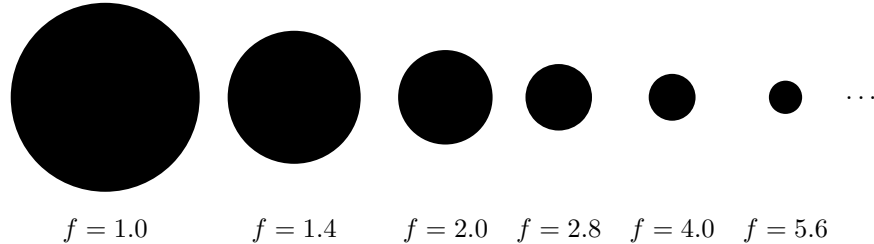


The camera's exposure system

1. *Exposure* is the process of exposing the camera's sensor to light.
Overexposure gives brighter images. *Underexposure* gives darker images.
2. Exposure is determined by three settings:
 - *Light sensitivity* (ISO: 100, 200, 400, 800, 1600, ...),
 - *Aperture opening* ($f = 1.0, 1.4, 2.0, 2.8, 4.0, 5.6, 8.0, 11, 16, 22, \dots$)



where a *larger aperture number* represents a *smaller aperture opening*, and

- *Shutter speed* (exposure time), usually a fraction of a second, e.g., 1/100 sec.
3. If the shutter speed is halved from, e.g., 1/100 sec to 1/200 sec, the ISO-number must be doubled from, e.g., 100 to 200 *or* the aperture must be opened up one step from, e.g., $f/5.6$ to $f/4.0$ to maintain the same exposure.
 4. The camera has different program settings which sets the aperture or shutter speed (or both) to give a good exposure. In the Av-mode you choose the aperture and the camera sets the shutter speed. In the Tv-mode you choose the shutter speed and the camera sets the aperture. In the P-mode the camera sets both the aperture and shutter speed. Finally, in manual mode (M) you must choose aperture and shutter speed.
 5. If you want to freeze movement you must use a fast shutter speed: 1/30 sec will result in motion blur, while 1/2000 sec should freeze any movement. Choose a larger aperture (smaller aperture number) and higher ISO numbers to allow faster shutter speed.
 6. At long shutter speeds it is difficult to hold the camera steady which also leads to blur. A rule of thumb is that the shutter speed should be less than $1/x$ sec where x is the focal length of the lens: for instance 1/200 sec at 200 mm.
 7. The aperture opening affects the *depth of field*, i.e., how much of the image is sharp. A large aperture opening (small aperture number) gives a shallow depth of field while a small aperture opening (large aperture number) gives a larger depth of field. Use a large aperture opening to blur the background in a portrait but a small aperture opening if you want a landscape image to be sharp throughout.
 8. If the histogram is pushed too far to the right, you have overexposed the image. In the M-mode you can then choose a smaller aperture opening, or reduce the shutter speed or the ISO number. In the Av-, TV- or P-modes however you must use the *exposure compensation* dial: -1 is the same as halving the shutter speed or using the next smaller aperture opening. If the histogram is pushed too far to the left however, the image is underexposed and you should use a positive exposure compensation.
 9. Higher ISO leads to more *noise* in the image so keep the ISO number as small as possible and increase it only if there is not sufficient light in the scene. Then make sure the shutter speed is fast enough to warrant a sharp image and the aperture gives the desired depth of field.