BASIC PRINCIPLES OF DIGITAL PHOTOGRAPHY
IN THIS LECTURE

• The Exposure
• The Aperture
• Depth of Field
• The Shutter Speed
• The ISO Setting
• Camera Metering
• Tying It All Together - Understanding Camera Lenses
• The influence of Focal length
Cameras are nothing more than a lightproof box with a hole on one side and a light sensitive material on the other side.
COMPONENTS OF SLR CAMERA

The SLR - Single Lens Reflex

light enters through the lens.

prism

viewfinder

digital sensor or film

The mirror sits at a 45 degree angle to the lens. During exposure, the mirror flips up to let light through to the sensor.
The two basic design types of digital cameras:

- **Compact, point-and-shoot** models

- **Digital SLR** models. Digital SLR models are often called dSLRs. The acronym SLR, means **single-lens reflex** which refers to some internal mechanisms used by this type of cameras. The most important thing to know is that the SLR cameras **enable you to change lenses**. You can use a wide-angle lens for your travel photography, for example, and switch to a close-up lens for pictures of flowers and other small subjects. Point-and-shoot models do not offer this flexibility. Both types of cameras have their pros and cons
Advantages:
- Surprising power in a small package.
- Convenience and Ease of Use.
- Autofocus, Autoexposure, and Auto just-about-everything else.
- Less expensive than dSLRs.
- Many point-and-shoot cameras offer just about the same advanced photographic controls as a dSLR.

Disadvantages:
- External controls are limited because the camera’s body is relatively small.
WHAT IS EXPOSURE?

• **Exposure** is a process for **controlling** the **amount of light** that is allowed **to record on the digital sensor**.

• The **main objective** of making an exposure is to **record just the right amount of light**; so that the image is neither **too dark** (underexposed) nor **too light** (overexposed).
The main settings that control exposure are:

- **Aperture**: controls the area over which light can enter your camera.

- **Shutter speed**: controls the duration of the exposure

- **ISO**: controls the sensitivity of your camera's sensor to a given amount of light
Many combinations can be made of the three exposure settings to achieve the desired exposure. Aperture affects depth of field, shutter speed affects motion blur and ISO speed affects image noise.
The zone of sharpness in photography is called the depth-of-field, and it extends in front of and behind the point that you actually focused on. **The size of the zone** is determined by three key factors: The aperture of the lens, **the focal length** of the lens used, and **the distance you are from the subject**. Varying these three elements allows you almost complete control over the depth-of-field in a picture.
• The amount of light coming through the lens is controlled by the aperture setting.
• The smaller the lens opening is, the greater the depth of field.
The aperture range of a lens refers to **the amount that the lens can open up or close down to let in more or less light, respectively**. Apertures are listed in terms of F-numbers, which quantitatively describe relative light-gathering area.

\[ F = \frac{f}{D} \]

where \( F \) is the relative aperture, \( f \) is the focal length divided by the aperture diameter.

- **Full focal length** as \( f/1=f \)
- **Half focal length**
Lenses with **larger apertures** are also described as being "**faster,**" because for a given **ISO speed,** the shutter speed can be made faster for the same exposure. Additionally, a **smaller aperture** means that objects **can be in focus over a wider range of distance,** a concept also termed **the depth of field.**

<table>
<thead>
<tr>
<th>f-#</th>
<th>Light-Gathering Area (Aperture Size)</th>
<th>Required Shutter Speed</th>
<th>Depth of Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher</td>
<td>Smaller</td>
<td>Slower</td>
<td>Wider</td>
</tr>
<tr>
<td>Lower</td>
<td>Larger</td>
<td>Faster</td>
<td>Narrower</td>
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Depth of field is the range of distance within the subject that is acceptably sharp. The depth of field varies depending on camera type, aperture and focusing distance, although print size and viewing distance can influence our perception of it.
The smaller the aperture size, the more that a scene will be sharp from near to far.

Depth of field is the area from near to far in a scene that is acceptably sharp in a photography.

Here the lens is set to its widest aperture, f/2 and focused on the middle boy, who is at a distance of 7 ft. The depth of field extends from more than 6 ft to less than 8 ft.
When the lens is stopped down to its smallest aperture, f/16 the depth of field increases.

Everything between about 5ft and 13ft is now sharp at the same focusing distance of 7 ft.

**NOTE**: The bigger the f-stop number, the smaller the lens opening; f/16 is smaller aperture than f/2.
DEPTH OF FIELD:

Images with different f-numbers showing the depth of field effect.
DEPTH OF FIELD:

Wide Aperture
f/2.0 - low f-stop number
shallow depth of field

Narrow Aperture
f/16 - large f-stop number
large depth of field
The **amount of time** that the **shutter is open**. Allowing the **sensor** to be **exposed to the light** coming in **through the lens**.

(measured in **seconds** or **fractions of a second**).

[BULB, 1 sec, \(\frac{1}{2}\), \(\frac{1}{4}\), \(\frac{1}{8}\), \(\frac{1}{15}\), \(\frac{1}{30}\), \(\frac{1}{60}\), \(\frac{1}{125}\), \(\frac{1}{250}\), \(\frac{1}{500}\), and \(\frac{1}{1000}\)]
The shutter speed is also responsible for either freezing movement or blurring movement.
How the shutter speed affects the exposure.

The aperture and the ISO settings have been kept constant as the shutter speed gets shorter, less light is allowed to reach the sensor. Less light results in a darker image.
ISO (International Standard Organization)

The **measure sensitivity to light** of a digital camera **sensor's**.

*In the case of traditional film, each individual roll of film has an ISO rating.*
The higher the ISO, the more sensitive the film is to light. An ISO 200 film is twice as sensitive (or 1 stop more sensitive) to light as an ISO 100 film and requires 1 stop less light to achieve the same exposure.
• The **side effect** of ISO is **digital noise**.
• The **higher** the ISO setting, the **more noise** is present in the image.
• **Digital noise** lowers the overall **clarity** of the image.
Understanding camera lenses can help add more creative control to digital photography. Choosing the **right lens** for the task can become a complex trade-off between cost, size, weight, lens speed and image quality. This section aims to improve understanding by providing an introductory overview of concepts relating to

- **lens elements & image quality.**
- **The influence of Focal length.**
- **Zoom lenses.**
The simplest cameras contain lenses which are actually comprised of several “elements." Each of these elements aims to direct the path of light rays such that they recreate the image as accurately as possible on the digital sensor. The goal is to minimize aberrations. Optical aberrations occur when points of the image do not translate back onto single points after passing through the lens, causing image blurring, reduced contrast or misalignment of colours.
The focal length of a lens determines its **angle of view**, and thus also how much the **subject will be magnified** for a given photographic position. Wide angle lenses have small focal lengths, while telephoto lenses have larger corresponding focal lengths.
The influence of Focal length

| Wide angle (fisheye) | Normal lens (42mm) | Telephoto lens (138mm) |
• A zoom lens is one where the photographer can vary the focal length within a pre-defined range. The primary advantage of a zoom lens is that it is easier to achieve a variety of compositions or perspectives (since lens changes are not necessary).

For compact digital cameras, lenses listed with a 3X, 4X, etc. zoom designation refer to the ratio between the longest and shortest focal lengths. Therefore, a larger zoom designation does not necessarily mean that the image can be magnified any more (since that zoom may just have a wider angle of view when fully zoomed out).
The aperture setting controls the amount of light coming in through the lens.

The shutter speed setting controls how long the sensor is exposed to the light coming in through the lens.

The ISO setting controls how sensitive the digital sensor is to light.

All three exposure factors, aperture, shutter speed, and ISO, are used in relation to one another.