Nikon

- Introduction to Single Lens Reflex Cameras -

Part 1 : What is an SLR camera ?

Though SLR cameras are common around the world, they have a rather prestigious image — they are perceived as "high-class" and thought to be used by only professional photographers.
The reasons for these presumptions, however, are not widely understood.
Let's discuss the logic of this reasoning by examining the history of photography and the mechanisms of cameras.
And you can tell how convenient today's photography system are by comparing it to a pinhole picture taken with an SLR camera.

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[3. What is an SLR Camera ?]

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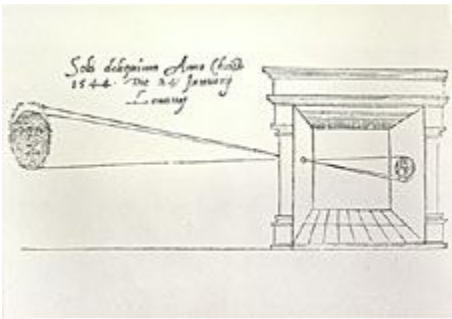
1. A Brief History of Photography

1.1. Camera Obscura

The word "camera" is derived from the Latin "camera obscura." In Latin, "camera" means "room", and "obscura" means "dark."

"Photo 0" illustrates the principle of camera obscura. Light enters a darkened room through a small hole, and the image of an object outside the room appears on the wall opposite the hole. This is the same principle at work in so-called pin-hole cameras.



"Photo 0" : The principle of camera obscura
(Photo courtesy of the JCII Camera Museum)

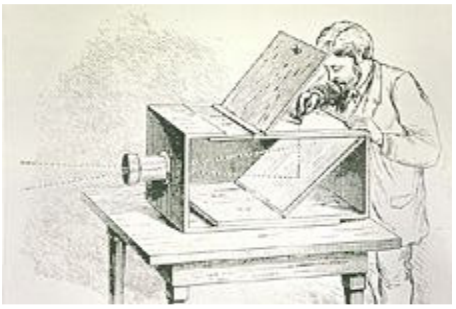
Dutch mathematician R. Gemma FRISIUS made this illustration of the solar eclipse that occurred on January 24, 1544, viewed using camera obscura.
It is believed, however, that camera obscura dates to ancient Greece, where Aristotle (384 B.C. to 322 B.C.) may have formulated its principle.
The oldest written record of the principle is attributed to Leonardo DaVinci (1452 to 1519).

The image created by a pin-hole camera is very dark.
Sometime in the 16th century, it was discovered that an optical lens could enhance an image by making it brighter. One practical application of this new finding was for painting, for which optical lenses were used as sketching and tracing tools. (See "Photos 1" and "2")

"Photo 1." : Camera obscura with an optical glass
(Photo courtesy of the JCII Camera Museum)

The image size of this camera, made in England around 1770 AD, is 6cm × 6cm. (To put this in perspective, visualize a modern 6 × 6 film camera.)

It is a reflex-type camera with a built-in mirror, which ensures the image will not appear upside down, though it does appear in reverse.



"Photo 2." : Camera obscura used for sketching (Photo courtesy of the JCII Camera Museum)

This ("Photo 2.") illustratesthe use and mechanism of a camera obscura similar to the one shown in "Photo 1.".
Upon close inspection, it is clear that the mechanism resembles that of an SLR camera. Because this model uses optical glass, the focusing point must be adjusted.
Therefore, the design allows the length of both the camera obscura and the lens to be adjusted.

A camera obscura using a lens is able to place bright pictures on a "focusing screen."
In the early history of the camera, the challenge was to take that image and fix it, mechanically or chemically, to create a "photograph."
This would render sketching and tracing obsolete.

1.2. Heliography and Daguerreo-type

Such an image was first fixed around 1826 by Frenchman Joseph Nicèhore (1765 to 1833).
His technique was known as **heliography**, literally "picture of the sun."
Though this was a revolutionary process, its light sensitivity was very low - about 8 hours (*! !*) of exposure time using a lens with f/17 - and the resulting picture was of inferior quality.
The process was far from practical.

The first image to be fixed using practical means was produced by Louis Jacques Mandè Daguerre (1787 to1851).
Later known as a "Daguerreo-type," it was introduced at the French Academy of Science on August 19, 1839, and was a so-called "silver plate" photograph (see "Photo 3.").

"Photo 4." shows a Daguerreotype camera, which was able to produce very clear images.
It had a much higher sensitivity than heliography, and a relatively short exposure time of 30 minutes.
Compared to the sensitivity of modern films, its ISO No. might be only about

0.0002 (!?).
Later models using brighter lenses improved image quality and were able to take portraits as well.

"Photo 3." : Sample of a Daguerreotype photo
(Photo courtesy of the JCII Camera Museum)

"Relief of the Parthenon." Taken by Baron Joan-Batistic-Louis Gros in 1850.
The main drawback of a Daguerreotype is that it cannot be reprinted.
Also, depending on the angle at which the image is viewed, it can be very difficult to see.

"Photo 4." : Sample of a Daguerreo-type camera, "Giroux"
(Photo courtesy of the JCII Camera Museum)

Put on the market in 1839, this was the first camera to be sold commercially.
It produced images 16.5 cm × 21.5 cm.
The warrantee label on the side of the camera was signed by Daguerre himself.

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However, the basic principle of light entering through the lens and being collected to fix the image has not changed.

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2. Exploring Your Camera !

2.1. Observing the Focusing Image

The viewfinder of an SLR camera is, in principle, identical to the camera

obscura shown in "Photo 2.".
Naturally, with modern optics (pentaprism, pentamirror, porro-mirror, etc.), the image assembled by an SLR camera is immensely superior.

When you look through your camera's viewfinder, you are not seeing the "actual" object.
With an SLR camera with a changeable viewfinder, you can see a much brighter and lucid image.
Simply remove the eye-level finder, lower the camera to waist level and look down into the focusing screen. (Used in this position, a finder is called a waist-level finder.)
You'll see your subject as a reversed (non-erect) image.

"Photo 5." :
Removing the eye-level (pentaprism) finder

There are SLR cameras that can and can't change viewfinder.
Nikon F, F2, F3, F4, F5 can.

"Photo 6." :
Viewing an image on the finder screen

Focusing screens were situated like this in early 35mm(135) format SLR cameras.
There are some medium-format SLR cameras that still use this configuration.

2. 2. Observing the image appearing on the film surface inside camera

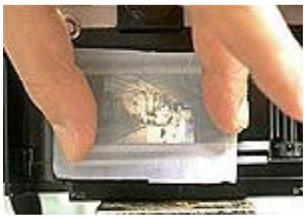
If you have a camera in which you must open the rear cover to change shutter speed to either Bulb (B) or Time (T), then you can observe the image that will appear on the film.
Place a translucent sheet such as a white plastic polyethylene bag or a piece of tracing paper onto the film plane (also called the aperture or film gate).
When you adjust the focus and aperture of the lens, you can actually see how they are controlled.
Put simply, the image that appears on the translucent sheet will be fixed onto the film.

CAUTION ! : **This is only an experiment and it is not the**

correct way to use a camera.
For this experiment, try to use a camera that is either already broken or a camera whose condition you don't really care about.
Do not touch the sector or the shutter curtain ! (read the instruction manual to figure out where it is).
Touching might cause them to function incorrectly.

"Photo 7." : Image through the lens

This is the actual image. The size (diameter) of the lens here is called the "exit pupil."



"Photo 8." : Image that will appear on the film

Placing a translucent sheet along the film path will enable you to see the image being projected. The image is non-erect (reversed).

"Photo 9." : Image that will appear on the film

When the focusing ring of the lens (focus distance ring) is rotated, the picture will become sharper or blurred. Try adjusting the lens aperture as well.

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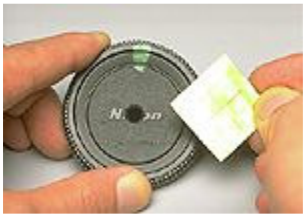
For this experiment, try to use a camera that is either already broken or a camera whose condition you don't really care about.
Do not touch the sector or the shutter curtain *!* (read the instruction manual to figure out where it is).
Touching might cause them to function incorrectly.

2. 3. Taking Pin-Hole Pictures Using an SLR Camera

Make a Ø 5 mm hole in the center of a black body cap for an SLR camera as shown in "Photo 10" (Pictured is Body Cap **BF-1A**, sold separately).
Make a pin hole-unit on a small piece of double-sided tape or black crafting tape and position it over the hole in the body cap ("Photo 11").
Your SLR camera is now a pin-hole camera ("Photo 12.").

"Photo 10." :

Body Cap **BF-1A** with a hole in its center.



"Photo 11." :

A piece of double-sided tape with a pin-hole unit in its center.

"Photo 12." :

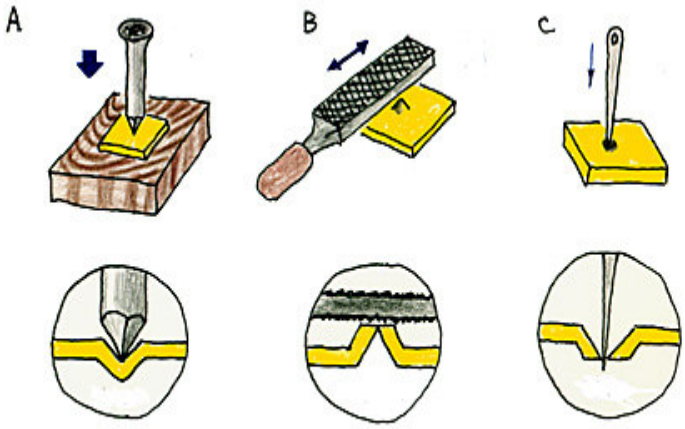
A complete pin-hole assembly attached to an SLR camera.

You can use a piece of thick black paper instead of a black body cap.

Using your SLR camera as a pin-hole camera, you can enjoy options not possible with an optical lens.
In this configuration, you can take very nice photos easily in follow light using an ISO 1,600 or 3,200 film.
Experiment a little and see what different kinds of results you can get.

2.3.1. Making a Pin-hole in a Metal Sheet

You can make a pin-hole cover (cap / "lens") rather easily with a piece of thin (0.1 to 0.5 mmt) metal sheeting.



"Fig. 1." : Making a Pin-hole

Make the hole as round and as small as possible.

Always be careful when working with sharp objects, metal and other potentially dangerous materials.

Make an impression in the metal with a nail ("Fig. 1.-A.").

Turn the metal over and file the protrusion until the hole is just about to open ("Fig. 1.-B.").

Then, use a sewing needle to make a tiny hole in the metal ("Fig. 1.-C.").

Other options include using a precision drill to make the hole or using aluminum foil instead of metal sheeting.

Keep in mind that the ideal size of the pin-hole is about Ø0.3 mm, though you can experiment with other sizes.

CAUTION ! : **The pin-hole unit must be attached to the front side of the body cap.**
An SLR camera has a reflex mirror that moves during shooting, and a pin-hole cover (cap / "lens") placed inside the body cap might damage it.

2.3.2. Performance of the Pin-Hole

"Fig. 2." shows how the pin-hole works.
Additionally, please refer to the following points.

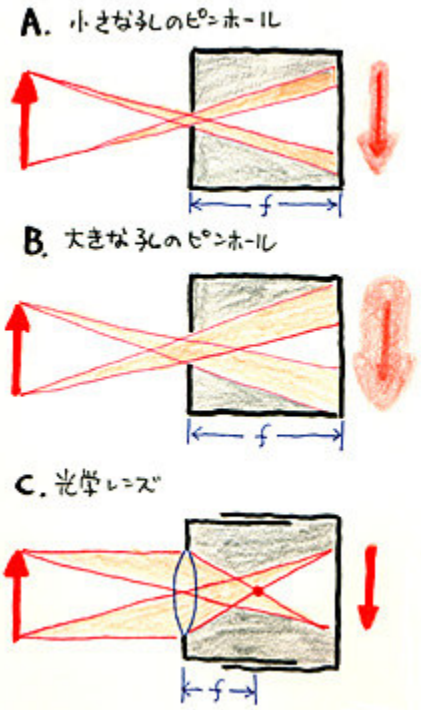
1. Focal length (f)
The length in millimeters from the pin-hole to the film is the same as the focusing distance (f) of an optical lens.
If you put a pin-hole on the front of an SLR camera's body cap, the focusing distance increases to about 50mm.
This means you can take pictures with the same effect as a 50mm lens.
However, the pin-hole does not meet the focusing point (see "Fig. 4").

2. Aperture value (F-Number)
The f-number is the focusing distance of the pin-hole divided by the diameter of the pin hole.
For example, if the focusing distance is 50mm and the pin-hole diameter is Ø0.3 mm, then f = 50 / 0.3, or 167.
Therefore, this f / 167 is about seven(7) times darker than an f / 16 lens.

3. Blurred picture
You do not need to focus a pin-hole camera.
The picture's content will blur proportionally between the nearest objects and

the farthest objects.
The amount of blur depends on the proportion of the pin-hole's diameter to the focusing distance.
Thus, the smaller the pin-hole and the smaller the focusing distance, the sharper the picture (See "Photos 15" and "16").

"Fig. 2." : Principle of the pin-hole camera and the optical lens



"Fig. 2.-A." : Small diameter pin-hole
"Fig. 2.-B." : Large diameter pin-hole
"Fig. 2.-C." : Optical Lens

It is not necessary to adjust the focus of pin-hole cameras (-A., -B.). However, the image becomes blurred in relation to the diameter of the hole and the focusing distance (f).
With an optical lens (-C.), focusing is necessary to make the image sharper or brighter.

2.3.3. Shooting Points

1. Framing
As stated above, a pin hole is a very dark "lens."
Because of this, it is extremely difficult to see an SLR camera's viewfinder image.
If you cover the eye piece with your hand, you might be able to see a vague outline of the image.
Frame the picture using your intuition. **A tripod is a must**.

2. Exposure
For your first attempt, you should take ± 2 steps of exposure.
By doing this, you will know the right amount of exposure after several shots.

On a bright day with follow light, it might be possible to use the exposure meter. Also, it might be possible to use AE (Auto Exposure) if the camera has aperture-priority AE mode.
On a cloudy day or in a dark place, the exposure meter might not be of use. In such a case, use the pin hole's aperture value (see 2.3.2., point 2) as a reference.

The series of aperture values is listed below.
Double the shutter speed (= Double the exposure time) for every step

downward.
It does not have to be precise --- approximate numbers will do just fine.

Aperture Value (f-Number)	1, 1.4, 2, 2.8, 4, 5.6, 8, 11, 16, 22, 32, 45, 64, 90, 128, 180, 256.....

Measuring Exposure

- Make the focal length of the pin hole 50mm and the pin hole diameter Ø0.3 mm. The aperture value is f / 167.
- By attaching an optical lens (a 50mm standard lens is ideal) to the SLR camera and letting the built-in exposure meter measure the f-value at f / 16, the appropriate shutter speed will be 1 / 30 sec.
- Because f / 167 (approx. f / 180) is about seven steps down from f/16 (see Aperture Value series above for reference), the appropriate shutter speed can be calculated by doubling 1/30 sec. seven(7) times.
  Doubling the shutter speed for each step yields a shutter speed of 4 sec. : 1 / 15 sec. --› 1 / 8 sec. --› 1 / 4 sec. --› 1 / 2 sec. --› 1 sec. › 2 sec. --› 4 sec.
- If this is your first time using an SLR camera with a 50mm lens as a pin-hole camera, you might want to try taking photos at an exposure level of ± 1 for each step on the aperture value series.
  This means taking a total of three (3) photos with shutter speeds of 2, 4 and 8 sec..
  Also, you can try using an exposure level of ± 2 for each step, for a total of five (5) photos with shutter speeds of 1, 2, 4, 8, and 16 sec.

3. Exposure Compensation
Depending on shooting conditions and the film type (film speed), a longer exposure time and additional exposure compensation might be necessary.
You should be especially careful with shutter speeds longer than 4 sec., because the longer the exposure time, the lower the film's actual sensitivity.
If you are uncertain about what results you might get, try overexposing the pictures (+1 to +3 EV).

"Photo 13."

Closing the aperture of an AI Nikkor 50mm standard lens (film speed at ISO 100, f / 16, 1 / 60 sec.)

"Photo 14."

Opening the aperture of an AI Nikkor 50mm (ISO 100, f / 2, 1 / 4,000 sec.)

"Photo 15."

Approx. Ø0.3mm diameter pin hole (Focal length approx. 50mm; ISO 100, approx. f / 167, 2 sec.)

"Photo 16."

Approx. Ø1mm diameter pin hole (Approx. 50mm; ISO 100, approx. f / 50, 1 / 15 sec.)

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3. What is an SLR Camera ?

You can take unique pictures if you look at an image on the viewfinder of an SLR camera or on the film surface and then take a pin-hole photograph.
We will discuss details later, but here are some general reasons why people think SLR cameras are "high-class" or "for professional use only".....

1). The image area or how the photo will come out can be determined accurately by using the viewfinder.*

The difference is obvious when compared to direct optical viewfinders.
An SLR camera reflects the image onto the focusing screens by using the light coming through the lens.
With this process, the camera can immediately fix the image onto the film, after checking the imaging area and how the image will turn out.
This is particularly useful when using telephoto lenses or shooting close-ups.
Indeed, one of the secrets to improving your photography skills is to observe the image on the viewfinder, one of the greatest advantages of an SLR camera.

*__NOTE__ : Cameras with finders having 100 percent field of vision, like the Nikon **F**, **F2**, **F3**, **F4**, and **F5**, allow you to see the imaging areas.

2). Interchangeable lenses

An SLR camera with an interchangeable lens allows you to use a wide variety of lenses, from super-telephoto and super-wide-angle lenses to close-up and shifting lenses.

3). Multiple functions and high performance

Thanks to advances in computer and photography technology, many functions of SLR cameras are automatic, including AE (Auto Exposure) and AF (AutoFocus).
These developments, along with the wide variety of accessories available for SLR cameras, make photography more versatile.

Now, there are digital SLR cameras that use CCD (charged couple device) instead of regular silver-halide films to capture images.

In Part 2, we will discuss the **characteristics of optical lenses**.

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