Aperture

Part 1 of the Photographic Golden Triangle

Exposure

- **Exposure** in photography refers to not only the amount of light that you allow into your camera, but also how it gets there.
- If you're shooting in manual mode, you control how light enters your camera.
- There are three different settings that allow you to adjust that light.
  - We refer to those three things together as the "photographic golden triangle."

Golden Triangle

- The photographic golden triangle is composed of three different camera settings you can change on your camera that adjust how your camera will compose an image.
- The first portion of the triangle is called **aperture**.
  - The other two are *shutter speed* and *ISO*.

What is Aperture?

- Aperture is the actual, physical opening on the part of your camera's lens that allows light inside your camera's body.
- You can adjust the size of the aperture's opening to do many different things.

What does aperture do?

- Aperture is what helps create the blurry backgroun d that makes the focal point of this photo stand out.

Aperture and the Human Eyeball

- People often compare a camera's aperture ring to a human eyeball.
- Your iris is the portion of your eyeball that changes size depending on the amount of light in the room and let's in light through the pupil (in this case, the hole in the aperture ring)
  - More or less light will get in to your eye depending on the size of your pupils.

More on Aperture and Eyes

- In bright sun, your pupils are very tiny (a small aperture) and at night your pupils are dilated (large aperture) to let in the appropriate amount of light.
- If you dilated your pupils (aperture opening) in bright sun, way too much light would be hitting your retina (camera sensor) and you would get a headache.
- Likewise, if your pupils were not opened very wide at night (they are normally almost fully dilated if its dark), not enough light would be hitting your retina and you would be unable to see.

How It Works

- When you hit the shutter release button of your camera, a hole opens up in the lens that allows light to hit your camera's sensor.
- The aperture that you set regulates the size of the hole.
  - The larger the hole in your aperture ring, the more light that gets in while your shutter is open.
  - The smaller the hole, the less the amount of light that gets in.

Aperture and Light

- The primary thing that your aperture adjusts is the amount of light let into your camera.
- The larger the F-stop number, the smaller the aperture opening and vice versa.
- When you adjust your aperture value from f/5.6 to f/8, the opening gets a little bit smaller, therefore letting in a little less light.
- And if you adjust your aperture opening from f/2.8 to f/2.0, you now have a wider aperture opening and are letting in more light.

What Aperture Looks Like

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Measuring Aperture

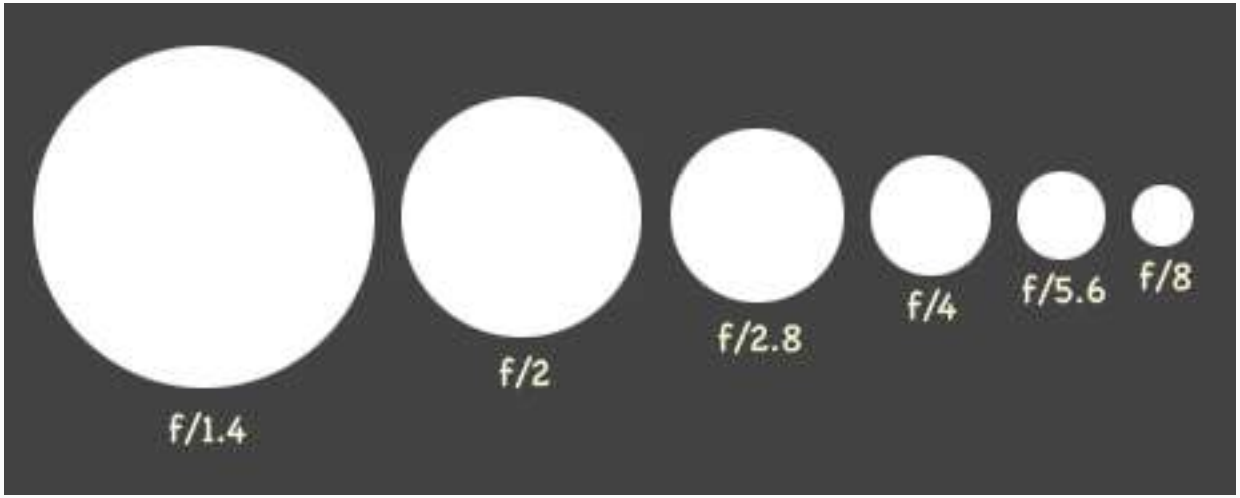
- Aperture values are measured in "F-Stops."
- What does the "F" in F-stop stand for?
  - It stands for “foot candle,” which is an antiquated type of light measurement.

Measuring F-Stops

- The following are sample F-stops used when measure aperture:
  - f/1.0, f/1.4, f/2.0, f/2.8, f/4.0, f/5.6, f/8, f/11…

Aperture Size

- Sample F-Stops and their corresponding aperture opening sizes.
- The white circles would correspond to the size of the aperture opening.



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Controlling only Aperture

- If you want to control JUST the aperture setting on your DSLR, set your camera to “A” or “AV” mode.
  - This is your “aperture priority” mode.
  - It will allow you to control ONLY the aperture on your camera and will automatically adjust the other two elements of the photographic golden triangle (shutter speed and ISO).

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Aperture and Depth of Field

- Another thing that you adjust when you change your aperture is the **depth-of-field** of your image.
- Depth of Field (sometimes abbreviated DoF) is the amount of your photograph that will be in focus.

More on Depth of Field

- **Large (or deep) depth of field** means that most of your image will be in focus whether it's close to your camera or far away.
- Higher f-stop numbers (small aperture opening) will increase the depth of field while small f-stop numbers (wide aperture opening) will give you larger depth of field (more of your photo is in focus).

Deep Depth of Field Example

- This is a photo with a deep Depth of field.
- It has a narrow aperture value of f/22.
- Notice how everything in the photo is in focus.

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Shallow DoF

- This is a picture with a shallow depth of field.
- It was shot with an wide aperture size (f/1.8)
- Small (or shallow) depth of field means that only part of the image will be in focus and the rest will be blurry.

Photo provided by Will Milne Denton ISD

Summary

- Aperture adjusts two parts of an image:
  - How much light is let into the image
  - The depth of field of your image
- Aperture is measured in F-stops.
  - The larger the aperture opening, the smaller the F-Stop number and vice versa.
- Lenses that have a wide maximum opening are generally more expensive than those that do not.

Shutter Speed

Part 2 of the Photographic Triangle

Introducing Shutter Speed

- The second portion of the triangle is called **the shutter speed**.

What is a Shutter?

- A shutter is a small mechanism in front of a camera's imaging sensor (or film with film cameras) that is normally closed.
- When it opens, it exposes the sensor or film to the light that is coming into the camera body.

What is shutter speed?

- Shutter speed refers to how quickly the shutter opens and closes, exposing light to the sensor (or film).
- Shutter speeds can be as long as several seconds, minutes or hours or as fast as 1/4000th of a second (and even faster for newer cameras).
- Imagine your shutter is a faucet. How quickly you turn the water on and then off again is the shutter speed.

Measuring Shutter Speed

- Shutter speed is usually denoted on your camera as fractions of a second or by real numbers followed by a closing quotation.
- Here are some examples:
  - 1/800 = one eight hundredth of a second
  - ¼ = one fourth of a second
  - 1/2000 = one two thousandth of a second
  - 2” = two seconds
  - 60” = sixty seconds

Shutter Speed Tips

- **Most of the time, you won't be shooting with a shutter speed slower than 1/60th of a second.**
  - This is because anything slower than this shutter speed is very difficult to use without getting blur in your images.
- If you do decide that you your shot needs a shutter speed slower than 1/60th of a second, you will need to utilize a *tripod*.

Choosing the right shutter speed

- When considering what shutter speed to use in an image you should always ask yourself whether anything in your scene is moving and how you'd like to capture that movement.
  - Do you want the motion to be blurred or frozen still?

Motion and Different Shutter Speeds

- Below are three different photos taken of the same spinning pinwheel.
  - Each photo has a different shutter speed.

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Fast shutter speed

Slow shutter speed

Choosing the Right Shutter Speed

- To freeze an image in motion, it would not be uncommon to use a speed upwards of 1/1000th of a second or faster, depending upon how fast the object is moving.
  - The faster the movement, the faster your shutter speed will need to be in order to freeze it.
- Alternately, some images made at night with a tripod should be several hours long in order to get enough light in the image.
  - These are referred to as “long exposures.”

Fast Shutter Speeds

- Fast shutter speeds enable you to capture moments like water splashing, a football player catching a ball, etc… without any motion blur.
- The faster you set your shutter speed, the less time you will be allowing light to hit your sensor.
  - In order to compensate for this, you will have to open your aperture wider to let more light in.

Fast Shutter Speed Example

- Notice how the water is “frozen” in time.

Photo provided by Will Milne Denton ISD

Slow Shutter Speeds

- If you're in a really dark situation and can't open up your aperture, you'll need to have a long shutter speed to get enough light.
- With long exposures, you can do cool things like light-painting, star trails and more.
- Anything moving during your long exposure can end up as a blur in your photograph.
- When shooting with slow shutter speeds, always remember to use a tripod.

Slow Shutter Speed Example

- Notice how the motion of the water has blurred while everything else is still in focus.

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Don’t forget about the other parts of the triangle!

- Remember that when you change your shutter speed you’ll need to change one or both of the other photographic elements (ISO, Aperture) to compensate for your changes in light.
  - If you change your shutter speed to freeze motion a bit more (i.e. from 1/250 to 1/500) you will be letting in less light and will therefore have to either open up your aperture by one stop (i.e. from f2.8 to f2.0) or up your ISO (i.e. from ISO100 to ISO200) to let in the same amount of light.

Shutter Speed, Aperture and ISO Used Together

- Besides the fact that the above two pictures have different shutter speeds, also notice that the depth of field is very different, too.
- This is due to the difference in aperture values.

Shutter Priority Mode

- DSLRs have a mode that allows the user to control the shutter speed and the camera to automatically select the aperture and ISO.
  - In most DSLRs this mode is called S or TV mode.
- You can also control your shutter speed by default when shooting in Manual (“M”) mode.

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Summary

- Shutter speed alters the amount of time that light is exposed to the image sensor.
- A long shutter speed lets light in for a long time and blurs motion.
- A fast shutter speed lets light in for a brief moment and freezes motion.
- The fastest shutter speed at which you should shoot without a tripod is 1/60.

ISO

Part 3 of the Photographic Golden Triangle

The Photographic Triangle: Part 3

- The third portion of the triangle is called **ISO**.

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WHAT IS ISO?

- ISO is your sensor's sensitivity to light.
- ISO stands for International Organization of Standards.
- High ISO creates a brighter photograph; low ISO creates a darker photograph.

Measuring ISO

- Cameras have a range of possible ISOs.
- ISO is measured by whole numbers, starting at either 50 or 100 and doubling from that point.
- Most current DSLRs top-out at around ISO 3,200.

Using High ISO

- Using higher ISOs allows a photographer to correctly expose a photo in dark situations.

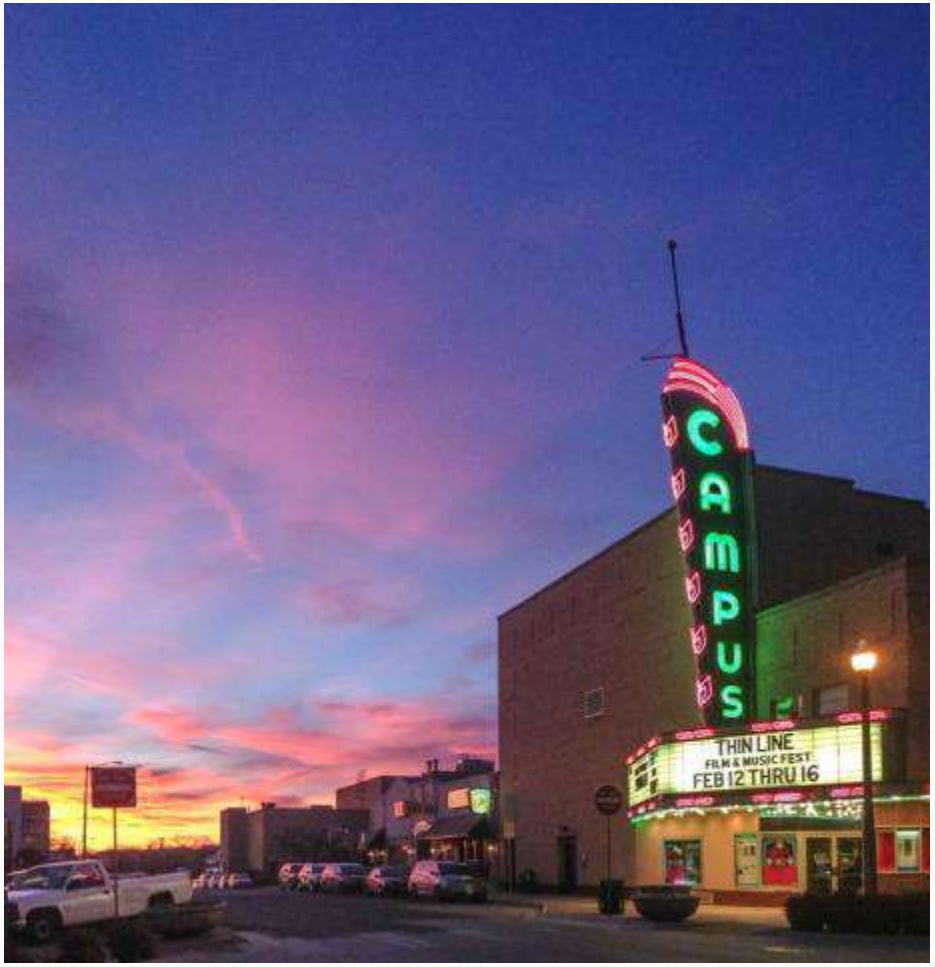

Photo provided by Will Milne, Denton ISD, Denton, TX

What ISO Does

- When you turn up your ISO, your camera does two things:
  - It makes your sensor more sensitive to light (brighter picture).
  - It produces more noise in your final image.
- Therefore, the ISO is often the ***last*** element of the photographic triangle to be adjusted and, when possible, should be left at its lowest possible number.

High ISOs

- A high ISO setting will force your image sensor to be extremely sensitive to light.
- However, when you turn up the ISO on your camera (ex: 800 to 1600), you are also allowing more digital noise into your photograph.

What is noise

- Noise is grain that makes your photograph look dirty.
- The noise might not be noticeable on your LCD screen, but it will be noticeable on your computer.

Noise Example

- The image to the right contains noise from shooting at a high ISO.

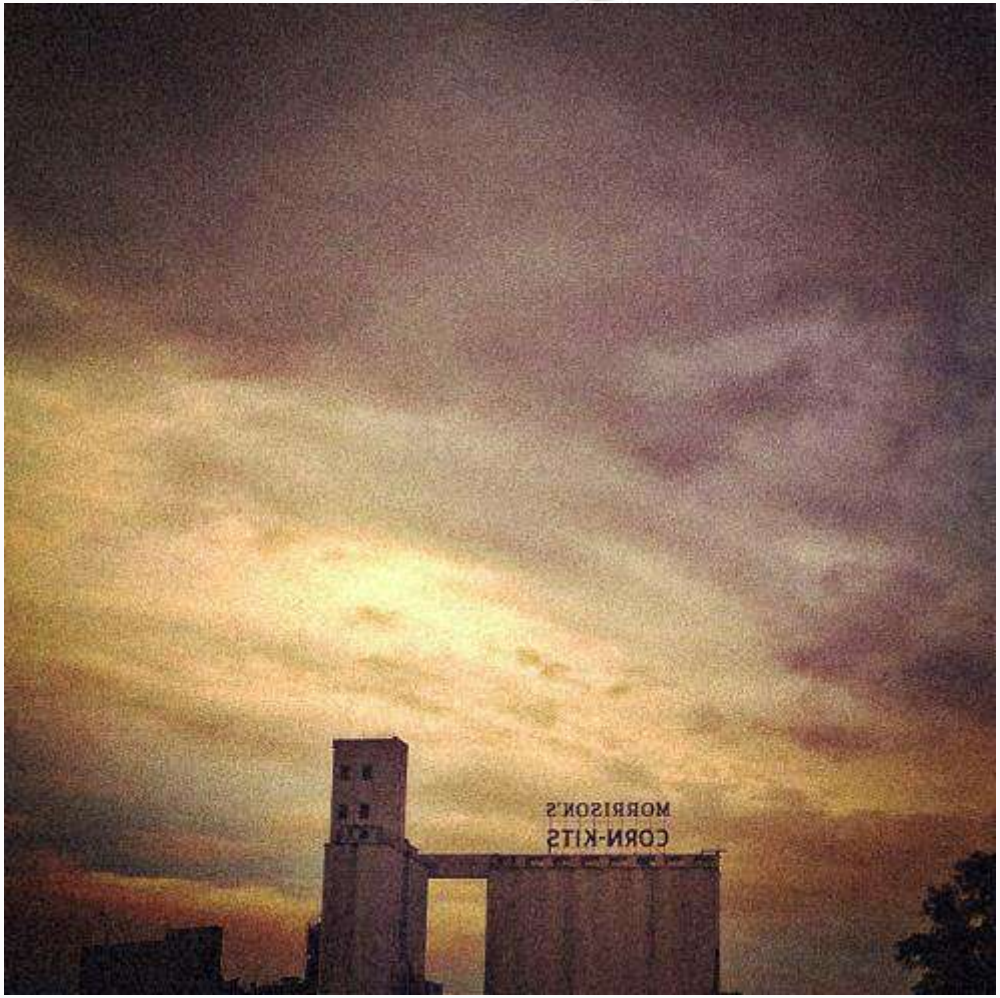

Photo provided by Will Milne, Denton ISD, Denton, TX

When to change ISO

- Suppose you take a picture and it is underexposed (dark).
- You have a few options:
  - Open the aperture more.
  - Increase the shutter speed.
  - Use your flash.
  - Or you could bump up your ISO.

When to Change ISO (Continued)

- In this example, let's imagine you're shooting a band at a concert and that you've already opened the aperture as wide as possible, you're shooting handheld at 1/60 (shutter speed) and you can't use your flash.
- What can you do to get in more light?

When to Change ISO (Continued)

- In this case, you would need to use a higher ISO!

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Notes on General ISO Usage

- You should use an ISO of 100 or 200 when taking photographs in sunlight.
- If the sky is overcast, then use an ISO within the range of 200 to 400.

Notes on General ISO Usage

- Night time or in cases of low light you might need to set your digital camera to an ISO upwards of 1600 or more (depending upon your shutter speed) in order to get a good exposure.

Photo provided by Will Milne, Denton ISD, Denton, TX

Summary

- ISO stands for International Organization of Standards.
- ISO adjusts the sensitivity of your camera's sensor to light.
- High ISOs can create lots of digital noise in your image.
- Unless you are purposefully trying to get noise, your ISO should almost always be the last exposure element to change.