Nikon

- Introduction to Single Lens Reflex Cameras -

Part 5. : "The Shutter Controls Time"

It's a basic fact of photography that you have to press the shutter release button to take a picture.
The word "shutter" as it applies to cameras has the same meaning as the shutters you see covering windows or store fronts; therefore, it's easy to guess what purpose a camera shutter serves.
But what actually happens inside a camera when you press the shutter release button *?*
What affect does changing the shutter speed have on a picture's appearance *?*

Written by KUMON, Yasushi

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3. Techniques using shutter speed

3.1. Long-time exposure / 3.2. Multiple exposure

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1. What is a shutter ?

A camera shutter is like a tiny door that opens up for a specified length of time to allow light to hit the film.
Early cameras (photo provided by the **JCII Camera Museum**) had a lid to cover the front of the lens. To take a picture, the photographer removed the lid, counted a certain number of seconds, then replaced the lid.
Though awkward, this timing method was necessary because film in that period had a very low sensitivity and it required several seconds for exposure in the daylight.
This method is still used when taking long-time exposure pictures of the starts.

Today, however, film sensitivity is very high and this manual exposure method has become obsolete, if not quaint.
Modern shutters can be set with astounding accuracy to remain open anywhere from a few thousandths of a second to a few full seconds.

There are two(2) major types of shutters used in modern cameras, the lens shutter and the focal plane shutter.

A lens shutter has the shutter mechanism close to the lens (some also work as the aperture mechanism) and is used mostly for large-format and medium-format cameras, as well as compact cameras.
Usually, there is a light-screening mechanism — a shutter blade, for example — in the front or back of the lens.
The opening and closing of this blade controls exposure time.
Because the shutter is built into the lens, another light-screening object is necessary in order to shield the film when making the lens interchangeable.
Today, most 35mm(135) format SLR cameras with interchangeable lenses do not use this lens shutter mechanism.

(One-time use cameras use lens shutters, but their speed is fixed around 1/100 sec.)

Modern 35mm(135) format SLR cameras and IX 240 SLR cameras use focal plane shutters. Let me explain this further in details.

1.1. Focal-plane shutter mechanism

The focal plane is the focusing surface, which means that the shutter is directly in front of the film. Because it's in this position, there is no real need to screen light when changing lenses.
A conventional focal plane shutter consists of two blades or two sets of blades that block light.
Exposure time is adjusted by making these blades pass by the film at different times.
The first blade is called the front curtain; the second is called the rear curtain.
The object you see when you open the back cover of an SLR camera is the shutter curtain. **Do not touch it *!***

One type of shutter curtain, called a horizontal-travel focal plane shutter, moves sideways.
The conventional horizontal type, called a drum-type shutter, is usually made of silk cloth or metal (stainless steel, titanium (Ti), etc.).

A shutter curtain that travels vertically is called a vertical-travel focal plane shutter.
On occasion, you might find a drum-type shutter that travels vertically; but most modern SLR cameras have two(2) curtains.
These are usually referred to as **square shutters, named after the "Copal Square Type I (One)" shutter unit built into the "Nikkorex F".**

This square shutter is composed of a front and rear curtain, each made of long, thin blades in a layered configuration.
Think of an elevator door, and you have an idea how they operate.

Again, **never touch this component**.

Photo 1.

Horizontal focal plane shutter (Nikon F2)
Both the front and rear curtains are made of titanium(Ti).

Photo 2.

There is a slight opening between the front curtain and rear curtain during film wind.

Photo 3.

Vertical focal plane shutter (Nikon F4)
The two sets of curtains, each set with two(2) blades, contain aluminum(Al)-alloy blades and two(2) carbon fiber blades, a total of four (4) blades.

1.2 Shutter and shutter release button

Pressing the shutter release button causes the shutter to open and close. It is during this moment when light hits the film that the film is exposed and a picture is taken.
It is the nature of photography that we sometimes see an event, a person or some other subject and think, "I'd like to take a picture of that right now."
But sometimes the timing seems off or inopportune. This begs the question, "Is there ever a decisive moment during photography, one best for taking any given picture ?"
When answering this question, keep in mind some of the disadvantages of SLR cameras.
First, the system for viewing objects is a bit complicated. The image in the finder is actually the image from the reflex mirror, which is built into the SLR camera.
This means when the shutter release button is pressed, the mirror pops up and the shutter's front curtain is set in motion. This process, from start to finish, takes about 1/20 (0.05 sec.), depending on the camera.
Additionally, you must consider the amount of time that passes between the moment you decide to take a photo and the moment you actually press the shutter release button.
The trick is, then, to press the shutter release button before "the decisive moment." A keen sense of anticipation, therefore, is the key to taking more rewarding photographs.
To be more exact, it requires few tenths of a second before a person decides to press the shutter button until the finger actually

presses the button.
Therefore, you should press the button a bit earlier.

Another thing to consider is that with a conventional SLR camera, it is impossible to confirm the shooting image when the shutter is open (in other words, the moment the picture is actually taken). When the shutter opens, the reflex mirror flips up to expose the film, which means it requires time to return to its original position. The amount of time needed for this is called quick return.
That is why the viewfinder "winks" when shooting with an SLR camera.
If you bear these things in mind, you might be able to take more "decisive moments", like Henri Cartier Bresson.

Photo 4.a. - 4.h.
Time between the shutter release button being pressed and when the shutter opens.....


Photo 4.a. - 4.b.
The moment when the shutter release button is pressed.
The image is projected by the reflex mirror.


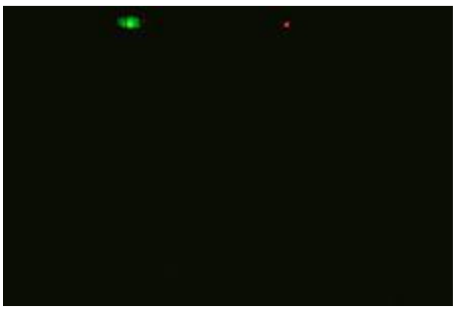

Photo 4.c. -4.d.
The moment the reflex mirror flips up.
The finder image blacks out.


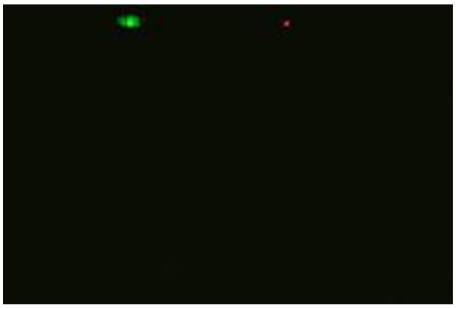

Photo 4.e. - 4.f.
The moment after the reflex mirror flips up.
The shutter blade of front curtain can be seen.
The finder image is still blacked out.


Photo 4.g. - 4.h.
The moment when the shutter curtain travels and the film is exposed.
The finder image is still blacked out.
After this process, the rear curtain passes by the film and the shutter closes.
The reflex mirror automatically returns to its original position.

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2. What changes with shutter speed ?

Shutter speed, of course, influences how a picture will turn out. Here, we'll discuss what shutter speed is and how it affects a picture's appearance.

With Program mode [P] or full-auto mode, the camera automatically sets the shutter speed. To choose your own shutter speed, switch to Shutter Priority ([S] or [Tv]) mode or "M" mode.

2.1 What is shutter speed ?

The number that appears on a camera's shutter dial or in its LCD panel is the shutter speed.
A shutter speed shorter than one second (value indicated as 1/__) means the shutter remains open for that amount of time, during which the film is exposed. If the number reads "500," then the

shutter will remain open for 1 / 500 sec.
If the shutter speed is longer than one second, the number will be a different color; on an LCD panel you'll see an "S" (for "seconds").
On most cameras, shutter speeds can be set to the times listed below.
Some cameras allow you to set shutter speeds between these times, while others allow an infinite number of speeds.

.....4 - 2 - 1 -1/2 - 1/4 - 1/8 - 1/15 - 1/30 - 1/60 - 1/125 - 1/250 - 1/500 - 1/1000 - 1/2000 - 1/4000 - 1/8000 (sec.) .....

These numbers, depending on how you look at them, occur in halved or doubled increments.
Each of these increments is called a step. For example, if shutter speed moves two(2) "halves," it moves two "steps."
This is significant when determining exposure. (This topic will be discussed in more detail in July's issue, "Introduction to Exposure.")

Additionally, the shutter indicator/dial will contain letters, usually T, B or X. What do these signify *?*

- **T** (Time)
  The front curtain opens when the shutter release button is pressed and remains open even after the button has been released. When you press the button again, the rear curtain travels to close the shutter.
  This is effective for long-time exposure, which might take few minutes.

- **B** (Bulb)
  The shutter remains open while the shutter release button is depressed and closes only after the button is released.
  This is a useful feature for shots that require a long exposure time. This is effective for long-time exposure, which might take few seconds.

- **X**, or a lightning bolt graphic (sync shutter speed / "X" contact)
  This is the fastest shutter speed you can select when using a speedlight, also known as an electronic flash.
  Maximum synchronizing shutter speed varies depending on the shutter mechanism; shooting with a speedlight should be

done with a shutter speed slower than the X speed.
A good photo cannot be taken at shutter speeds faster than the X speed. Why ?

With a focal plane shutter, speed is controlled by the timing of the front and rear curtains.
Contrary to common belief, most cameras do not adjust exposure time by changing travelling speed of shutter curtain.
What changes is the amount of time between the moment the front curtain begins to travel and the moment the rear curtain begins to travel — when the rear curtain travels depends on shutter speed.
If you select a faster shutter speed, the space between the rear of the front curtain and the face of the rear curtain narrows, beginning at 24 x 36 mm, the size of 35mm-format film.
Essentially, only a thin slit passes in front of the film (See Figure 1).

Accordingly, if a speedlight flashes at the same time as a shutter set at a very fast speed, only a thin portion will be exposed.
The speedlight must flash when the shutter is fully opened.
The "X" shutter speed is the fastest speed at which the shutter fully opens.

Certain cameras can automatically set the shutter speed so it doesn't exceed the "X" speed when being used with a charged speedlight, which sends a signal to the camera.
Thus, if you are setting the shutter speed manually, you must be more cautious when taking pictures using speedlight.

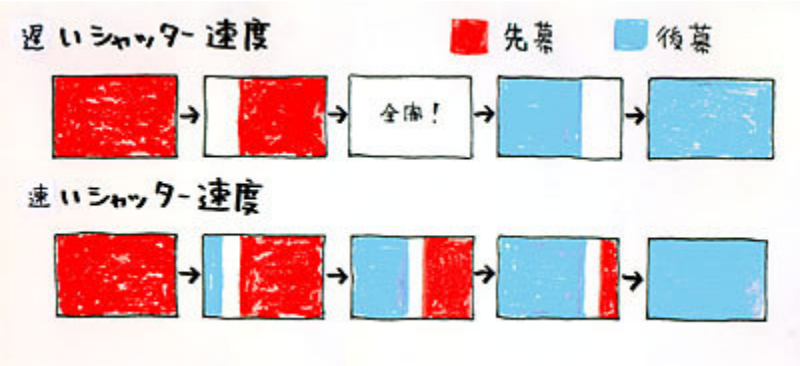

Figure 1.
The movement of shutter curtains in both "slow" and "fast" shutter speed
(figure shown is a horizontal focal plane shutter).
"Red" is the front curtain movement, and "blue" is the rear curtain movement.
Notice the white "space" between the "red" and "blue".

2.2 Shutter speed and picture brightness

The slower the shutter speed, the longer the film is exposed to light. As the amount of light hitting the film increases, the picture's brightness increases.
Many people think it's not possible to take photos in dark places, but this is just not true. In places light enough for us to see our surroundings, a picture can come out bright if the shutter speed is very slow. This said, it is possible to take photos under pale moonlight, or even with illumination from a flashlight.

There are certain conditions necessary for taking such pictures, though. Obviously, the subject should not be moving.
The camera must be held very still, with a tripod if possible, and the shutter should be controlled with a self-timer or remote release.
If there is artificial light — a street light, for example -- in the picture, then overexposing the photo with an extended shutter speed is a good idea.
Please note that not all film that has been exposed for a long time will turn out satisfactorily. Exposure time affects film sensitivity, and the longer the exposure, the less sensitive the film becomes (known as reciprocity law failure).

Photo 5.a. - 5.c.
A night scene can be taken using a slow shutter speed.

Taken at "auto" mode

Shutter speed half (1 step) slower, with same the aperture

Shutter speed one fourth (2 step) slower, with the same aperture

2.3 Shutter speed and picture blur

Blurring is a problem when taking photos at slow shutter speeds.
If the subject moves, it will appear blurred.
If the camera is jostled, the entire image will be blurry.
The problem only increases when shooting with a telephoto lens or shooting close-ups.
Lenses with high magnification (shooting with a telephoto lens or taking close-up pictures) causes more picture blur.
The best way to minimize blurring is to use a monopod or tripod.
Blurring due to hand-held camera shake can be minimized by shooting the picture at 1 / focal length (in mm). For example, with a 200 mm telephoto lens, a shutter speed of 1 / 200 sec or faster is best. As for me, I choose a shutter speed a bit faster than this equation.
In any case, you can take less blurring, instantanenous picture at fast shutter speed.

Photo. 6.
A picture of a moving subject changes depending on the shutter speed.


1 / 1000 sec.


1 / 60 sec.


1 / 4 sec.

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3. Techniques using shutter speed

You can take unique pictures by simply adjusting the shutter speed. In order to take these kinds of pictures, you have to pay close attention to film sensitivity and the aperture.

But first, try setting the camera to "S" shutter-priority mode (also called Tv mode, depending on the manufacturer). Your first attempts may not be successful, but with a little practice your pictures will improve.

3.1. Long-time exposure

As we said above, it's possible to take bright pictures, even in dark places, by using longer shutter speeds.

However, if conditions are too dark, the exposure meter may not function. If this should happen, adjust the exposure/shutter speed drastically and shoot a test picture.
Remember, shutter speed should be changed in increments of doubles or halves (2 minutes, 4 minutes, 8 minutes, etc.) and a tripod and a remote release or self-timer operation are necessary.

How any given subject will appear in the final photo depends on subject's movement and shutter speed. Different settings apply for different situations, but here are two(2) guidelines to keep in mind: photograph automobiles at 1 / 125 sec. and people who are walking at 1/15 sec.
Follow the subject in the viewfinder and the background will appear smeared. This technique is known as panning.

To highlight the current of a river, the shutter should be set slower than 1 / 4 sec.

For long-time exposures in bright locations, use a low-sensitivity film or ND filter to avoid overexposure.
A camera that has an MRC function can change the film even before the film roll is finished.

Photo 7.
"Long-neck" (one of the japanese famous monster)

Photo 8.
"Ectoplasm"

3.2. Multiple exposure

With cameras featuring multiple exposure functions, you can place one picture on top of another.
Though it is a bit difficult, you can also take multiple-exposure pictures, even if your camera does not have this feature.

Multiple exposure simply means exposing film two(2) or more times, or opening the shutter two or more times on the same frame of film.
This will not work in auto-exposure mode, but think of it as adding shutter speeds. For example, two-time exposure at 1 / 250 sec. is the same as : 1 / 250 sec. + 1 / 250 sec. = 1 / 125 sec. of exposure.
With negative film, one- or two-step overexposure is not a problem: a two-time exposure means 1-step overexposure; four (4)-time exposure means 2-step overexposure.

Multiple exposure is especially nice for pictures of fireworks.
With ISO 100 film, set the aperture around f / 8 and the shutter speed to about 1 sec. (The brightness of the fireworks in the final picture will depend on the aperture and the firework "trails" on the shutter speed.)
With multiple exposure, it's possible to take photos of many fireworks in the same frame; and because the background will be dark, you can use a long exposure by setting the shutter speed to "B" (Bulb) mode.
In order to get good multiple exposure shots, you should remember where and what elements you've placed in the picture.

Photo 9.
A thousand-hand bodhisattva

Photo 10.
Ghost behind the back

Be adventurous with shutter speed and see what results you can get.
Well, try taking pictures with shutter-priority mode ([**S**]-mode) or with manual mode ([**M**]-mode).
Luck and experience are the two(2) main ingredients of successful photography, so keep experimenting and learning from every photo you take.
Remember, "pictures without making mistakes can generally be taken by anyone".

In the next issue, Part 6, we will discuss aperture.

Names of products in this article were being used in Japan (Nippon) at the time of writing.

Colour of photographs appearing in this www site may differ from the originals.
Specifications are subject to change without any notice or obligation on the part of the manufacturer. Apr. 1999

News
I have supervised a two-week Japanese TV program

(NHK "Hitori-de-dekirumon !") , 1999-04-26.
It will be an exclusive episode on how to have fun with one-time use cameras.
I will be appearing as a manager of a film developing store.
Hope you enjoy !

Go to "Who's Afraid of SLR Camera ?" Index

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