# Camera and Photography Basics

***DSLR***

Digital cameras come in many types. The one we'll be using today is a "digital single-lens reflex" (DSLR), which looks a lot like older film cameras of the SLR type.

"Digital" - the camera produces images digitally instead of on film

"Single-Lens" - there is one path for light to enter the camera

"Reflex" - the light entering is split via mirror to both imaging chip and viewfinder

SLR cameras, whether digital or film, are notable for allowing simple switching of different lenses to accomplish various photographic techniques.

***CCD vs. CMOS***

Digital cameras usually use one of two types of image sensor, either a charge-coupled device (CCD) or a complementary metal-oxide semiconductor (CMOS).

CCDs used to be the more common technology, but newer cameras outside of specialized applications tend to use CMOS because they operate more quickly, allowing DSLR cameras to shoot video in addition to stills.

***ISO***

The International Organization for Standardization (ISO) established a numerical scale to rate how sensitive different kinds of film were to light. This scale was retained for digital cameras. When you change the ISO value on a DSLR, you can think of it as changing film to something more or less light sensitive to what is currently in the camera. A big advantage of a digital camera is that you can change the ISO from shot to shot, instead of only per roll of film.

Higher ISO numbers are more light sensitive, meaning the camera will be able to take pictures in darker environments. However, higher ISO numbers also tend to produce grainier images.

- ISO 100: suitable for a bright, sunny day

- ISO 800: indoor spaces when not using a flash
- ISO 1600: dim or even dark environments

***F-Stop***

The measure of how much light is allowed to enter the camera to reach the imaging sensor. This is controlled mechanically, by opening or closing the camera ***aperture***. Different lenses have different apertures, handling different f-stop ranges.

Lower f-stop numbers indicate that the aperture is more open, allowing in more light. Lower f-stop numbers also narrow the depth of field, causing the area of focus to be relatively shallow, with foreground and background parts of the image being out of focus.

- f/1.2 - f/2.8 - lets in a lot of light; shallow depth of field
- f/4 - f/8 - useful in many scenarios; somewhat wider depth of field
- f/11 - f/32 - best for bright settings; wide depth of field

***Depth of Field***

The “depth of field” is the distance between the nearest and furthest in-focus objects in an image. A narrow depth of field will have a very narrow area in which objects will be in focus. A wide depth of field will put most elements of the image in focus. Turning the focus ring will adjust the position of the in-focus area, or *focal point*.

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|---|---|---|
| Shallow depth of field<br>Aperture = f/1.4. DOF=0.8 cm | Aperture = f/4.0. DOF=2.2 cm | Wide depth of field<br>Aperture = f/22. DOF=12.4 cm |

***Shutter Speed***

The shutter speed, aka exposure time, is the time that the image sensor is exposed to light when capturing an image. The *shutter* is a mechanical window inside the camera that opens and closes to allow light into the sensor for a selected amount of time.

A fast shutter speed, such as 1/1000 of a second, will allow light into the sensor extremely briefly. This will work in bright lighting conditions, but may not allow enough light to impact the sensor in dimmer light.

An extremely slow shutter speed, for example ½ second, 1 second, or even more, will allow a lot of light into the sensor and can be useful in low light conditions. However, a lot can happen over a few seconds. Long exposure times may create “motion blur” for any moving object within the frame (or for the whole frame if the camera itself is moving). This may or may not be a desired artistic effect.

### *Over- and Under-Exposed*

Overexposed images may look “too bright” because they were captured with settings to allow an overabundance of light into the sensor. An unwanted overexposure might happen because ISO was set too high, f-stop was set too low, or shutter speed was set too high.

Underexposed images may look “too dark” because they were captured with settings to allow less than expected light into the sensor. An unwanted underexposure might happen because ISO was set too low, f-stop was set too high, or shutter speed was set too low.

### *The Exposure Triangle*

A photographer must understand the relationship between **ISO** (how sensitive the light sensor will be to light), **f-stop/aperture** (how much light is allowed to pass through the lens), and **shutter speed** (how rapidly the shutter closes, cutting off the incoming light).

Any adjustment to one of these settings will impact the others. It is up to the photographer to set all three in balance, to achieve the desired depth of field, motion blur, and exposure.

### *Mode Dial*

The Canon EOS 5D Mark IV DSLR (the camera we are using) has a mode dial, located on the upper left of the camera chassis. This includes the following settings, any of which can be used to achieve the desired exposure triangle balance:

- C1, C2, and C3: user defined presets
- B: Bulb mode (the shutter remains open as long as the shutter button is held down)
- M: Manual mode (photographer controls all settings)
- Av: Aperture Priority mode (set the aperture; other settings are set automatically)
- Tv: Shutter Priority mode (set the shutter speed; other settings are set automatically)
- P: Program AE mode (aperture and shutter are set automatically based on brightness)
- [$A^{+}$]: Scene Intelligent Auto mode (fully automatic mode)

### *White Balance*

Digital cameras require a certain amount of calibration to capture color information (RGB) properly. This calibration is called “white balance,” because the camera is being given the information it needs to identify white areas of the image and reproduce them correctly.

Most cameras include a manual white balance feature, but the “auto” white balance is likely to handle most situations. DSLR cameras often include predetermined white balance settings too:

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