph than the camera's choice

of aperture and shutter speed settings. The reality is that your own eyes are often a better judge of light and shadow than the camera's light sensor.

05: Aperture & Shutter Speed

Understanding the Modes

Some cameras give you the option to choose from several different modes relating to aperture and shutter speed. While each of the modes can produce good pictures, it can be helpful to understand what each mode does. There are particular instances when a specific mode will give you a better photograph for the type of scene or image you are trying to capture.

MANUAL MODE

Manual mode is available on some cameras, including many digital and traditional SLR cameras. **Manual mode** is one in which the photographer makes all of the decisions about the aperture, shutter speed, white balance, ISO, and so on. This gives the photographer the greatest amount of control over the settings and the photograph that results. However, using this mode also requires the most amount of knowledge about what the different settings mean and how to combine various settings for the best photograph.

AUTOMATIC MODE

In contrast to the fully manual mode, **automatic mode** means that your camera selects the aperture, shutter speed, white balance, and so on. Some cameras give you a bit of decision-making power in that you can override the flash or make the flash into red-eye reduction. While automatic mode will often give you a good photograph, it is worthwhile to keep in mind that the camera doesn't know the type of photograph that you are taking. It treats all photographs the same, making adjustments for the amount of light available. This means that if you want the background slightly blurred for a portrait or to be able to catch fast action, the automatic mode may not give you the results that you want.

Notre Dame de Montreal Basilica Rectilinear

PORTRAIT MODE

In the **portrait mode**, your camera will automatically use a larger aperture. This will make the background slightly out of focus, putting the emphasis on the person that you are photographing. You may want to choose this mode when you are photographing a single person (or object) and can get close to the person. In particular, this mode works well if you photograph a person's head and shoulders.

SPORTS MODE

With the **sports mode**, your camera will automatically choose a faster shutter speed. Sports mode is specifically designed to capture moving objects and keep them in focus. When you photograph in this mode, you can also pan (or move the camera) in the same direction as the movement. This can help you get the shot that you want. Another tactic is to pre-focus your camera on the area where the action will be taking place as the movement continues. This, however, takes practice as you'll need to take the picture at just the right moment.

LANDSCAPE MODE

Another common mode on many cameras is the **landscape mode**. This mode uses a small aperture to keep the photograph as in focus as possible. This means that even items farther away will often be in focus. The landscape mode might be the one you would choose at a scenic overlook when you want to get an entire scene within the photograph. A tripod may be useful in this mode, as the smaller aperture will often result in a slower shutter speed.

Macro of a mummified Seahorse

MACRO MODE

When you want to take a close-up photograph of something like a flower or other object, the macro mode might be the best choice. A **macro mode** allows you to get closer to your subject. Your distance to the object will depend on your particular camera's abilities; some cameras will allow you to get closer to the subject than others. As the depth of field is very shallow in this mode, you'll find that focusing at close distances can be challenging. For a macro mode photograph, you will typically want to use a tripod or other stable base, as even slight movements can throw off the focus of the photograph.

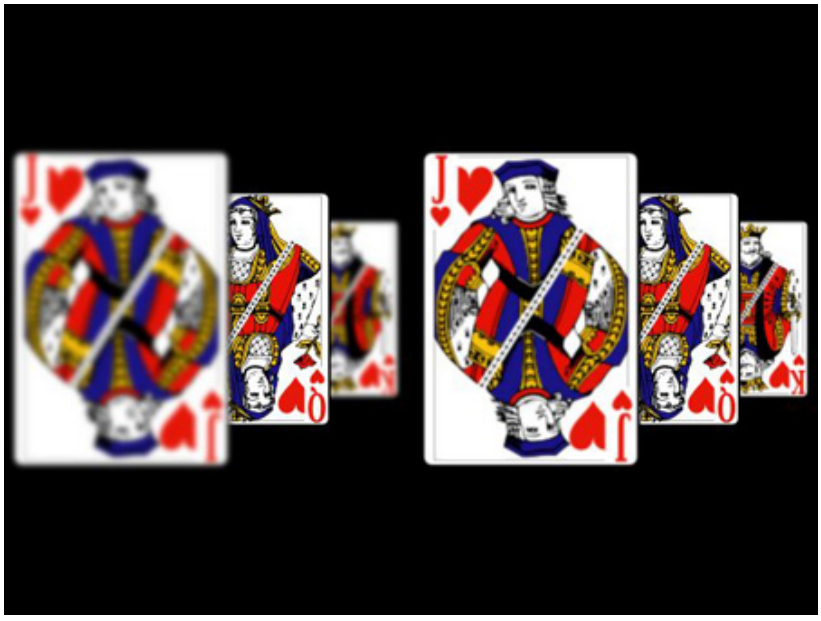
NIGHT MODE

Taking photographs at night can be tricky. **Night mode** makes taking pictures in low light situations a bit easier. This mode uses a longer shutter speed to capture the image and uses a flash to light up items

closer to the camera. If you want a clear picture while using the night mode, you will want to use a tripod or another stable base for the camera. The long shutter speed increases the risk of blurry photographs if there is any camera shake during the exposure. However, if you want to take a blurred photo of lights in a dark setting, the camera shake will often result in some interesting patterns. Give both a try and see which one you like best!

SHUTTER PRIORITY MODE

The **shutter priority mode** is often represented by an "S" or "TV" on the camera settings. This mode allows the photographer to set the shutter speed, while the camera will adjust the other aspects (like aperture, white balance, and so on) in relation to the shutter speed setting. This setting can let you experiment with photographing motion or with creating a deliberate blur with lights, water, or other moving objects.



Different depth of field settings

APERTURE PRIORITY MODE

Aperture priority mode is another semiautomatic mode. This time, instead of the photographer setting the shutter speed, the photographer selects the particular aperture for the photograph. The camera will then make the necessary adjustments to the shutter speed, white balance, and so on. This mode might be a good choice if you want to control the depth of field in a photograph.

OTHER MODES

Depending on your camera, you may have other modes available as well. For example, some cameras have a movie mode that allows individuals to take video with their digital camera. Snow mode may help adjust the lighting and color of snowy scenes. Some cameras also use modes specific for underwater photographs and for taking pictures of fireworks, beach scenes, and indoor shots.

06: Aperture & Shutter Speed

Night Photography

One place where aperture and shutter speed play an important role is in night photography. Once the day starts getting dark, many photographers put away their cameras. However, if you've ever seen a great dusk or nighttime photograph, you know that the time after the sun sets can produce some dramatic and beautiful pictures.

Dusk is an ideal time to shoot “night” shots, since there is generally just a bit of light left in the sky and city/artificial lights have often come on. This will create a bit more color to the photograph, as opposed to a strict nighttime shot. The contrasts will also be a little bit less severe.

Slow shutter speed

For the best night photographs, you’ll need to have a camera with a shutter speed of about three to thirty seconds. This will compensate for the lower light levels. Some cameras will keep the shutter open for longer periods, if the shutter release button is continually pressed. One thing to keep in mind when trying to take a night photograph is that aperture priority and shutter priority modes may not contain the full range of aperture and shutter speed settings that your camera has. If your results are not quite what you hoped for, you may want to try the full manual mode to see if you can push the settings just that extra bit.

Two aspects will increase your success with nighttime photography. The first is a tripod. With night photographs, it is very important to eliminate all possible camera shake. This will help prevent blurry images. The second aspect is either a remote controller for the camera or a self-timer on the camera. Either of these aspects will reduce the possible camera shake that can happen when the shutter release button is pressed.

The advantage of a digital camera in taking nighttime photographs is that you can see the results right away. This allows you to adjust the aperture and shutter speed to just the right settings for the available light. You will want to start with a particular set of settings for shutter speed and aperture. Remember to adjust both of them as you learned earlier in the unit. For example, if you use a shutter speed of three seconds, you may want to try an aperture of f/4. If this doesn't create the right exposure (it is under- or overexposed) try doubling or halving the f-stop to the next setting, depending on the lighting, to see whether this will give you a better exposure. It may be helpful for you to write down the particular settings that you choose for each photograph so that you can adjust the settings if you need to.

In some cases, the night mode on your camera may produce a good photograph. This mode will make the decisions for you in terms of aperture and shutter speed. One thing to keep in mind when using the night mode is that the flash will often be set off to light up images close to the camera. This can be helpful in some circumstances, such as if you were taking a picture of a person at night. However, a flash can also ruin a different photograph. Some cameras will allow you to turn off the flash, and others will allow you to adjust the flash so that

it is less strong in the photograph. Generally, a flash is really only useful if the subject of the photograph is within a few feet of the camera. After that, the flash loses its ability to really light the scene or the object.

One aspect to keep in mind when taking nighttime photographs is that, depending on the time of night, most of the light will probably be coming from artificial sources. This artificial lighting can affect the color of the scene. To compensate for this, you may need to adjust the white balance on your camera. Different white balance settings can create very different looks, so you may want to try a few of them out to see how the scene will change.

In this unit, we discussed the role of aperture and shutter speed in creating the right exposure. Learning to control these two aspects in a camera can give you better images in a variety of different settings. We examined how aperture and shutter speed affect each other and how the various camera modes adjust these aspects for different situations. Finally, we discussed how aperture and shutter settings can be adjusted to take photographs at night.

UNIT THREE: Photography Text Questions

Please complete the following questions. It is important that you use full sentences and present the questions and answers when you submit your work. The answers to the Review & Critical Thinking questions are worth

10 points.

Unit Three: Text Questions

Review & Critical Thinking Questions

1. What is aperture priority mode? When might you use this mode on a camera?

2. What is depth of field? How can you adjust the depth of field in a photograph?

3. What is the relationship between aperture and shutter speed? How can you describe this relationship?

4. What is the landscape mode? How does this mode adjust the aperture? What is the result of this adjustment?

5. How is shutter speed generally measured? What do the measurements mean?

6. How is aperture measured? What do the measurements mean?

7. Why is learning to control aperture and shutter speed important?

8. Which camera mode do you think you are most likely to use? Why?

9. Have you tried to take some action photographs of people, animals, or other objects? How did the photographs turn out? What are some of the challenges with taking action photographs?

10. What are some of the difficulties of taking night photographs? How can you reduce these challenges?

UNIT THREE: Photography Lab Questions

At this point, you are asked to complete the web journey questions.

Each link has a set of questions beneath it.

The answers to the lab questions are worth **10 points**.

Unit Three: Lab Questions

What is Exposure? ***<- your first lab link: https://vimeo.com/91467849***

1. What is exposure?

2. What can affect illuminance?

3. How do camera settings influence exposure?

The Aperture ***<- your second lab link: https://vimeo.com/91569600***

1. Describe how the aperture size relates to the size of the lens opening.

2. How does the amount of light allowed through the lens influence a photograph?

3. Describe a situation that you might want to adjust the f-stop for your photograph? What benefit would you gain?

Shutter Speed ***<- your third lab link: https://vimeo.com/95462808***

1. What is the shutter?

2. How do the shutter speed numbers relate to the time the shutter is open?

3. If you were to set the shutter speed for a long opening, what effects might you notice in your photographs? Why?

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