

## Camera Basics

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### depth of field

In [optics](#), particularly as it relates to [film](#) and [photography](#), **depth of field** (DOF) is the distance between the nearest and farthest objects in a scene that appear acceptably sharp in an image. Although a [lens](#) can precisely focus at only one distance at a time, the decrease in sharpness is gradual on each side of the focused distance, so that within the DOF, the unsharpness is imperceptible under normal viewing conditions.

In some cases, it may be desirable to have the entire image sharp, and a large DOF is appropriate. In other cases, a small DOF may be more effective, emphasizing the subject while de-emphasizing the foreground and background. In [cinematography](#), a large DOF is often called [deep focus](#), and a small DOF is often called [shallow focus](#).

The DOF is determined by the camera-to-subject distance, the lens [focal length](#), the lens [f-number](#), and the [format size](#) or [circle of confusion](#) criterion.

For a given format size, at moderate subject distances, DOF is approximately determined by the subject [magnification](#) and the lens f-number. For a given f-number, increasing the magnification, either by moving closer to the subject or using a lens of greater focal length, decreases the DOF; decreasing magnification increases DOF. For a given subject magnification, increasing the f-number (decreasing the aperture diameter) increases the DOF; decreasing f-number decreases DOF.



Shallow depth of field f1.8 on 85mm lens



Larger depth of field f16 on 85mm lens

## shutter speed

In [photography](#), **shutter speed** is a common term used to discuss **exposure time**, the effective length of time a [camera's shutter](#) is open.<sup>[1]</sup> The total [exposure](#) is proportional to this exposure time, or duration of [light](#) reaching the [film](#) or [image sensor](#).

In still cameras, the term *shutter speed* represents the time that the shutter remains open when taking a photograph. Along with the [aperture](#) of the lens (also called [f-number](#)), it determines the amount of light that reaches the film or sensor. Conventionally, the exposure is measured in units of [exposure value](#) (EV), sometimes called stops, representing a halving or doubling of the exposure.

Multiple combinations of shutter speed and aperture can give the same exposure: halving the shutter speed doubles the exposure (1 EV more), while doubling the aperture (halving the number) increases the exposure by a factor of 4 (2 EV). For this reason, standard apertures differ by  $\sqrt{2}$ , or about 1.4. Thus an exposure with a shutter speed of 1/250 s and f/8 is the same as with 1/500 s and f/5.6, or 1/125 s and f/11.

In addition to its effect on exposure, the shutter speed changes the way movement appears in the picture. Very short shutter speeds can be used to freeze fast-moving subjects, for example at sporting events. Very long shutter speeds are used to intentionally blur a moving subject for artistic effect.<sup>[2]</sup> Short exposure times are sometimes called "fast", and long exposure times "slow".



Slow shutter speed 85mm lens 1/10 sec (shake)

Fast shutter speed 85mm lens 1/125 sec (sharp)

The ability of the photographer to take images without noticeable blurring by camera movement is an important parameter in the choice of slowest possible shutter speed for a handheld camera. The rough guide used by most [35 mm](#) photographers is that the slowest shutter speed that can be used easily without much blur due to camera shake is the shutter speed numerically closest to the lens focal length. For example, for handheld use of a 35 mm camera with a 50 mm [normal lens](#), the closest shutter speed is 1/60 s. This rule can be augmented with knowledge of the intended application for the photograph, an image intended for significant enlargement and closeup viewing would require faster shutter speeds to avoid obvious blur.