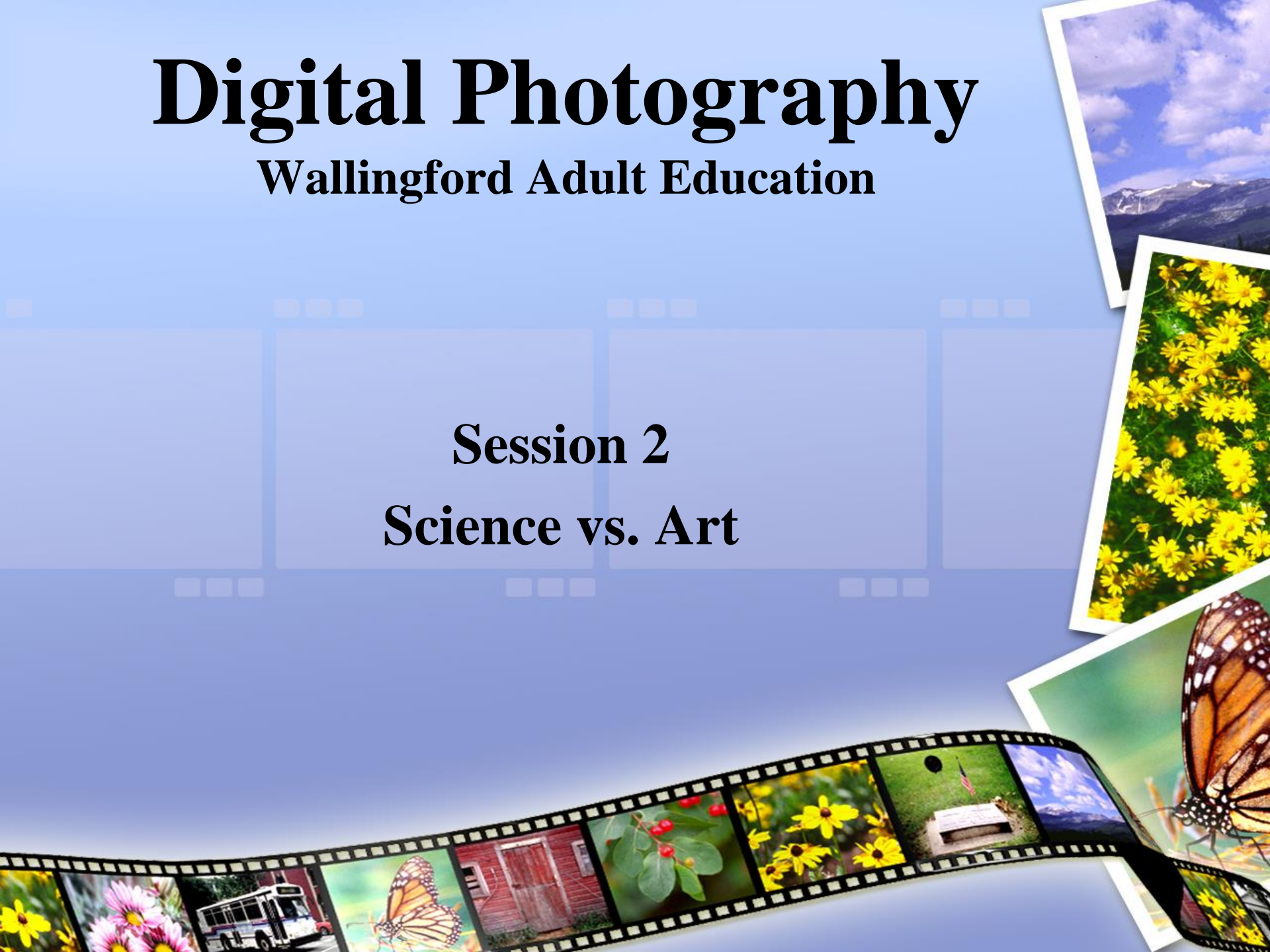


Digital Photography

Wallingford Adult Education

Session 2

Science vs. Art





Session 1 Recap

- **Learn the basics**
- **Learn the Equipment**
- **Take pictures**
- **HAVE FUN!**

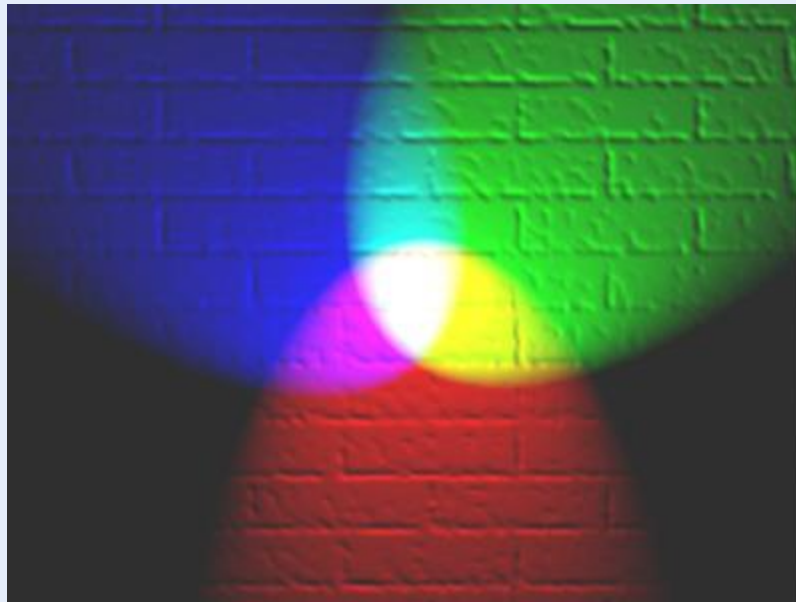


Science vs. Art

- **Elements of Good Photography**
 - Two key elements: focus and exposure.
 - Without getting them right, all is lost.
- **How light works with the Photo medium (film vs./digital)**
 - Similarities and differences
- **How exposure works**
 - Aperture
 - Shutter Speed
 - ISO Setting
- **How aperture affects the picture**
- **How shutter speed affects the picture**
- **How they work together**
- **How to get your desired effect**

How Light Works

- **RGB**



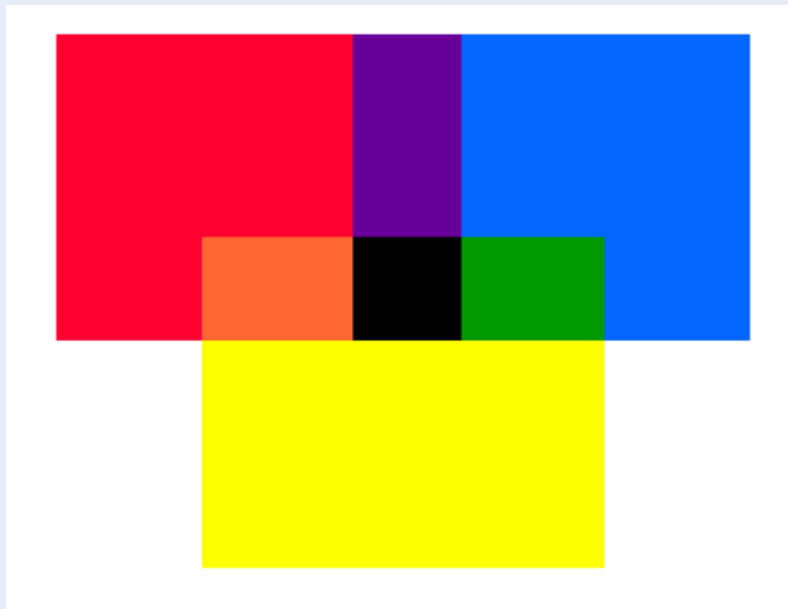
Additive

White = All colors Together

Black = No colors

How Paint Works

- **RYB**



Subtractive

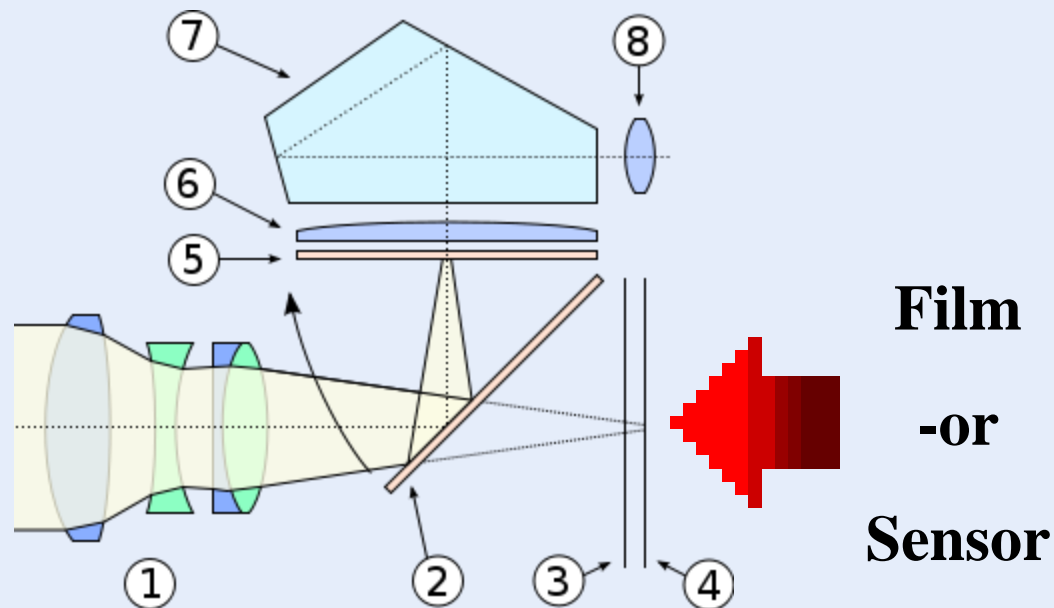
All together Different!

Black = All colors Together

White = No colors

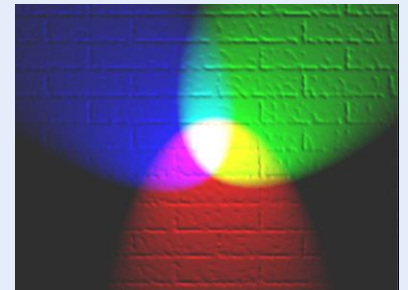
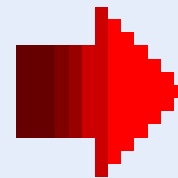
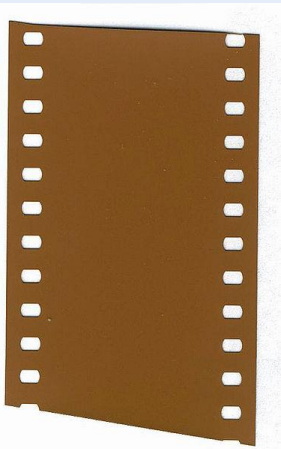
How the Camera Works

- **Film / Digital it's the Same**



Film

- **Film is Chemical**

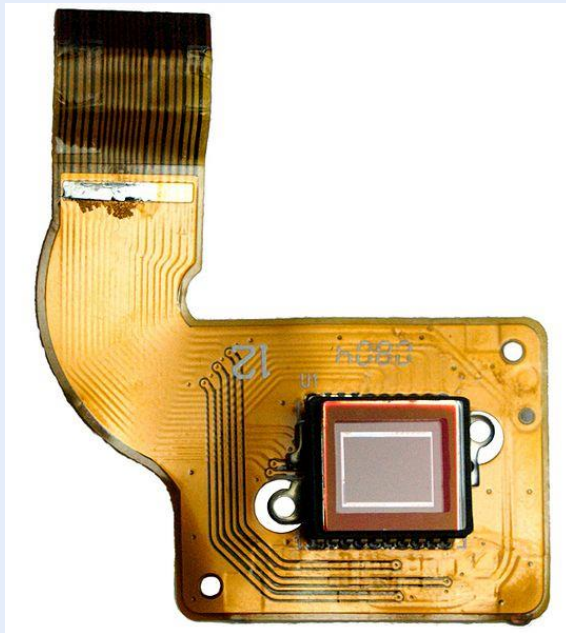


Film Darkroom

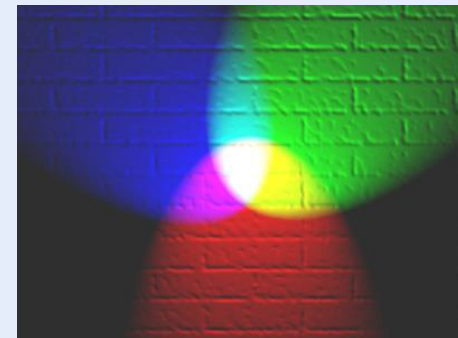
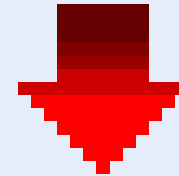


Digital

- Digital is Electronic



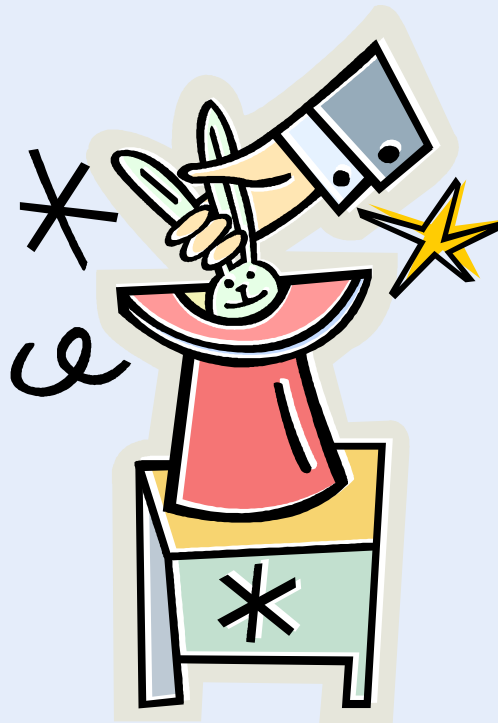
100101001001010100110100100
100110101010100101010101010
010100110101010100101011010



Digital Darkroom



Either Way It's Magic!





Useful Info about Digital

- **EXIF Info**
 - **Stored information about the picture:**
 - Camera
 - Shutter Speed
 - Date
 - *f*-Stop
 - Time
 - ISO Speed
 - **Used for historical record**
 - **Useful as a learning tool**

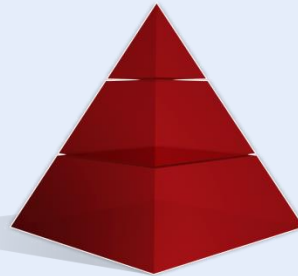
Exposure

- **It's a Balancing Act**
 - **Between Lens Aperture**
 - **And Shutter Speed**

Aperture

Correct Exposure

Shutter Speed



Lens Aperture

It's like the iris of
your eye



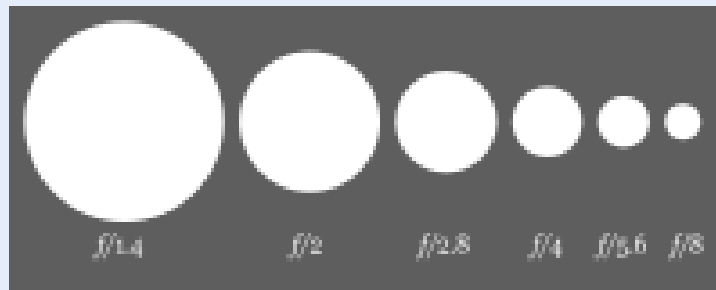
Open wide to let
in more light

Closed down to let
in less light



Lens Aperture

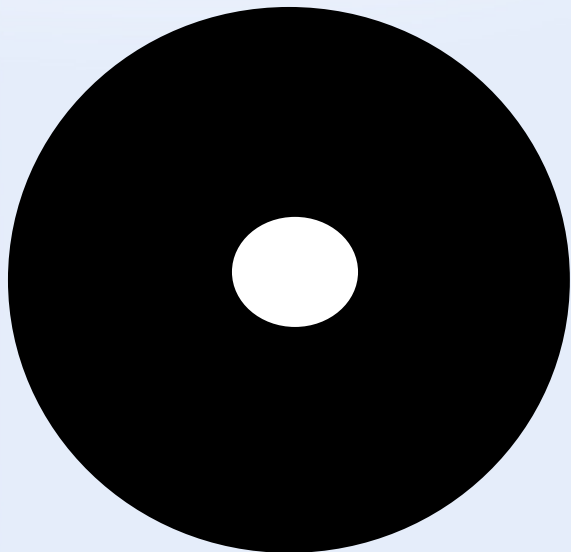
- **The Diaphragm of the Lens**
 - Controls the amount of light reaching the sensor (film)
 - The larger the aperture, the more light



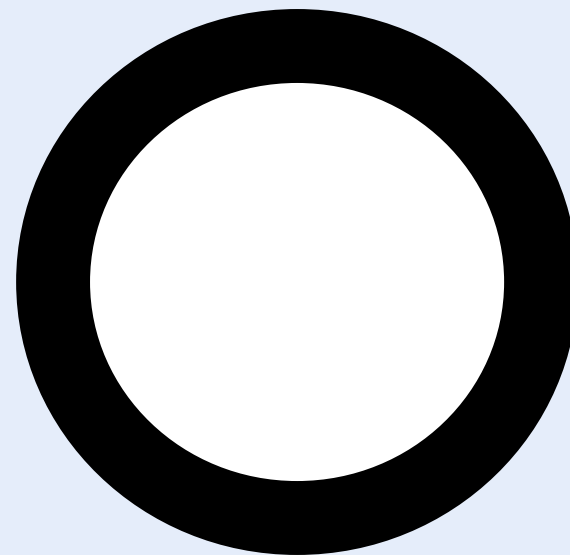
Designated by *f*-Stops

The larger the aperture, the smaller the *f*-Stop #

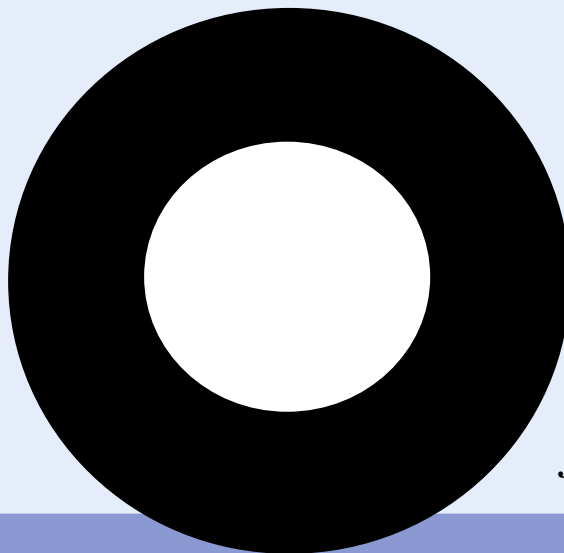
f-Stops



f / 8



f / 1.4



f / 2.8



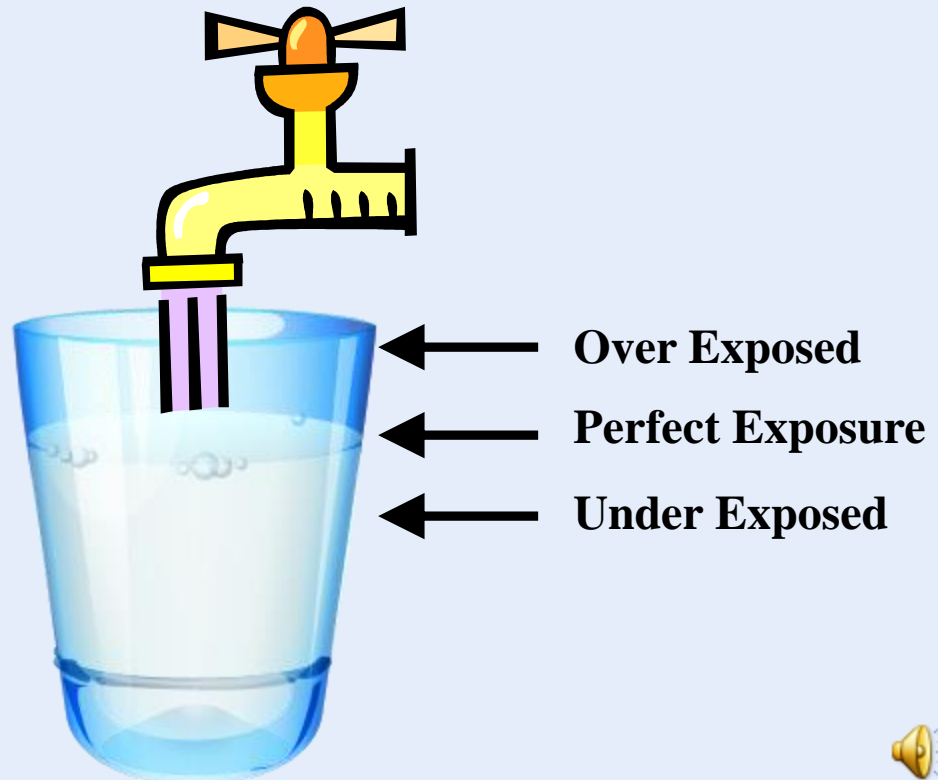
Shutter Speed

- Controls the amount of time the camera allows light to reach the sensor (film).
- Expressed in fractions of a second:
 - 1/60 Slowest recommended speed for hand-held
 - 1/200 General stop motion
 - 1/1,000 Stop action
- More on this later!

Filling the Water Glass

- Turn the faucet on full blast

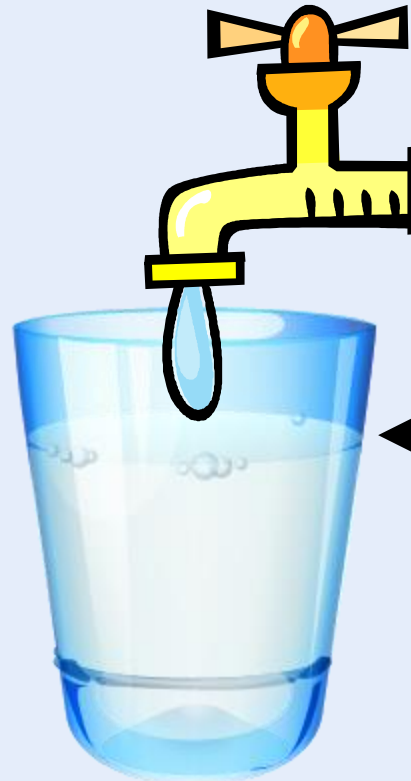
How long does it take to fill the glass?



Filling the Water Glass

- Turn the faucet on low

How long does it take to fill the glass?

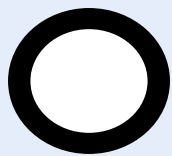


Perfect Exposure



Back to Our Balancing Act

- The amount of light reaching the sensor must be balanced by the amount of time it is allowed to reach the sensor
 - More Light –Less Time



f 2.8

1/1,000 sec

- Less Light –More Time

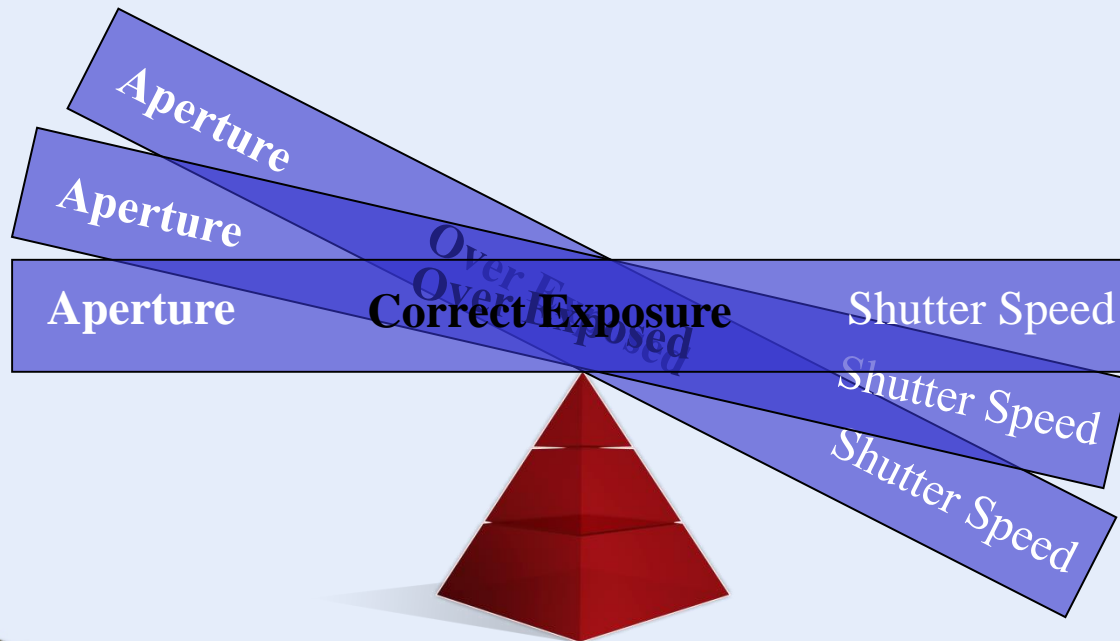


f 8

1/125 sec

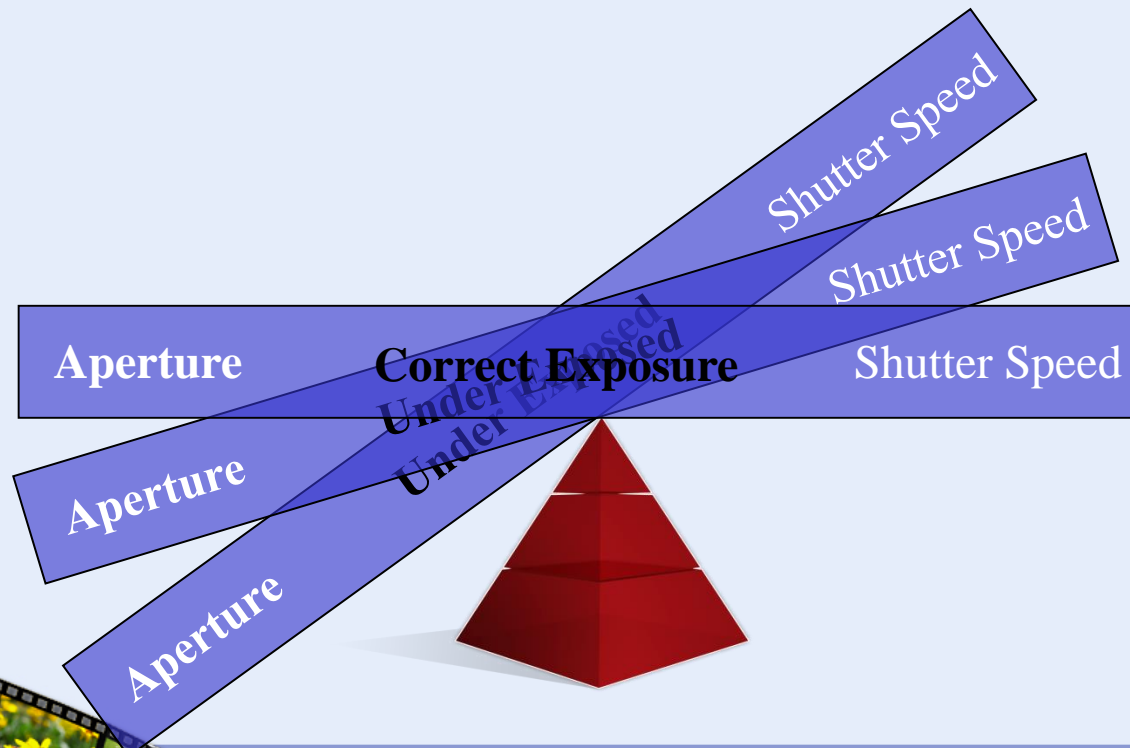
Our Balancing Act

More Light – Less Time

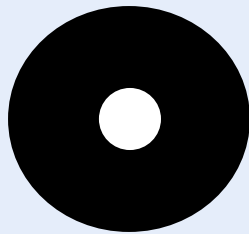


Our Balancing Act

Less Light – More Time



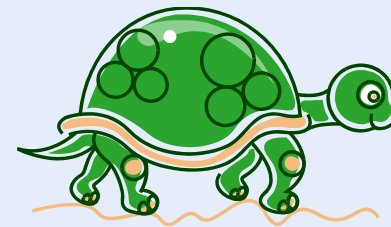
Our Balancing Act



Aperture

Small Aperture

f / 8

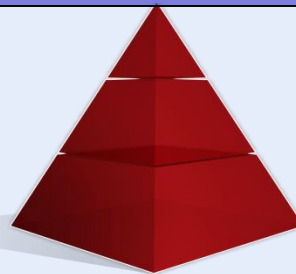


Shutter Speed

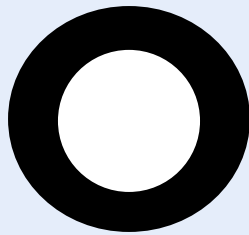
Slow Shutter Speed

1 / 125

Correct Exposure



Our Balancing Act



Aperture

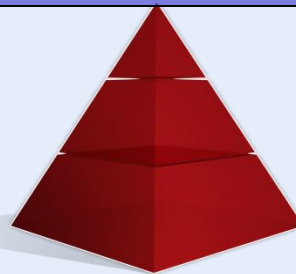
Large Aperture
f / 2.8



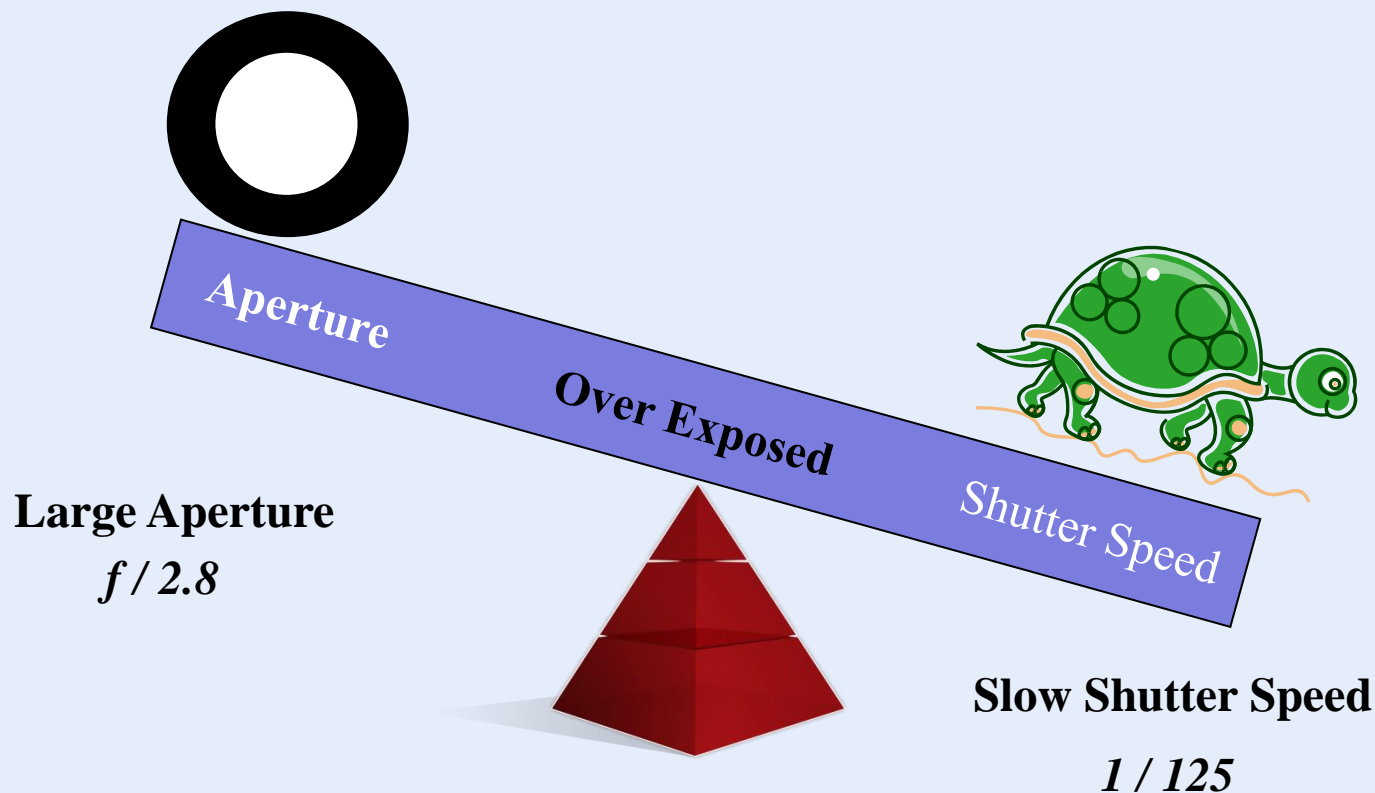
Shutter Speed

Fast Shutter Speed
1 / 1,000

Correct Exposure



Out of Balance



Picture too Bright!



Over Exposed

- **Picture Too Bright**
 - Loss of detail in the highlights
 - Washed out look
 - Shadows are too bright

Over Exposed



***f*-Stop: *f* 8**

Shutter Speed: 1/13

ISO: 200

Over Exposed

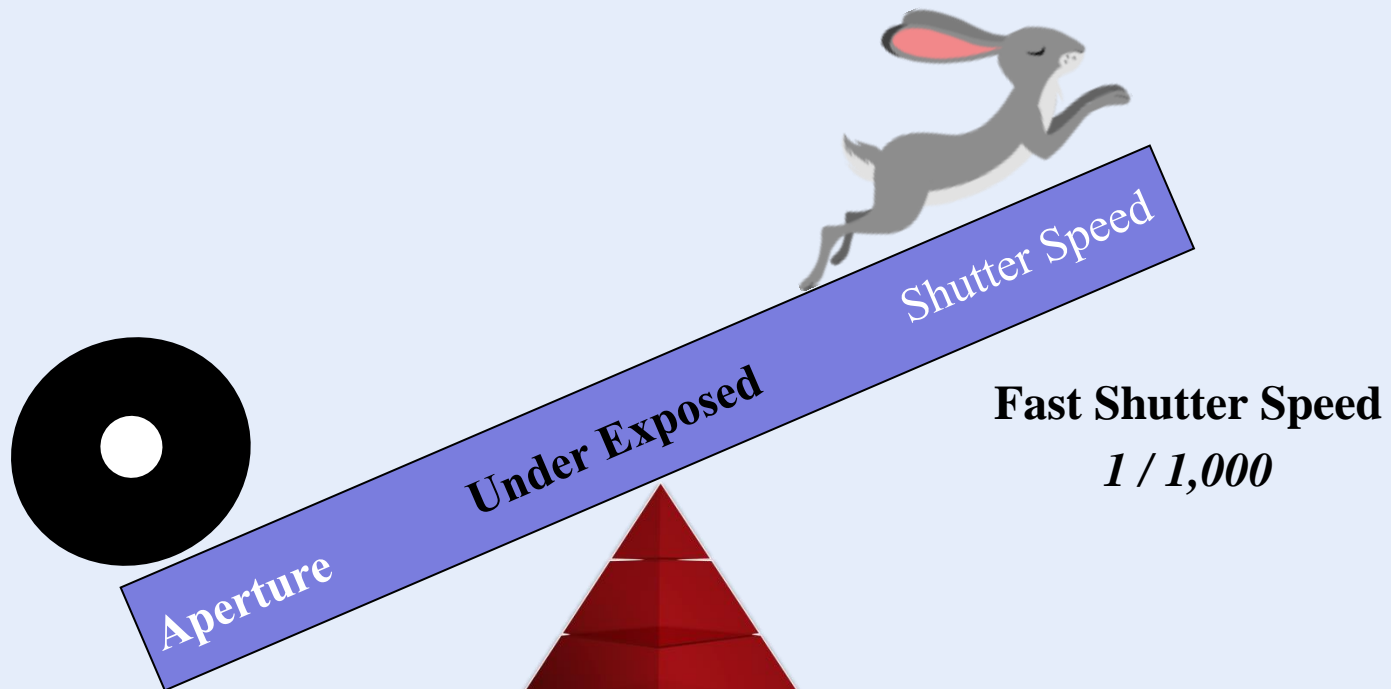


f-Stop: *f* 5.6

Shutter Speed: 1/60

ISO: 320

Out of Balance



Small Aperture
 $f/8$

Fast Shutter Speed
 $1 / 1,000$

Picture too Dark!



Under Exposed

- **Picture Too Dark**
 - **Low contrast**
 - **“Muddy” look**
 - **Loss of detail in the shadows**

Under Exposed



***f*-Stop: *f* 5.6**

Shutter Speed: 1/20

ISO: 1600

Under Exposed



***f*-Stop: *f* 10**

Shutter Speed: 1/200

ISO: 100

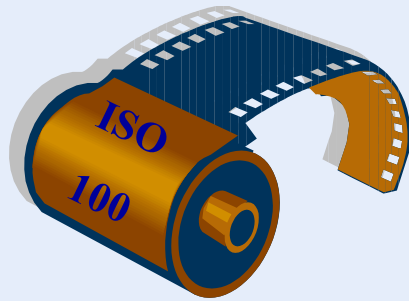


“Film Speed”

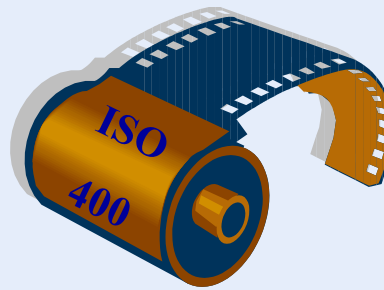
- **ISO Rating**
 - **The sensitivity of the film –or sensor to light**
 - **The Higher the number the more sensitive to light.**
 - **The higher the number, the “grainer” the picture.**
 - **Used to compensate for out of balance exposure**

ISO

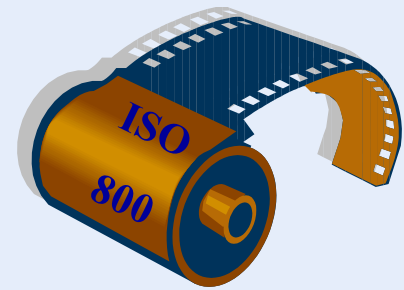
- **Film**
 - The entire roll had same ISO rating



Bright Light



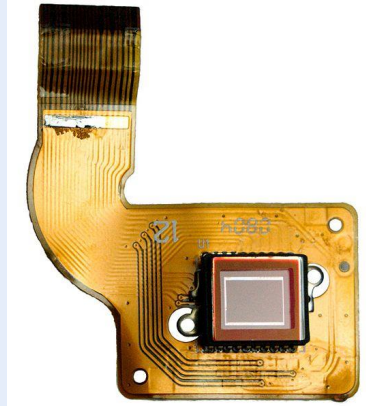
Medium Light



Low Light

Digital ISO

- **Digital Cameras**
 - Each picture has it's own ISO rating
 - Happens in the background
 - Unless you manually adjust it (if you can)



Crank it Up!





Digital Noise

- **The Higher the ISO Number**
 - The more sensitive to light
 - You can take perfectly exposed pictures in low light.
- **But –there’s a cost!**
 - “Digital Noise”

Digital Noise



High ISO #

Low ISO #

The Exposure Triangle

Aperture

Shutter
Speed

Correct Exposure

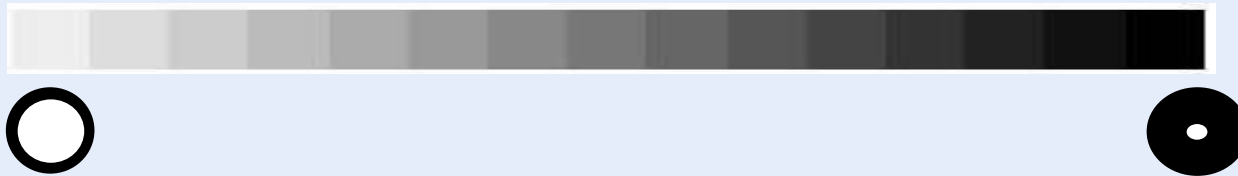
Exposure
Triangle

ISO Value

By the Numbers –Old School

Traditional Aperture Numbers

f 1.4 *f* 2 *f* 2.8 *f* 4 *f* 5.6 *f* 8 *f* 11 *f* 16 *f* 22 *f* 32



Each increase in *f*-Stop Doubles the amount of light reaching the sensor.

By the Numbers –Old School

Traditional Shutter Speeds

1/1000 1/500 1/250 1/125 1/60 1/30 1/15 1/8 1/4 1/2 1



Each decrease in Shutter Speed Doubles the amount of Time light reaches the sensor.

By the Numbers –Old School

Traditional ISO Ratings

100 200 800 1600 3200 6400 12800



Each increase in ISO Rating Doubles the light sensitivity of the sensor.

By the Numbers –Old School

Traditional Aperture Numbers

f 1.4 *f* 2 *f* 2.8 *f* 4 *f* 5.6 *f* 8 *f* 11 *f* 16 *f* 22 *f* 32



Traditional Shutter Speeds

1/1000 1/500 1/250 1/125 1/60 1/30 1/15 1/8 1/4 1/2 1



Traditional ISO Ratings

100 200 800 1600 3200 6400 12800





By the Numbers -Today

- Today's cameras are not locked into full
 - *f-Stops*
 - *Shutter Speeds*
 - *ISO Ratings*
- They have infinite sliding-scale variations



**Do I Really Need To Know all
this Math??**

NO!

NO!

NO!

NO!

**But understanding the relationship between
Aperture, Shutter Speed, and ISO Rating is
important!**

NO!

NO!

NO!

NO!

Putting it all Together



Back to Our Balancing Act

- **The Balancing Act**
 - **Between Lens Aperture**
 - **Shutter Speed**
 - **And ISO Rating**

Aperture

Correct Exposure

Shutter Speed

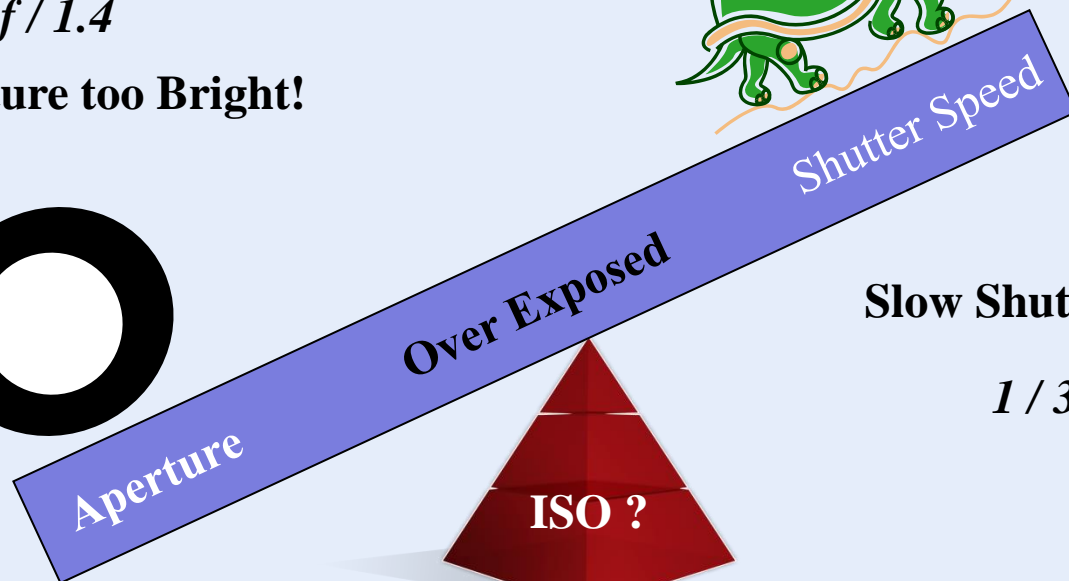
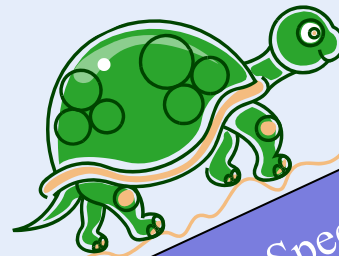
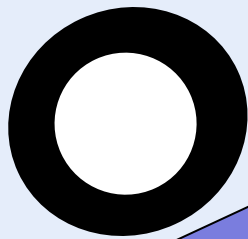
ISO

Our Balancing Act

Large Aperture

$f / 1.4$

Picture too Bright!



Slow Shutter Speed

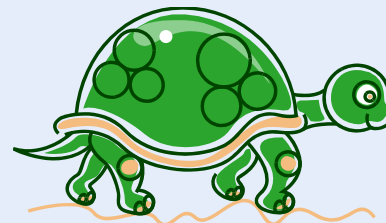
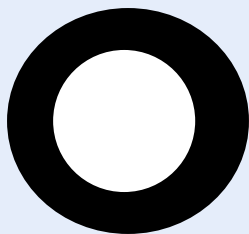
$1 / 30$

ISO 100

ISO 1600



Exposure Balanced



Aperture

Correct Exposure

Shutter Speed

Large Aperture

f / 1.4

Back in Balance!

Slow Shutter Speed

1 / 30

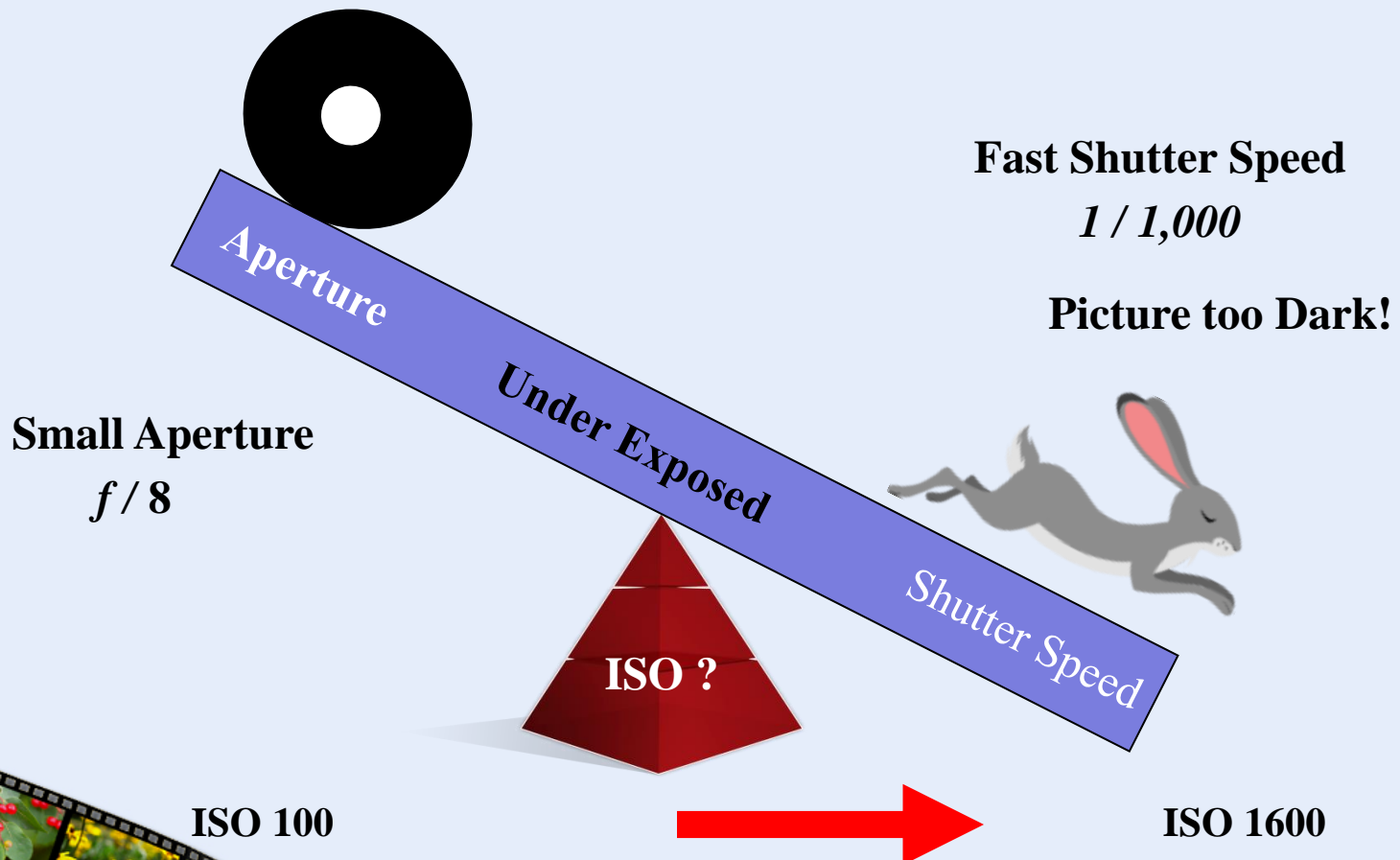
**ISO
200**

ISO 100

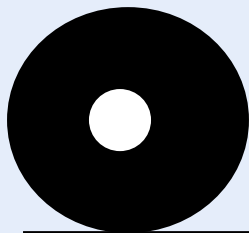


ISO 1600

Out of Balance



Exposure Balanced



Aperture

Correct Exposure

Shutter Speed

Small Aperture

f / 8

Fast Shutter Speed

1 / 1,000

Back in Balance!

ISO 100

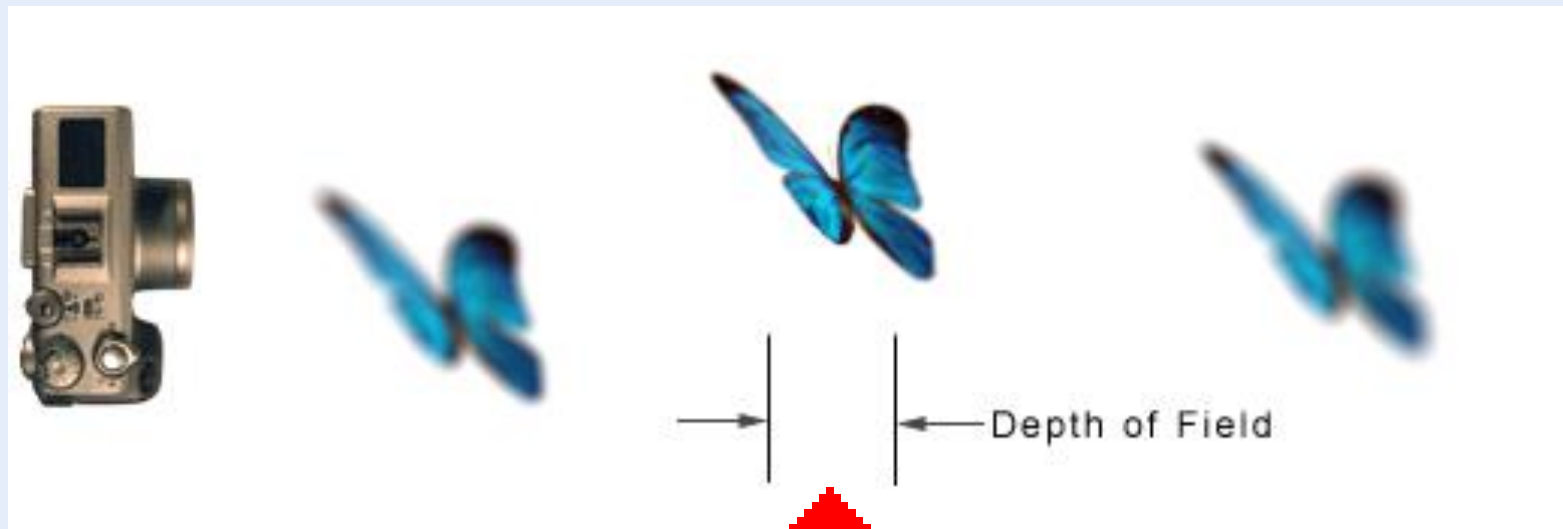
ISO
800

ISO 1600



Depth of Field

- The amount of the picture that is in focus



Out of Focus

In Focus

Out of Focus

Depth of Field

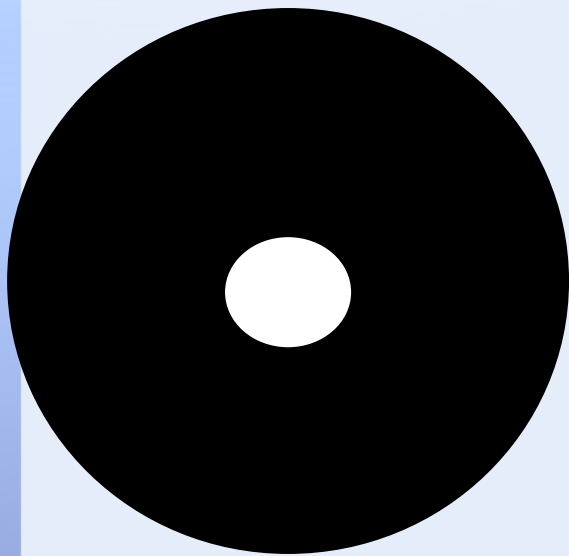
- The amount of the picture that is in focus

**Long Depth of
Field**



**Shallow Depth
of Field**

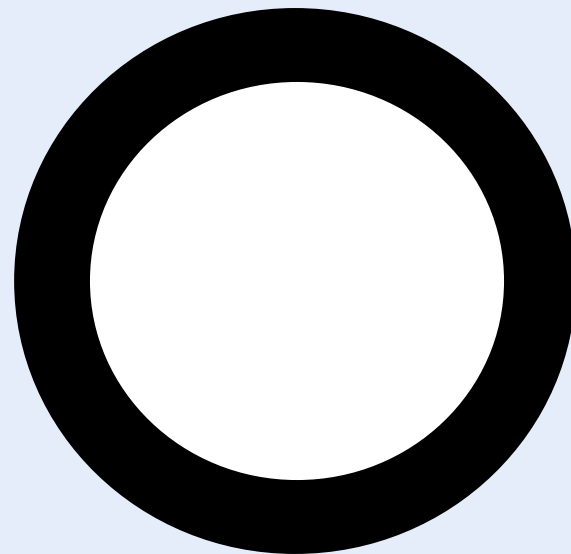
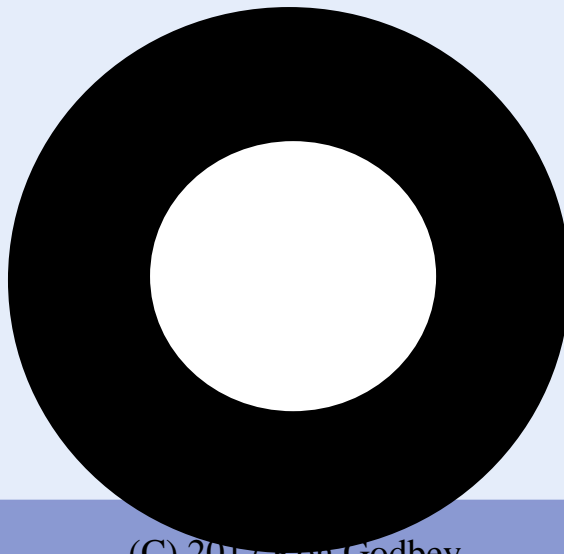
Controlled by Aperture



f/16

**Long Depth of
Field**

**Medium Depth
of Field**
f/8



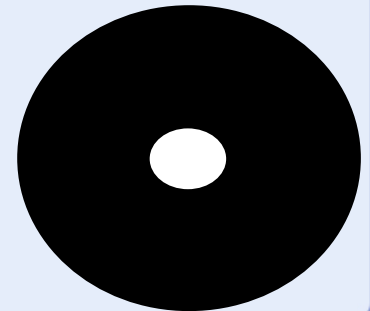
f/2.8

**Shallow Depth
of Field**

Depth of Field

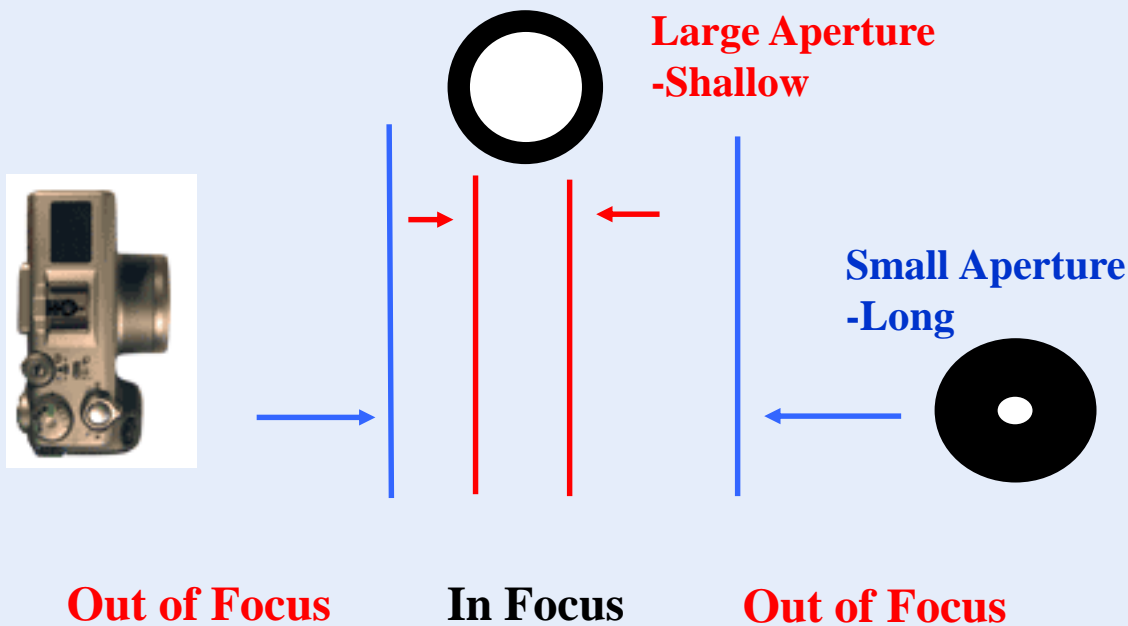
- **Long Depth of Field (small Aperture)**
 - Landscapes
 - Multiple objects at different distances
 - “Shotgun” Approach

(I don’t have time to think about all this stuff –I just want to take the picture!)



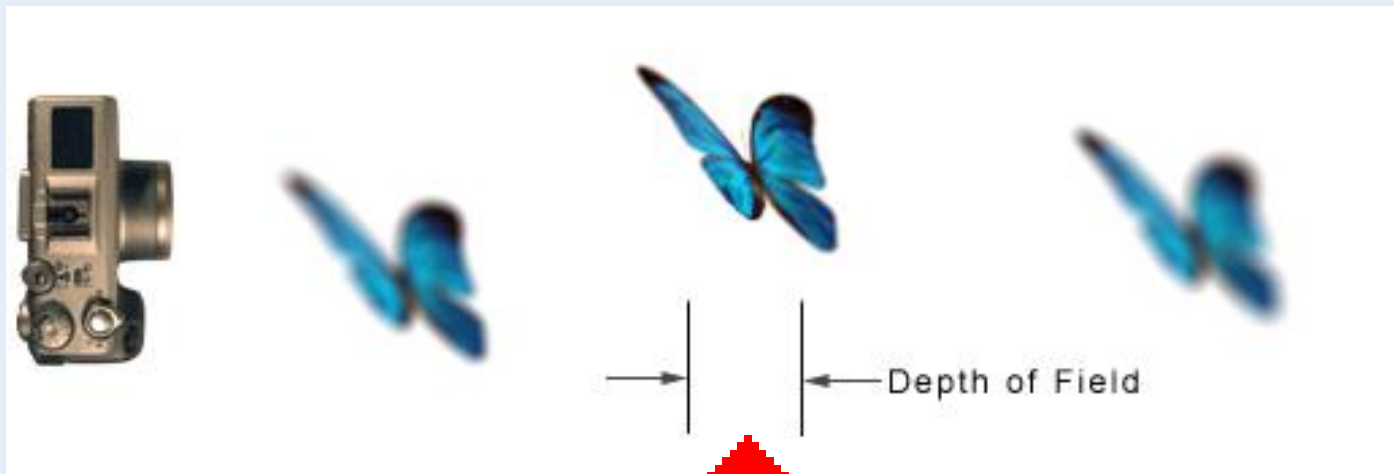
Depth of Field

- The amount of the picture that is in focus



Depth of Field

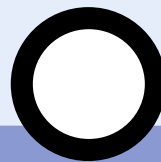
- The amount of the picture that is in focus



Out of Focus

Shallow

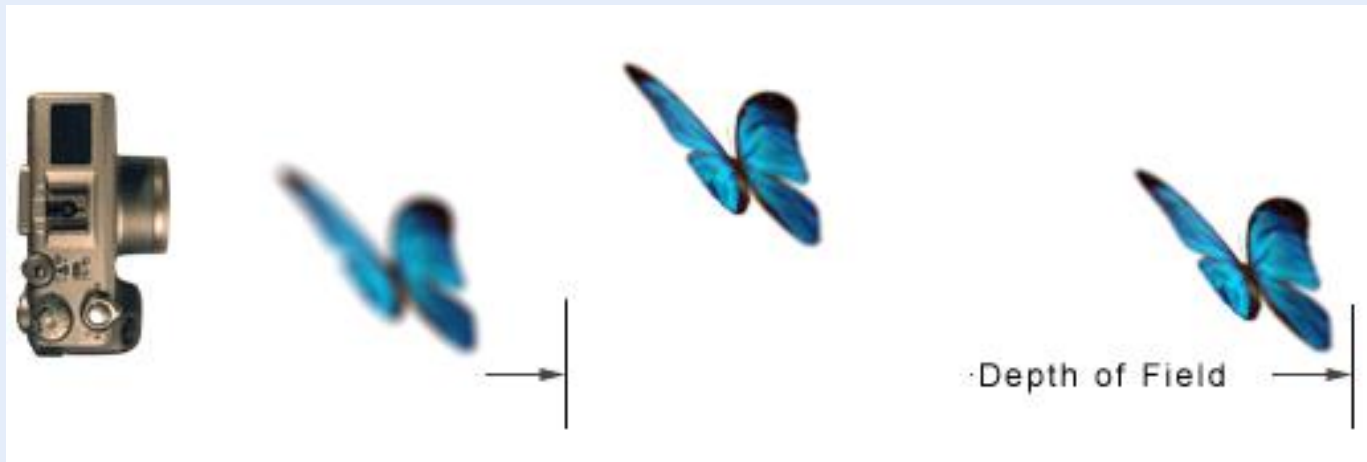
Out of Focus



Large Aperture

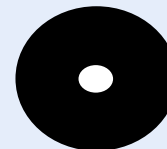
Depth of Field

- The amount of the picture that is in focus



Out of Focus

Long



Small Aperture

Depth of Field



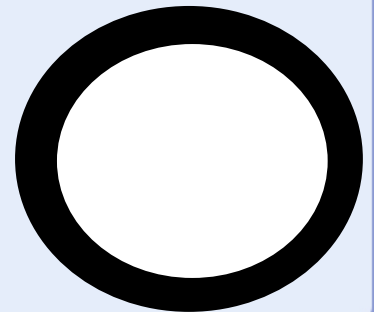
f-Stop: *f* 3.5

Shutter Speed: 1/1600

ISO: 100

Depth of Field

- **Shallow Depth of Field (large Aperture)**
 - Portraits
 - Close-ups
 - “Crap, I screwed up –it’s out of focus”
(Shallow depth of field is the hardest to get right)



Depth of Field -Shallow



***f*-Stop: *f* 5.6**

Shutter Speed: 1/60

ISO: 125



Rule of Thumb #2

- **The closer you are to the subject, the shallower your Depth of Field.**
- **It can be controlled by the aperture.**

Depth of Field

- Camera lens is always wide open
- Depth of Field is only applied when the shutter button is pressed





Know When to use it

- **Portraits** -Shallow? Or Deep? **Shallow!**
- **Landscapes** -Shallow? Or Deep? **Deep!**
- **Close-ups** -Shallow? Or Deep? **Shallow!**
- **Parties** -Shallow? Or Deep? **It Depends!**

Rule of Thumb #3

- **The Eyes Have it!**
 - Always focus on the eyes



f-Stop: *f* 4

Shutter Speed: 1/60

ISO: 100

Depth of Field Examples

- **BAD!**



f-Stop: *f* 4

Shutter Speed: 1/60

ISO: 100

Depth of Field Examples

- Good



f-Stop: *f* 3.5

Shutter Speed: 1/60

ISO: 100



Shutter Speed

- More on this now!
- Controls the amount of time the camera allows light to reach the sensor (film).
- Expressed in fractions of a second:
 - 1/60 Slowest recommended speed for hand-held
(Common for Flash Photography)
 - 1/200 General stop motion
 - 1/1,000 Stop action

Shutter Speed

- **Fast Shutter Speed**
 - Stops motion
 - Reduces camera shake



Shutter Speed

- **Slow Shutter Speed**
 - Blurs motion
 - Increases chance of camera shake



Shutter Speed

- Use to Get your Desired Effect



Rule of Thumb #4

- In General, use the fastest Shutter Speed possible
 - Less than 1/60 can show camera shake
 - Use a Tripod



Or a Tree-pod

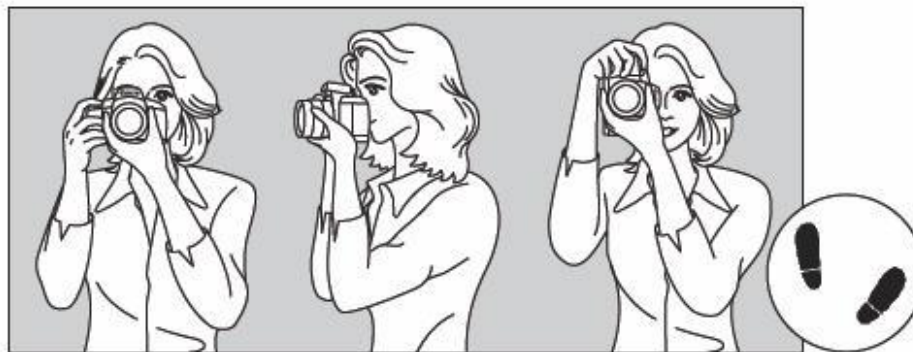


Rule of Thumb #5

- **Learn How to Hold the Camera Steady**

Holding the Camera

To obtain sharp images, hold the camera still to minimize camera shake.



Horizontal shooting

Vertical shooting

1. Wrap your right hand around the camera grip firmly.
2. Hold the lens bottom with your left hand.
3. Press the shutter button lightly with your right hand's index finger.
4. Press your arms and elbows lightly against the front of your body.
5. To maintain a stable stance, place one foot in front of the other.
6. Press the camera against your face and look through the viewfinder.

Shutter Speed Examples

Fast or Slow?

FAST!

Freeze motion

Sharp Focus

Clear Detail



f-Stop: *f* 5

Shutter Speed: 1/500

ISO: 3200

Shutter Speed Examples

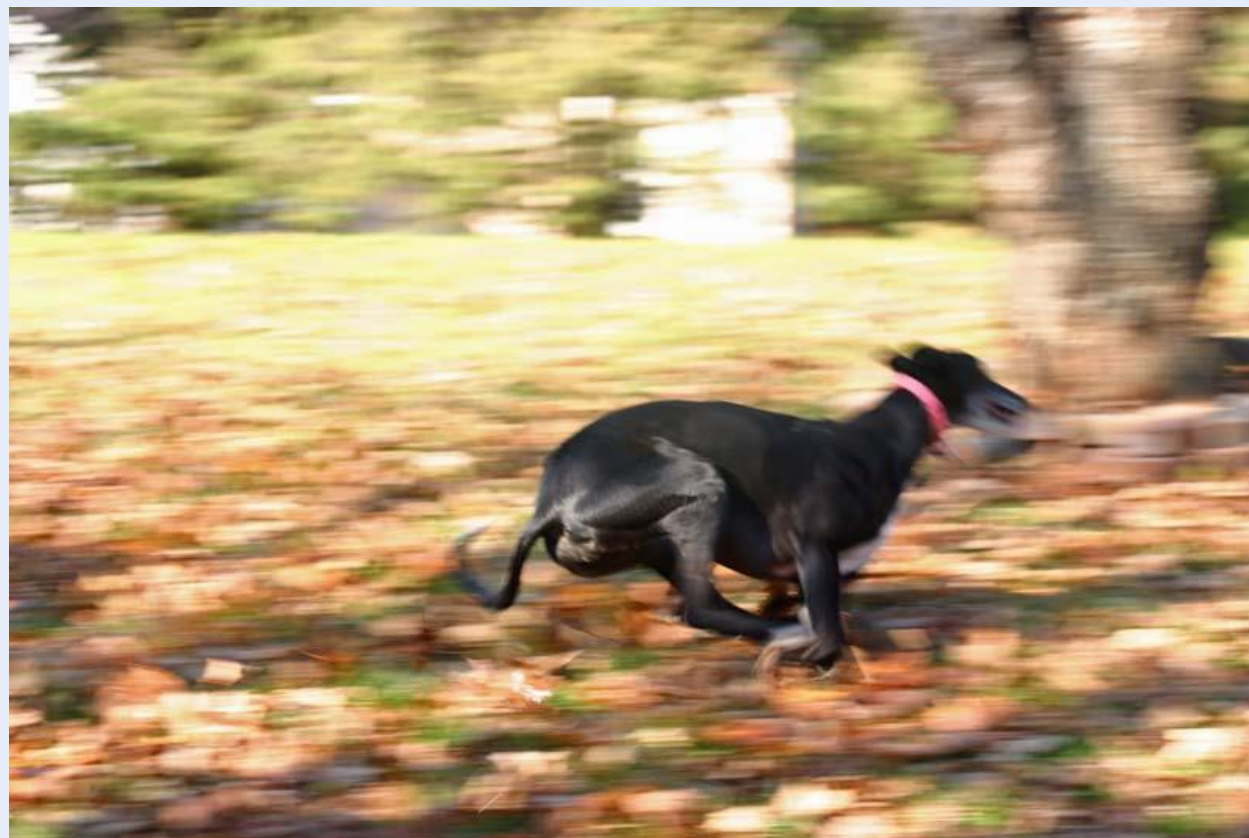
Fast or Slow?

SLOW!

Blur motion

Soft Focus

Less Detail

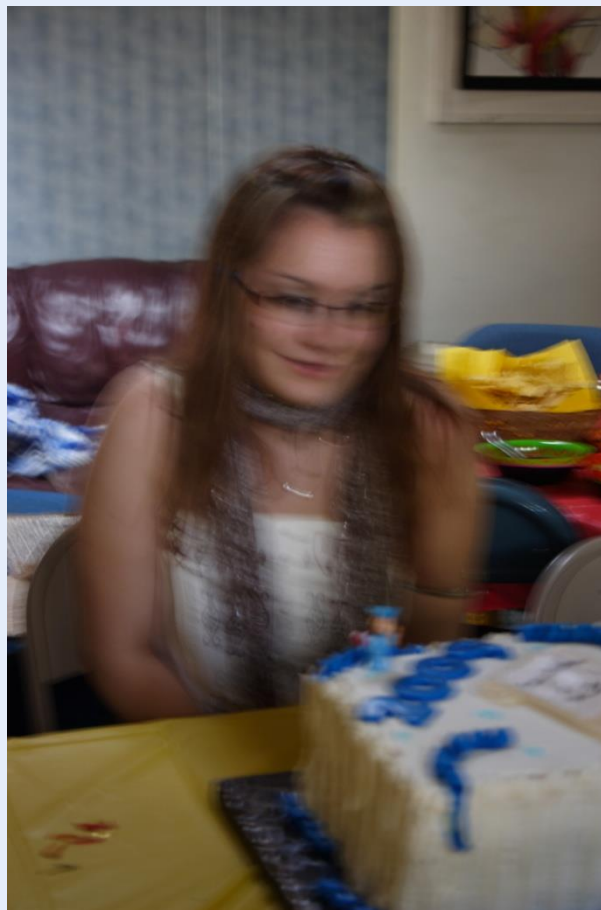


f-Stop: *f* 5.6 Shutter Speed: 1/100

ISO: 100

Shutter Speed Examples

- **BAD!**
- **Too Slow!**
- **Camera Shake!**



f-Stop: *f* 5.6

Shutter Speed: 1/5

ISO: 100



How Aperture and Shutter Speed Work Together

- **Aperture effects Depth of Field**
 - Wide Aperture -Shallow Depth of Field
 - Small Aperture -Long Depth of Field
- **Shutter Speed Effects Freezing of Motion**
 - Fast Shutter Speed -Stops Motion
 - Slow Shutter Speed -Blurs Motion

How Aperture and Shutter Speed Work Together

- **Consider the main Preference of your Picture:**

- **If it is to have a Shallow Depth of Field**



- **Use a wide aperture**

- **Realize you will need a FASTER shutter speed**

- » **And motion will be frozen**



- **If it is to have a long Deep Depth of Field**



- **Use a small aperture**

- **Realize you will need a SLOWER shutter speed**

- » **And motion may be blurred –hold camera steady!**



How Aperture and Shutter Speed Work Together

- **Consider the main Preference of your Picture:**

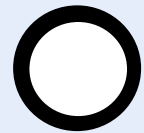
- **If it is to Stop Motion**



- Use a **FASTER** shutter speed

- Realize you will need a wider aperture

- » And you will have a shallow depth of field



- **If it is to Show (blur) Motion**



- Use a **SLOWER** shutter speed

- Realize you will need a smaller aperture

- » And you will have a deep depth of field



Camera Simulator

- Link to Camera Simulator





Show and Tell!

- **Bring out your Cameras**
 - Tell us a little about it
 - How long have you had it?
 - Do you love it –or HATE it?
 - What does it do that you like
 - What can't it do that you wish it could?
 - Have you read (really read) the instructions?

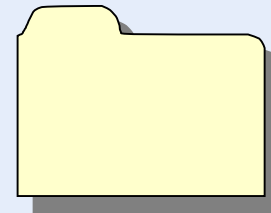


Show and Tell!

- **Let's look at your Good Pictures**
 - **Why is it good?**
 - **What did you do right?**
 - **What could you have done to make it better?**
 - **From what you have learned so far, tell us about the Science (i.e. shutter speed, aperture, exposure)**

Show and Tell!

- **Let's look at your Bad Pictures**
 - Why is it bad?
 - What did you do right?
 - What went wrong?
 - From what you have learned so far, tell us about the Science (i.e. shutter speed, aperture, exposure)
- **Remember: You learn more from your bad pictures than you do from your good pictures**





Session 2 Recap

- **Light is light whether it's RGB or 100101**
- **The Balancing Act**
- **Aperture**
- **Shutter Speed**
- **ISO**
- **Making them work together**



Next week

- **Session 3: The Science of Art**



Assignment

- **Bring your camera to class**
- **Take some pictures**
- **E-mail me a good picture**
 - Think about why it's good
- **E-mail me a bad picture**
 - Think about why it's bad