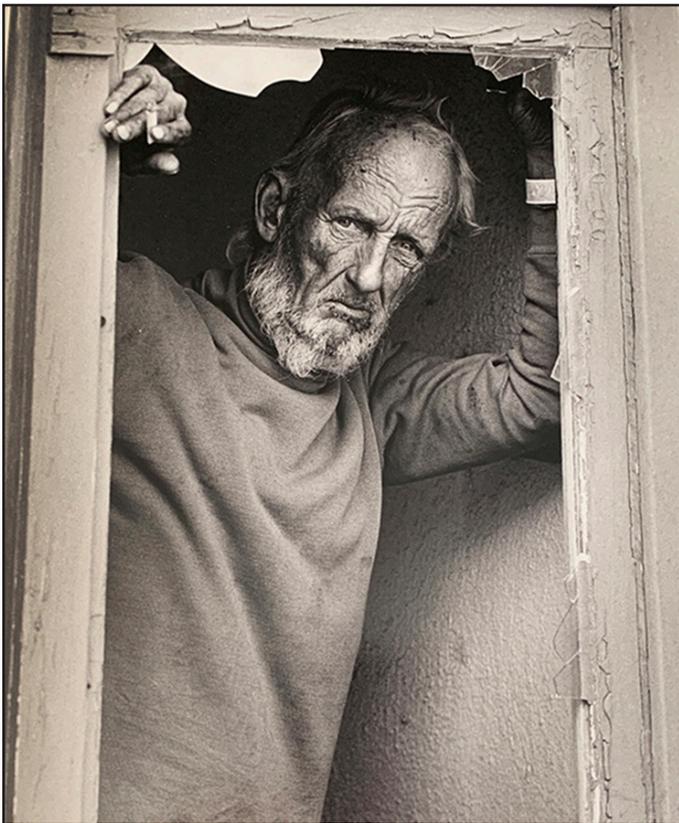


# Photography Program

an overview of photographic principles and more...



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# Introduction:

Our goal in photography, is to take an image we see (or sometimes create) and put that image on to a medium of storage (glass plates, film, digital sensor). We preserve that image for viewing, printing, manipulation (in the darkroom or Photoshop), and so on.

What moves that image on to our medium is the reflection of light off of our subject. How much light reflecting off the subject will determine just how we move the image that is in front of our lens, on to our medium of storage. Our controls, ISO, Shutter Speed and Aperture settings allow the proper amount of reflected light on to our medium.

If we are photographing outdoor subjects, especially “landscape” and nature photography, we, with little exception, have no control over the amount of light available (the amount of light reflecting off of our subject). When photographing outdoor portraits, we normally do have the ability to move our subject into a different lighting situation. Working in a studio, where we can control the lighting is a different situation, beyond the scope of this class.

This class will focus on better understanding our camera controls, especially for outdoor photography (landscape, nature, wildlife and outdoor portraiture), however, much of this class can apply to studio photography as well.

With outdoor photography, we can have lighting situations ranging from very bright sunny days (which reflect a great deal of light off of our subject), to overcast days with less light, and then on to dawn, dusk, or heavily shaded areas that provide minimal light reflecting off of our subject.

## Holding your camera:

When hand holding your camera, rather than having your left elbow floating out, try tucking your left elbow into your body and supporting the camera and lens with your left hand under the camera. This will provide much more stability to the camera when “hand holding” as well as not leaving your elbow floating out in the air to possibly get bumped.



Don't be this guy!



This way of holding your camera provides more stability.

# The Digital Advantage:

- One of the biggest advantages of digital cameras is the ability to allow for a lot of “practice”. There is no additional expense to take hundreds of photographs with a digital camera. You can really hone in on your skills as well as camera controls with digital cameras with no additional expense.

- Manipulation of the final image is now done on a computer using programs such as Photoshop as opposed to manipulation of the image during enlargement. While some may call this a disadvantage, it does allow for more people to get involved in photography. A higher percentage of people have photo programs than had darkrooms, especially color darkrooms.

# The Digital Disadvantage:

- Sloppy photography: relying on automatic controls and the ability to take hundreds of photos, in the hope of getting “a good one”.

- Quality over quantity, skill over luck, the ability to pre-visualize the image, understand exposure controls, dial in the correct exposure and especially the ability to achieve consistent results is the goal.

With film, we normally had limited adjustments:

- ISO - was determined by the film itself (of course we could push film on a limited basis)

- Focus was done manually

- Shutter speed was dialed in manually

- Aperture was dialed in manually

Even metering was done with a hand-held light meter (this is still done in studio conditions with artificial lighting) as many cameras did not have light meters built in.

I am amazed at how many wedding photographers say they shoot between 4,000 and 5,000 images at a wedding. I would find it a nightmare to go through that many images. With medium format film, the cost between film, developing and proofing was \$1 per image..it cost us \$1 ever time we pushed the shutter button. Your photography had to be precise or it could get expensive. 200-300 images were the average amount of photographs I normally took at a wedding. Even in the last few years, when switching over to digital cameras, I still shot around 300 images at a wedding since I treated the digital camera the same way I treated my film cameras....Manual exposure settings with a hand-held light meter.

- One additional consideration is the way the digital sensors, amplifiers and electronic components process the image. Meaning that each manufacturer (even different cameras within the same manufacturer), will have a different outcome with things like: Skin tones, dynamic range, reaction to ISO and such. Unlike film, where each camera would have almost an exact outcome (if you were using the same type of film). Of course, to be extremely precise, some photographers would test each film emulsion batch, however, that was more of a rare exception than the norm.

# The Exposure Triangle: (ISO / Aperture / Shutter Speed)

ISO, Aperture and Shutter Speed are the controls we use to move the light on to our storage medium. With roll film, our ISO control is limited to the roll of film we are using since the whole roll of film is the same ISO. A nice advantage of digital photography is the ability to change our ISO with each image photographed. This advantage is similar to sheet film, as you could have different film holders with different ISO rated film in each holder. Sheet film, however, is now used only by a select group of hobbyists extremely dedicated to that type of photography, using 4x5 or 8x10 view cameras.

## ISO:

ISO, formerly know as ASA(DIN in Europe) is the sensitivity of the film or digital sensor.

The lower the ISO number, the less sensitive to light, the higher the ISO number the more sensitive to light.

So why not always use the more sensitive option? With more sensitivity comes more grain (film) or noise (digital). Grain and noise make for an image with less sharpness and lesser quality.

Low ISO= Less Sensitive, we need more light to hit the film or digital sensor -

With less sensitivity, we need to move more light on to the film or digital sensor which will require more available light, a longer exposure and/or wider lens aperture. (more on this later).

Normally a lower ISO will work well with brighter conditions.

High ISO= More Sensitive, we need less light to hit the film or digital sensor -

With more sensitivity, we can move less light on to the film or digital sensor which will allow for a shorter exposure and/or smaller lens aperture. (more on this later)

Normally a higher ISO will work well with lower light conditions.

The general rule of thumb is to use the lowest ISO possible for the best image quality.

Note: Digital has a much greater advantage over film with higher ISO use. Film would normally start to see grain in the 400 ISO range, while digital (especially with better cameras) still show fantastic image quality at ISO's in the 2000 range or greater

The second advantage, as mentioned above, that digital has over film, is the ability to change ISO's with each image. With film, having a predetermined ISO, you were stuck with the same ISO for every image on the entire roll of film, usually from 12 (120 film), 24 (220 film) to 24 or 36 (35mm film).

To get technical for a moment, with digital, the ISO is actually a function of "amplification" of the light hitting the sensor, however, for this program, thinking of the ISO as sensitivity will help you understand other aspects of exposure more easily.

## ISO (continued):

A good way to visualize ISO is the “Sink Method”. When using a sink to wash up, a larger sink is preferred over a small sink.. The down side is the larger sink requires more water to fill.

Think of water as light....



The large sink above represents a lower number ISO. It needs more water to fill, however, is more desirable. Just as a lower ISO is more desirable, giving less grain or “Noise”. The lower ISO needs more light for the exposure just as the large sink needs more water to fill it.



The small sink above, while less desirable to use, needs less water to fill. This sink represents a higher number ISO. In a similar fashion, a higher ISO is less desirable, giving more grain or “Noise”, however the high ISO needs less light so, in low light conditions, this may be the only option.

So we look at our conditions and select our ISO. Experience will help determine which ISO to select, however with digital, it’s easy to come back to ISO and adjust if a lower or higher ISO will work better with the other controls you need (aperture & shutter speed), to adjust how much light hits our sensor.

Your ISO will determine the parameters of the shutter speed and aperture you will be selecting, however, knowing which shutter speed and aperture you prefer for the image, will determine which ISO you select. Each effects the other as you will see.

# Shutter Speed & Aperture:

Once we select our ISO (sensitivity), we now need to fill the medium with light. Again, we can look at the sink analogy.



*Above:  
Larger pipe opening  
will require less time  
to fill the sink with  
water.*

*Larger aperture =  
less time needed  
(faster shutter speed)*



*Above:  
Smaller pipe opening  
will require more time  
to fill the sink with  
water.*

*Smaller aperture =  
more time needed  
(longer shutter speed)*

Think of your sink as the ISO. The sink is filled with two variables, the size of the pipe and the amount of time you let the water run.

**Time** is your shutter speed, a slower shutter speed = longer exposure, which is the amount of time the light is allowed to hit your medium (film/sensor). You can relate this to how long you need to run the water to fill the sink.

Your **aperture** is the size of the lens opening, you can relate this to the size of your pipe filling the sink with water. The larger pipe will fill the sink faster, so less time is needed (faster shutter speed). A smaller pipe will take longer to fill the sink so more time is needed (slower shutter speed)

Note: we never want to overfill the sink (over expose the main subject image).

# Shutter Speed:

Two major factors involve the selection of shutter speed.

- 1) Do we want to stop motion or show motion?
- 2) Do we have a support available, tripod or such, to keep the camera steady if we desire a long exposure for our image. (Image stabilization in some lenses and cameras)

NOTE: There are different types of shutters: Leaf / Curtain / Electronic (more on this later)



The motion of the water over the water-fall (left image) is emphasized by the use of a slow shutter speed. This slow shutter speed will normally require a camera support of some kind. You can get blurry images with long hand-held exposures due to camera movement.

The motion of the helicopter rotor is appropriate, as it shows it is flying.



The use of a fast shutter speed stopped the fast moving tennis ball in flight, creates a better image than if the ball were unrecognizable due to motion. Fast shutter speeds are normally a good option for sports photography.

Either the engine of this helicopter has stopped in flight, or the photographer used a shutter speed too fast to show the motion of the rotor. This looks a bit unnatural.



In this case of sports photography a slower shutter speed allowed the photographer to pan. This keeps the subject sharp while motion blurring the background. This can take some practice to master, along with knowing some special techniques to assist your timing.

# Shutter Speed (continued):

**Taking a quick step back to ISO....**A more sensitive (higher) ISO will allow for a faster shutter speed (aperture being the same). So if you are photographing sports, especially in low light, selecting a higher ISO will allow more ability to use a faster shutter speed to stop motion.

A less sensitive (lower) ISO needs more light, which is appropriate for a slower shutter speed that can show motion such as the movement of water over a waterfall or pan action photography.

**Shutter speeds range from very fast, to very slow.** Fast speeds allow less time for the light to hit our medium and can stop motion. Slow speeds allow more time for the light to hit our medium and can also show motion.

We still need the same volume of light (water in the sink), so we have to adjust our aperture (lens opening) to compensate for more or less time of the shutter speed (see next page).

1/1000 of a second is a fast shutter speed allowing little time for the light to hit the medium

1/4 of a second is a slow shutter speed allowing more time for the light to hit the medium

Keep in mind the “**safe**” **shutter speeds for Hand-Holding your camera**. You will certainly get more stability holding your camera the way we previously discussed, however this can be an individual issue. Generally 1/60 of a second is considered the slowest shutter speed to be hand-held. It is best practice to use a tripod with slower shutter speeds.

**Shutter speeds when using flash.** Cameras with a Focal Plane shutter will have top-end shutter speed limitations (normally 1/125 or 1/250). This is due to how the curtain shutter works. Curtain shutters never fully open at faster shutter speeds, they have one curtain following the other, creating a slit that exposes the film/sensor. A flash can only evenly expose when the shutter is completely open, which does not happen at fast shutter speeds.

Leaf shutters normally will go up to a higher “flash sync” shutter speed because they do not have one curtain following the other to make the exposure. A leaf shutter has to open all the way up to make the exposure and the flash will go off when the shutter is open fully.

**Shutter drag.** Slow shutter speeds, used in conjunction with a flash will allow the background (the part not exposed by the flash) to show. In darker situations, the flash will freeze the subject so it will appear sharp in the image, while the slow shutter speed will give added exposure to the background. Additionally if your camera is on a tripod, the background will appear sharper than if the camera is hand held.

**Front or Rear curtain sync:** This option determines when the flash will fire. Either after the first curtain opens or just before the second curtain closes. Typically with moving objects a rear or second curtain sync looks more natural.

# Aperture:

Two major factors involve the selection of aperture.

- 1) How much Depth of Field (area front and back of the image in focus) do we want.
- 2) What focal length lens are we using which affects the above. (At the same aperture, Longer focal length lenses have less depth of field at a given focus distance than shorter focal length lenses)

*Note: This will be discussed in more detail later, however, for now, be aware, when we are discussing aperture...a smaller f/number equals a larger lens opening, a larger f/number equals a smaller lens opening. See chart, next page.*



A wider aperture will have less Depth of Field, especially with longer lenses. This wider aperture will let more light on to our medium so a faster shutter speed and/or lower ISO will be needed.

The two images on the left show the primary subject in focus, however the foreground and backgrounds are not in focus. This is known as a “shallow” depth of field.



A smaller aperture will have more Depth of Field, especially with shorter lenses. This smaller aperture will allow less light on to our medium so a slower shutter speed and/or higher ISO will be needed.

The far left image using a smaller aperture, shows background in sharp focus which can be distracting in a portrait.

The image on the right uses a smaller aperture to make sure the entire image (front to back) is in focus. A smaller aperture is usually appropriate for landscape photography.

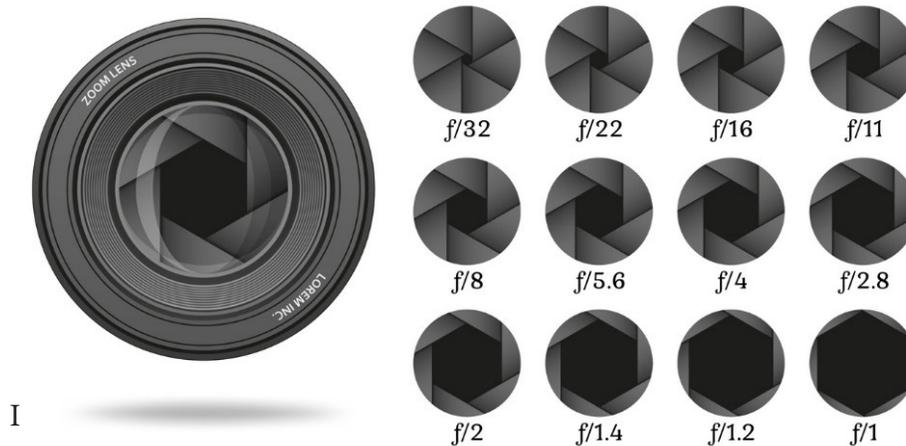
Given the above:

- A more sensitive (higher) ISO will allow for a smaller aperture, as it needs less light to hit the medium and a smaller aperture lets in less light than a wider aperture. So, if you are photographing landscapes, especially in low light, selecting a higher ISO will allow you to use a smaller aperture and get more depth of field. Alternatively to adjusting ISO (or in conjunction with) , you can go to a slower shutter speed to let **more** light on to you medium using more time.

- A less sensitive, (lower) ISO needs more light, which is appropriate for a wider apertures. So if you are photographing portraits or isolating a subject, such as a wildflower, a wider aperture is preferred. In this case a lower ISO (less sensitivity) will require a larger aperture to let more light on to the medium. Alternatively to adjusting ISO (or in conjunction with), you can go to a faster shutter speed to let **less** light on to your medium using less time.

# Aperture (continued):

Apertures (measured in f-stops) range from wide lens openings to very small openings. Below is a representation of available apertures. Keep in mind, not all lenses have the entire high end or low end of apertures. For example some less expensive and some zoom lenses will start their wider opening at  $f/4$  or  $f/5.6$ . By contrast, some very expensive, high quality lenses may open up to  $f/1.4$  and close down to  $f/64$ . The other thing to note is while  $f/64$  may sound like a larger aperture than  $f/4$ , the reverse is true. A smaller number denotes a larger aperture (lens opening) while a larger number denotes a small aperture.



The diagram above shows what the inside of the lens looks like the instant the photograph is taken. As you can see, the smaller opening,  $f/32$ , will let much less light in than  $f/2$ . After the photograph is taken, most cameras return the lens to full aperture so you can see through the viewfinder and lens more easily.

So, the first 2 questions we should be asking ourselves prior to taking a photograph is:

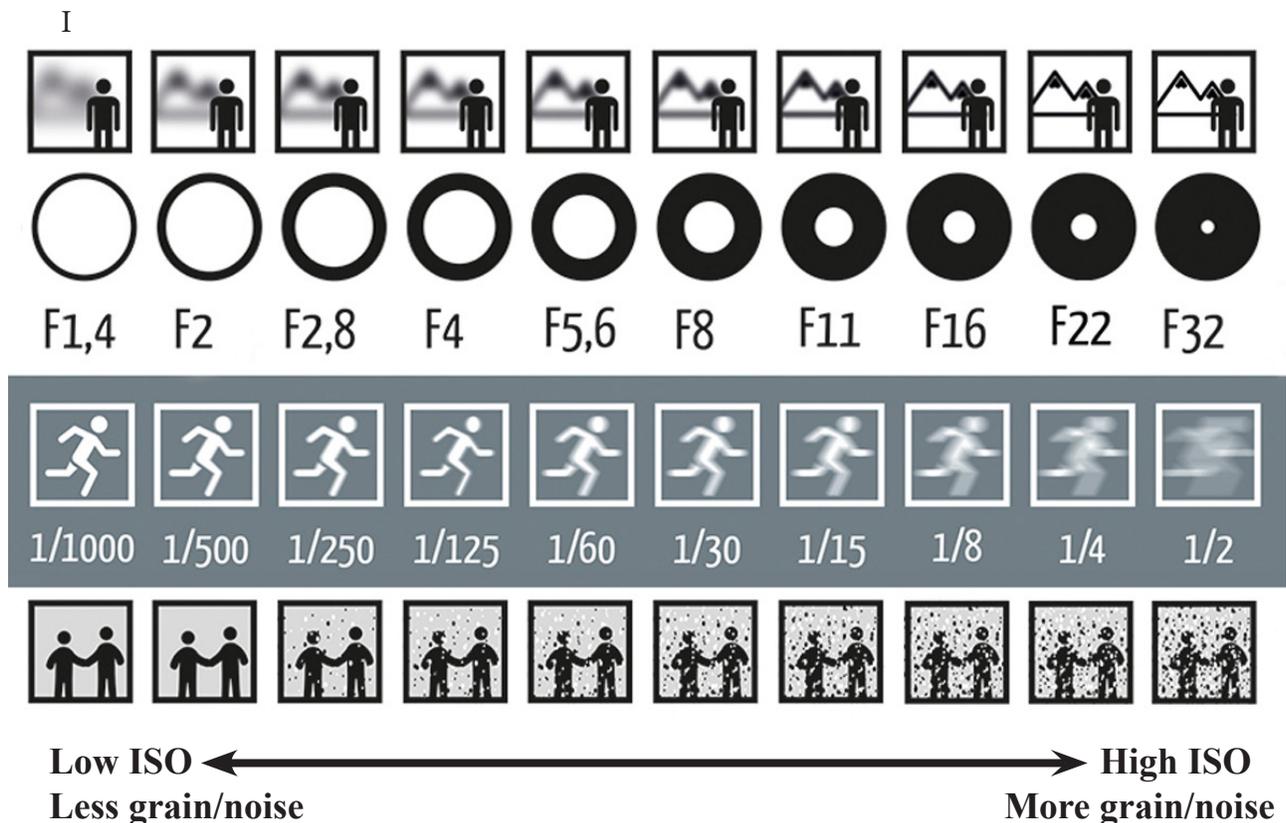
- 1) Am I in a bright or dim (or somewhere in between) lighting condition?
- 2) Which is my main priority in this photograph:
  - A) Stop Motion - using a fast shutter speed (some sporting events being a good example)
  - B) Show Motion - using a slow shutter speed (some landscapes with flowing water or other situations where you want to show motion.
  - C) Shallow Depth of Field - using a wide aperture (isolation of the subject from the foreground and background - some portraits, wildlife, wildflowers and so on)
  - D) Deep Depth of Field - using a small aperture (landscape photography, environmental portraiture and such)

After adjusting our ISO for the given light, we then set the controls on the priority we desire. We may, after adjusting aperture and shutter speed, determine we need to come back and adjust our ISO to gain our desired result. Digital allows us to do this for each individual image.

# The Exposure Triangle - ISO / Aperture / Shutter Speed:

This illustration helps show the effects of adjusting each element in the triangle. Three things to keep in mind.

- 1) The focal length of the lens will also determine depth of field, so the illustration shows a “normal” focal length lens such as a 50mm on a full sensor or 35mm camera. The “normal” designation is because that focal length lens is approximately the same field of view as we see with our eyes.
- 2) With shutter speeds and blur, some lenses and some cameras have image stabilization that helps tremendously with camera movement blur but not the motion blur they are showing in the illustration.
- 3) Grain with film has not changed much at all. The higher ISO means more grain, however digital cameras just keep getting better and better at the higher ISO range so there is less noise at higher ISO's than in the past.



# The Triangle of ISO / Aperture / Shutter Speed:

Some examples:

On a very bright day, photographing a landscape, I pick ISO 200 for example. I then pick f/22 for a deep depth of field getting both foreground and background in focus. f/22 is a small opening so I have to slow down my shutter speed to 1/125 of a second to let enough light in, since the f/22 aperture is not letting much light in. I notice the waterfall is not showing enough movement so I want to slow down my shutter speed to 1/60 of a second to show more motion. My camera is on a tripod.

I am now letting in more light than what my ISO requires. In this case, since I have the aperture I desire, I would change my ISO to 100, making it less sensitive, now an appropriate exposure for the combination of f/22 and 1/60 of a second shutter speed.

Note: In the above example, I would probably not be photographing a landscape during the very bright hours of the day. These types of situations would be better suited to be photographed during dawn or dusk for the best lighting. John Sexton (assistant to Ansel Adams) called the lighting at this time of day “Quiet Light”.

In a shaded area with beautiful shaded lighting and an open sky, I desire to photograph a wildflower. I pick 800 as my ISO because I am in the shade. I know, to isolate the wildflower and blur the foreground and background, I need a shallow depth of field so I open up my aperture to f/4 which lets quite a bit of light on to the medium. My shutter speed needs to be somewhat fast since my aperture is at f/4. I find, when metering, my shutter speed is 1/4000 of a second. In this case, I can easily drop down my ISO for better image quality and still maintain a fast enough shutter speed to hand-hold my camera and not get any motion blur. I drop my ISO down to 200 (a two stop difference). Now my shutter speed drops as well, why - Because I made my ISO less sensitive to light so I need more time to let light on to my medium since my aperture is staying the same at f/4. In this case, my shutter speed drops two stops as well to 1/1000 of a second.

An indoor basketball game with artificial stadium lighting, I pick ISO 800 and wanting to stop action as my priority, I select 1/500 of a second. I want a bit of depth of field to show other players, while my main player subject must be in sharp focus, the other players do not need to be quite as sharp so I pick f/4 as my aperture. When metering I find 1/500 of a second will only allow me to get f/2.8. In this case I could drop my shutter speed to 1/250 of a second or raise my ISO to 1600. Either situation would work as long as the 1600 ISO does not show too much noise with your camera.

Note: in the last two examples, the focal length of the lens will also determine depth of field, so changing lenses can come into play to control depth of field.

# Exposure:

A long long time ago, back in the early 1900's there was a push to standardize film speeds, metering and other aspects of photography. A group of individuals got together and decided that if the earth and all it's contents were put into a large blender, the tonality average would be 18% gray. For this reason all light meters are set to register 18% gray as the correct exposure.

## How your light meter thinks:

Your light meter thinks everything it looks at is 18% gray, either with the correct amount of light on it, or too little or too much.

If you meter an 18% gray card, your light meter thinks "this is 18% gray" and will have you adjust the shutter speed and f/stop for the 18% card it is looking at - This is actually the correct exposure!

If you meter a very white object, your meter thinks "this is a gray card with too much light on it", so it will have you adjust the shutter speed and f/stop to make the white object 18% gray. In this case you will under expose the subject.

If you meter a very dark object, your meter thinks "this is a gray card with not enough light on it", so it will have you adjust the shutter speed and f/stop to make the black object 18% gray. In this case you will over expose the subject.

In the example below you will see how metering off of different reflectiveness yields different results. All examples show a black card (left), a gray card (center) and a white card (right)



The above example shows metering off of the 18% gray card.

The meter thinks "this is a gray card and it is correct, so the proper exposure is achieved.

The meter has you set your shutter speed and aperture accordingly. The other cards (black card and white card) are also the exposed correctly!

ISO 400  
1/60 f/8.5  
This exposure is correct



The above example shows metering off of the black card.

The meter thinks "this is a gray card with not enough light, it wants to make the black card gray by letting in more light.

The meter has you set your shutter speed and aperture accordingly, and now the black card looks gray - notice how the other cards are affected.

ISO 400  
1/60 f/4.5  
Over Exposed Image



The above example shows metering off of the white card.

The meter thinks "this is a gray card with too much light on it. it wants to make the white card gray by letting in less light.

The meter has you set your shutter speed and aperture accordingly, and now the white card looks gray - notice how the other cards are affected.

ISO 400  
1/60 f/22  
Under Exposed Image

# Exposure (continued):

Other considerations with metering are the type of “view” your light meter is seeing. Most cameras allow you to adjust your meter to view the entire scene (it is still looking for that 18% gray), or possibly “center weighted” metering, which will also look at the entire scene but give more credibility to the objects in the center of the image, or possibly “spot” metering, which will pick a very narrow field (normally in the center of the image) and look at that small area as 18% gray and have you adjust accordingly.

The most accurate method of metering is spot metering since it concentrates on one small area. The down side to spot metering is, you really need to understand what the spot area is seeing and adjust accordingly.

Most landscape photographers will use spot metering and adjust for the tones in the scene. Until you fully understand how to spot meter and understand the basics of the zone system, you might be better off using other metering options.

For fast metering, there are a couple of options that might work for you.

- 1) Incident metering - measures the light falling on the subject giving you the equivalent of using an 18% gray card, however it is much faster. The downside is you are not adjusting for all the tonalities in your image as you would using the zone system, however, you will achieve proper average exposure.
- 2) Metering off of an average Caucasian hand and opening up one stop by either adjusting your shutter speed or aperture. The average Caucasian hand is approximately Zone VI - So your light meter sees it as a gray card with one stop too much light on it. You adjust this by giving the exposure one less stop to compensate.
- 3) You can use the “sunny 16” method. On a sunny day, set your aperture to f/16  
Set your shutter speed to the ISO. For example ISO 100 use 1/125 of a second.

<b>ZONE</b>	<b>DESCRIPTION</b>	<b>EXPOSURE</b>
<b>I</b>	Near black, with slight tonality, but no texture.	
<b>II</b>	Textured black. Darkest part of image has slight detail.	-3
<b>III</b>	Average dark materials and low values with texture.	-2
<b>IV</b>	Average dark foliage, dark stone, landscape shadows.	-1
<b>V</b>	Middle gray. Clear north sky, healthy grass, average weathered wood.	0
<b>VI</b>	Light stone, shadows on snow in sunlit landscapes.	+1
<b>VII</b>	Shadows in snow with acute side lighting.	+2
<b>VIII</b>	Lightest tone with texture, textured snow.	+3
<b>IX</b>	Slight tone without texture. Glaring snow.	
<b>X</b>	Pure white. Light sources and specular reflections.	

I

While beyond the scope of this class, you can see the zone system above allows you to really control exposure to get the exact tonality of the image on to your medium just by adjusting exposure.

# Exposure (continued):

With film, we would use the zone system to expose for the shadows and develop the film for the highlights in an effort to preserve all of the important tones in the scene.

With digital it is important to preserve the highlights, as once highlights are lost in digital, you can not get them back. So, if you are photographing a bride in a high contrast lighting situation, be sure you do not “blow out” the white wedding dress, even if it shifts the mid and dark tones darker. Those can usually be salvaged in Photoshop while a loss of highlights can not.

I listened to one wildlife photographer talk about photographing an animal in a scene with a bright background. Well, we now know that you meter (especially averaging meters) will see all that bright light and think “here is a gray card with too much light” so it will cause you to stop down, thus under exposing the main subject...the animal. A spot meter and understanding the zone system would avoid this, however with wildlife and even sports, there is normally not enough time to meter and think about the zone system. You, however, understanding how the light meter thinks. You now know, the meter is seeing all that bright background light and thinking “this is a gray card with too much light”. The meter wants you to stop down, but you know to open up to the correct exposure. Opening up how many stops comes with experience of reading how bright the scene is. The important thing to remember is, you are not “over exposing” the image by opening up, you are adjusting for the **correct exposure on the subject**.

By now, you know the light meter thinks in 18% gray. So metering off of a gray card will give you the proper exposure. Lets look at that wild animal scene with a bright background and sort it out.



Above: Our camera meter is set on average scene metering.

The background is bright (it is actually pure white), so it makes the meter think “this is a gray card with too much light”

The meter wants us to stop down (smaller aperture and/or faster shutter speed), to let less light in, therefore underexposing our wild animal.

ISO 400 1/125 - f/11.5



Above: We are now metering the same scene off of a gray card. There is now a gray card behind our wild animal.

Our camera meter is set on average metering and is seeing the 18% gray card, therefore giving the proper exposure.

ISO 400 1/125 - f/5.6 is the proper exposure. Now let's take that proper exposure to the original scene (right image)



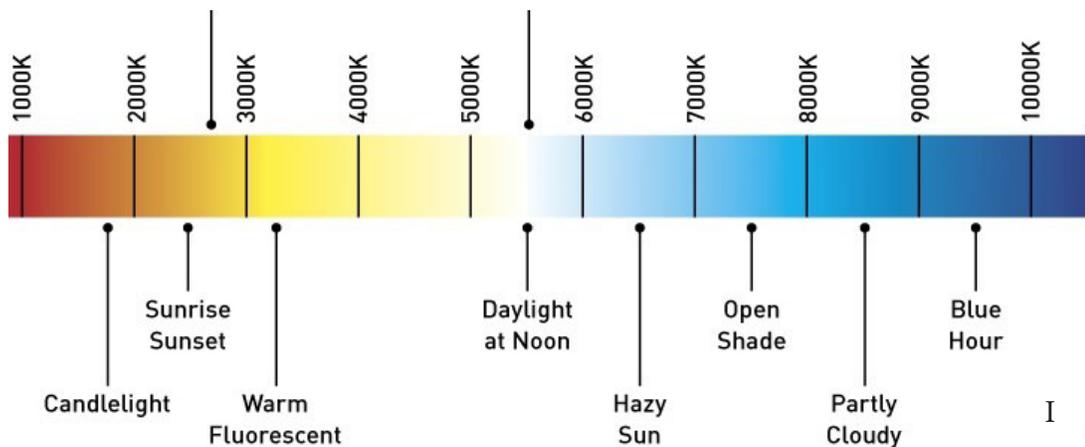
Above: We now take our exposure from the scene with the gray card, which gave us the proper exposure and bring it to the scene with the wild animal and the bright background. You can see the wild animal is now in proper exposure.

You are not “overexposing”, the scene, you are adjusting to give the proper exposure to your subject.

# Exposure (continued):

The interesting fact is, our eyes can adjust and see more information in a contrasty scene than the film or digital sensors can see. This is why understanding the “zone system” can help you become a better photographer. With the zone system, you can use your knowledge and your camera’s meter and see what shadow information, as well as what highlight information will register on your film/digital sensor.

Hand in hand with proper exposure, is **White Balance** (with digital) or selecting the proper type of film (when shooting film). Our eyes can easily adjust to different light temperatures (see Kelvin scale below). When we walk from outside lighting (approximately 5600 kelvin) into a room with warm fluorescent lighting (approximately 3200 kelvin), our eyes adjust (actually our brain makes the adjustment) and will still see someone’s blue shirt as blue. Our sensors/film can not interpret this change as easily as our brain does. For this reason, we need to purchase the proper film for the lighting conditions we will be in, and for digital we need to adjust our camera’s white balance. Auto white balance is an option with most digital cameras, however “auto WB” is not as precise as using a custom white balance or actually dialing in the exact kelvin temperature, or using the cameras presets for the exact lighting conditions.



## Practice:

If you really want to get good with exposure, practice learning what objects are middle gray. When time permits, spot meter off of a gray card then spot meter off of various areas in your scene and see which match the gray card meter reading. With practice, you will be able to look at a scene and be pretty good at seeing which part of the scene is middle gray. Meter off of this area for good exposure results, however, be aware of where your shadows and highlights are compared to your 18% middle gray, and adjust your exposure (if necessary) to preserve shadows or highlights.

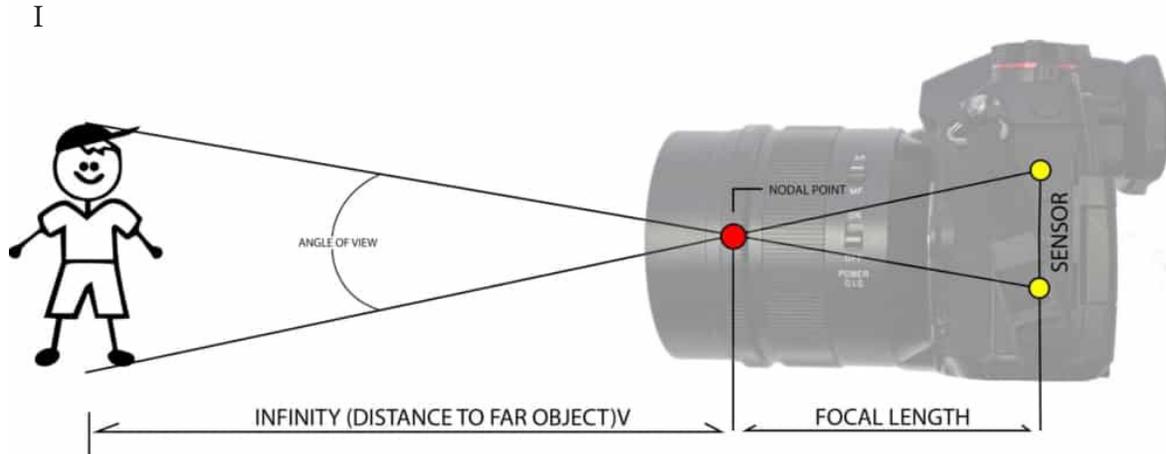
## Histogram:

Your histogram (with digital cameras) can help guide you with your exposure. One important aspect is to not let any critical highlights “blow out”. Specular highlights and light sources (pure white with no detail) can be allowed to blow out.

Another aspect of your histogram is to slide the information to the right. Meaning, if the majority of your histogram is toward the shadows (with a good deal of space left in the highlight area), you can change your exposure to slide the histogram a bit to the right and you will get more detail in the shadow areas.

# Lens Focal Length:

Technically, the focal length of the lens is measured from where the light converges inside the lens (the focal point) to the digital sensor or film plane.



For our purposes and simplification, we should look at focal length as our angle of view and how close we can see our subject.

A wider focal length lens, 24mm for example, will have a much wider angle of view than a 135mm lens. The 135mm lens will get us closer to the subject without moving the camera position.

The angle of view will change with different film/sensor sizes. For example, a 50mm lens (which is considered “normal”\*) on a full sensor digital camera, (or 35mm film camera), will be longer (less angle of view) on a small sensor digital camera. That same 50mm lens will be a wide angle on a medium format camera and an 80mm lens will be considered normal on a medium format camera. (see below)

A “portrait” lens compresses the face slightly, so with a full sensor camera or 35mm film camera, a portrait lens would be in the 80mm to 125mm range. Taking a portrait with a normal lens or wider lens will distort the face and be less flattering. Also using a wide aperture and putting the background out of focus, will usually make for a better portrait (unless it’s an environmental portrait).

Get to know your camera and the angle of view for the various focal length lenses as well as what works best for your type of photography.

\*When a lens is considered “normal” for a particular film/sensor size, this is because it is the closest angle of view to what we see with our eyes.

APS-C - 35mm lens is considered a normal lens

35mm Film Cameras and Full size digital sensors - 50mm is considered normal

Medium Format Cameras - 80mm is considered normal

Large Format 4x5 Cameras - 150mm is considered normal

# Depth of Field and Hyperfocal Focus:

Depth of field is the area of the image (front to back) that is in focus.

*There are 3 basic things to be aware of:*

1. Longer Focal Length lenses have less depth of field than shorter lenses.
2. The depth of field increases beyond your focus point- notice how the numbers are closer together the further out you focus. So, focusing 1/3 into a subject will give more overall sharpness to the entire photo as opposed to focusing half way in which will lose more subject focus closer to the camera.
3. If you are focused at infinity using a small aperture, move the focus ring to put infinity at your aperture and you will get more foreground in focus.



1) The lens on the left above is a 50mm lens, which would be considered a standard or “normal” lens for a 35mm or full sensor camera. The lens on the right above is a 135mm lens which is a longer lens for the same format camera.

Both lenses are set to an aperture of f8 (as you can see just below the red or orange line with the ball on each lens). Each lens is focused at approximately 10ft (as you can see by the number in white just above the line with the ball).

Looking at the distance of focus in feet, (white numbers above the line with the ball), you can see the 50mm lens (left photo) shows at f8 (looking at the parallel numbers beside the line with the ball) shows your focus area to be from approximately 5 feet to past 30ft.

Looking at the distance of focus in feet you can see the 135mm lens (right photo), also focused at 10ft, shows only from approximately 9.5ft to 11ft.

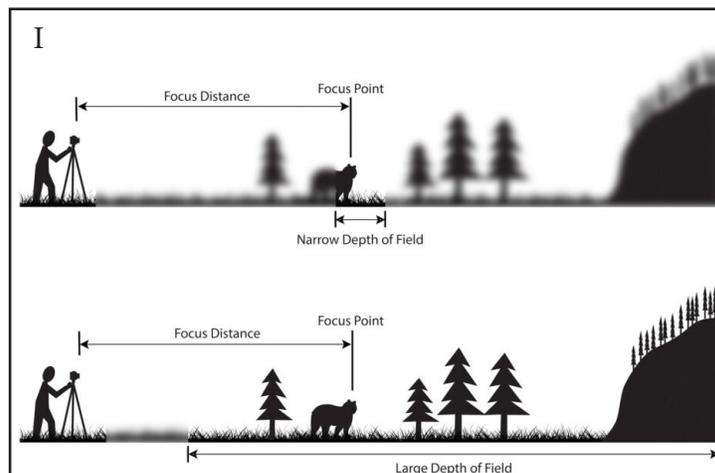
## Depth of Field and Hyperfocal Focus - Continued

2) The depth of field increases beyond your focus point- notice how the numbers are closer together the further out you focus. So, focusing 1/3 into a subject will give more overall sharpness to the entire photo as opposed to focusing half way in which will lose more subject focus closer to the camera.



As you can see above, the distance numbers are closer together the further out you focus. When looking at the lens barrel, you will see a large distance from 3ft to 7ft, however when you look from 10ft to 30ft on the barrel, the numbers are much closer together. This basically means, when you focus on a subject, there will be more in focus behind the subject than in front of the subject. For this reason, focusing 1/3 of the way into the scene will render more of the image in focus as opposed to focusing 1/2 way into the scene.

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The above image also illustrates how, when focusing on a given point of focus, there is more in focus behind the subject (further from the camera) than in front (closer to the camera).

## Depth of Field and Hyperfocal Focus - Continued

3) If you are focused at infinity using a small aperture, move the focus ring to put infinity at your aperture and you will get more foreground in focus.

This is a simple trick to get more foreground in focus:



In this example, the aperture is set to f22 (you can see the 22 below the orange line with the ball on the end). On the left picture, we focus our image and find we are at infinity (as you can see the infinity mark just above the orange line with the ball).

The example on the left shows we have a depth of field, (the area in focus), from approximately 90ft to infinity.

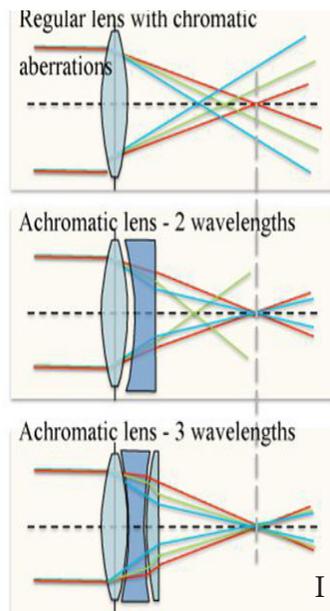
If we simply rotate the focus barrel and move our infinity to the 22 on the right side of the index, (right photo) we now have from approximately 40 feet to infinity in focus...a gain of 50ft of focus!

# Lens Basics:

Are more expensive lenses better than less expensive lenses? What are the differences?

There are several factors that go into determining if one lens is of better quality than another lens. Here are a few factors to consider:

- Quality of the glass
- Assembly of the lens
- Lens coatings
- Quality of the motor (in auto-focus lenses)
- How many elements in how many groups - Not all wavelengths of color focus at the same point, so optical engineers provide more elements to get the colors all to converge at one point in the lens. See photo below.
- Zoom vs. Prime - 40 years ago this used to be no contest, however quality of zoom lenses have gotten to the point where they are extremely close to the quality of prime lenses at a given focal length.



## Lens Basics (continued):

**Contrast breakdown:** This occurs when the background is significantly brighter than the subject in the foreground. At approximately a 3 stop difference of brightness, the lens develops contrast breakdown and the main subject now looks “flat”, lacking in contrast.



**Lens Flare:** Similar in some ways to contrast breakdown, lens flare occurs when a bright, non image-forming light hits the lens. At times, this can be avoided by using a proper lens hood.



**Bokeh:** Is the way the lens renders out of focus points of light (a cone of light rays, that are not coming into perfect focus). Different lenses at different apertures will cause different effects. This is similar to (but not exactly the same as) **Circles of Confusion**.

The size of the Bokeh balls is determined by aperture. The larger aperture (f/2.8 for example) will render larger Bokeh balls. A smaller aperture (f/16 for example), will render smaller Bokeh balls.



# Additional Information:

## (Class discussion)

- Shutter Types - Curtain / Leaf / Digital
- Polarizing Filters - Circular Polarizers to cut glare, darken sky
- Outdoor Portrait Tips - Shade / Open Sky / Background Brightness / Fill Flash / Reflectors
- Portrait Posing - Singles / Couples / Head Tips / Do not crop at joints
- Basic Composition - Rule of 3rd's / Art is subjective
- Flash Basics - While you may see hundreds of flashes going off in the stands of a football game, it will have no effect on the exposure. On-camera flash units carry only about 20-feet. I have actually seen people trying to photograph the moon using an on-camera flash!
- Ring Lights - These types of flash units are excellent for wildflower photography.
- Outdoor Lighting
- Extra Gear that is nice to own - Cable Release / Tripod / Digital Target / Gray Target / Sensor cleaning items / Reflectors & Diffusers (for outdoor portraits) / Flash Unit
- Types of Photography - Portrait / Street / Landscape / Nature / Wildlife / Art
- Understanding the “Modes” of your camera - SP / AP / P / Manual
- Exposure compensation in “auto” modes
- Reciprocity Failure with film and longer exposures