

# Photography Exposure

Matthew Cragg

## Five Terms

Aperture: This controls how much your shutter opens, allowing in light. It affects your exposure as well as your focus depth.

Shutter speed: Simply put, how fast does the camera capture the photo. It's the amount of time that the camera's shutter remains open per photo.

ISO: The name comes from the International Organization for Standardization. Functioning like the shutter speed, ISO controls how a camera's sensors react to the light allowed in. It can be very sensitive or not at all, allowing the sensor to block out blinding light or pick up on the very smallest amount.

White balance: This setting helps you tell the camera "What's white" and in turn, "what the other colors should be." By considering the color of your source of light, like a fluorescent bulb vs an orange sunset.

HDR: "High Dynamic Range." This allows you to create those wallpaper background photos where we have a very bright sun above, and a dark mountain side where you can see all the details of full frame.

## Technical Definition - Aperture

Definition: The size of the hole a lens creates, allowing that amount of light through the opening to the camera.

Overview: Aperture settings are referred to as the F-stop value. Merriam-Webster defines aperture as "an opening or open space" ("Aperture"). It also provides a definition in relation to photography, but this is a great starting point. Thinking of aperture as the size of the hole your lens is making, lets you picture what mechanically is occurring. The smaller the F-stop value the more light is let in, and the opposite is true for a large F-stop.

Before we continue talking about aperture, keep this in mind. Aperture is, literally, one part of the picture. Although it's key, there are three main aspects to a camera's settings. Those are ISO, shutter speed, and aperture. When shopping for a lens consider what type of aperture you want depending on what you like to photograph. When taking the photos know the strength and weaknesses of aperture, but don't forget about ISO and shutter speed.

Example of Adjusting Aperture/F-stop value:

F-stop can be adjusted on a lens, if the lens has the option, by turning the F-stop ring. See Figure A.



Figure A



Figure B

Some cameras also have settings to adjust the F-stop value automatically. See Figure B. In this image note the exposure values displayed on the screen. The F-stop is set at 2.8 and can be adjusted a scroll wheel on the camera.

Here are two example photos using very different F-stop values.



Figure C

In Figure C note the shallow depth of field. A very small part of the image in focus. With this small of an F-stop value you are only allowing a portion of the image to be captured in focus.

In Figure D a large F-stop is used. Note how much more of the frame is in focus. The depth of field has grown significantly with the increase in F-stop value.

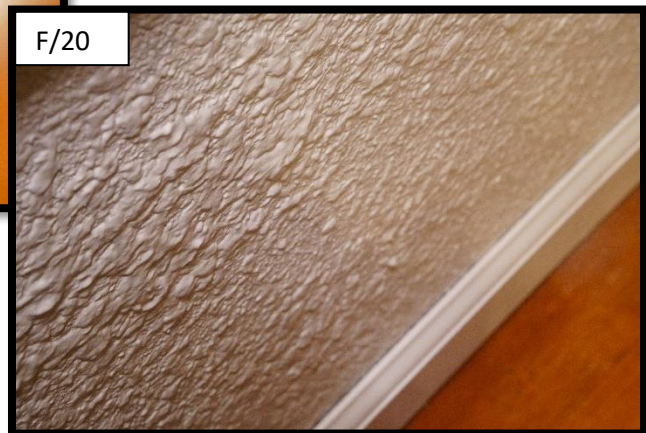


Figure D

Explanation: Within a camera lens there is something called the iris or the diaphragm. Iris is a great term to use, because it works much like the iris of an eye. The iris, or diaphragm, creates a round opening to allow light to pass into the camera's sensor or film. This controls the amount of light that is allowed in while the shutter is open.

The size of these openings are called F-stops. There are what's known as main stops. These are staples of aperture and were a standard with older cameras. They are f/1.4/2/2.8/4/5.6/8/11 and f/16 ("Zafra"). Modern lenses often exceed the main stops, not just in quantity but also in depth. Meaning there can now be stops both below and above those numbers, as well as half, third, or quarter stops in between. This allows for more options when selecting an F-stop.

The difference between each main stop, in terms of light, is either doubled or halved depending on which direction you move. Meaning that f/5.6 allows half as much light in as f/4. And f/11 allows twice as much light in as f/16.

Between stops f/1.4 and f/2 the diaphragm size halves. Imagine the diaphragm was open to a diameter 5mm at stop f/5.6. Changing to stop f/4 would mean that diaphragm is now open to a diameter 7mm. We can calculate this by multiplying the diameter by  $\sqrt{2}$  when changing to a lower F-stop or dividing by  $\sqrt{2}$  when changing to a higher F-stop.

It is helpful to know what your iris or diaphragm is doing when you change F-stops, but why not just use the diameter instead of F-stop numbers? Because different lenses will record light differently even if their diaphragm is open to the same diameter ("Aldred"). Due to the focal length, the distance between the diaphragm and the point where light first enters the lens changes. A longer focal length would require a diameter of 15mm to let in the same amount of light as a shorter focal length lens set at a diameter of 5mm. F-stops are proportional to the diameter and the focal length and tell us how much light will be allowed through, regardless of lens size.

When taking a photo there is an amount of light coming through the lens, however great or small. Aperture effects the depth of field by closing the cone of light that the lens is collecting. With an open aperture like f/2.8 the diaphragm is very open, allowing light to travel through the lens over a wide area thus creating a large cone of light ("Eloch"). That will cause for parts of the photo to be out of focus. Your depth of field is the area where you choose to gather light directly to a camera sensor or film by focusing. With an aperture of f/2.8 there are many light beams that will not gather directly to the sensor or film, resulting in blur from the areas outside of the depth of field.

When using a closed aperture like f/16 the diaphragm is much smaller. Now the light beams, although less in number, are forced to enter through this smaller hole resulting in a small cone

of light. There is now less variation in where those light beams land on the sensor or film. That causes the depth of field to grow. The image captured now will have light beams from the foreground and background that are funneled through a small diaphragm onto the sensor or film. A large depth of field will have a majority if not the whole frame in focus.

Conclusion: Aperture has a great impact on how a photograph turns out. It is a setting that controls both the amount of light captured has and where the camera can focus. Changing your aperture will dim or brighten a photograph and at the same time adjust to what depth the camera is able to focus. Understanding how light interacts with different aperture settings helps photographers better capture their subject.

## Works Cited

Aldred, John. "F-Stops vs T-Stops - What Are They? and When Do You Use Them?" *DIY Photography*, DIY Photography, 26 Dec. 2016, <https://www.diyphotography.net/f-stops-vs-t-stops-use/>.

"Aperture." *Merriam-Webster.com Dictionary*, Merriam-Webster, <https://www.merriam-webster.com/dictionary/aperture>.

Eloch. "Why Does a Small Aperture Increase Depth of Field?" *Physics Soup*, Physics Soup, 18 May 2012, <https://physicssoup.wordpress.com/2012/05/18/why-does-a-small-aperture-increase-depth-of-field/>.

Zafra, D. "Camera Settings Guide – Best Photography Camera Settings." *Capture the Atlas*, 3 Feb. 2021, <https://capturetheatlas.com/camera-settings/#hdr>.