PHOTO FUNDAMENTALS

CAMERA AND DARKROOM PART THREE: THE SHUTTER AND APERTURE SING A DUET

INTRODUCTION

This assignment will continue to explain the basics of exposure and camera operation, with emphasis on the shutter, its affect on the image, and how it works with the aperture for a specific exposure setting.

REVIEW

From our last handout, we learned that the aperture controlled the intensity of the light entering the camera by means of the DIAPHRAGM, a mechanical device similar to the iris in our eye. The diaphragm creates a circular opening in the center of the lens that is called the APERTURE, and effectively reduces the size of the lens but does not effect how much of the image is placed on the film. We also learned how to read the lens distance scale, and how to apply depth of field to the image by reading the aperture indicators on the distance scale.

WHAT DOES THE SHUTTER DO?

The shutter is a simple doorway that protects the film from light when it is closed, and exposes the film to light when its open (see text, pg. 14). It does not regulate the INTENSITY of the light, but only the amount of TIME that the light is allowed to fall onto the film. The amount of time the shutter exposes the film is referred to as the SHUTTER SPEED. The shutter speed is set with a dial that refers to the time in fractions of a second. Modern cameras often indicate the shutter speed with an LCD readout on the top of the camera.
However the shutter speed is set, the fractions of seconds that the dial or setting refers to is usually expressed by only the lower half of the fraction:

\[
\begin{align*}
1/125^{th} \text{ second} & = 125 \\
1/250^{th} \text{ second} & = 250 \\
1/500^{th} \text{ second} & = 500 \\
\end{align*}
\]

The fractions are relatively easy to understand, and are graduated to represent a 2X change in the amount of time the shutter is open. Example: 1/500\text{th} of a second is half as much time as 1/250\text{th} of a second.

**QUESTION FOR YOU:** Each change in the aperture setting (1.4 to 2, 2 to 2.8, 2.8 to 4, etc..) represents a two fold (2X) increase or decrease in the INTENSITY of light going through the lens. Do you think it's a coincidence that the shutter speeds represent a two fold increase or decrease in the amount of TIME the film is exposed to that light? Hmmm.

**WHAT EFFECT DOES THE SHUTTER SPEED HAVE ON IMAGE QUALITY?**

The shutter has less effect on the image than the aperture, although it can be used to your advantage. Here are a few situations where the shutter speed can be used as a compositional tool:

1. Fast shutter speeds (1/250\text{th} of a second up to 1/4000\text{th} of a second) can freeze motion. This is great for sports photography or other action scenes where the photographer wishes to render a moving object clearly.
2. Fast shutter speeds help us reduce camera shake. When hand-holding the camera, never use a shutter speed that is less than the focal length of the lens expressed as a fraction. Example: For a 50mm lens, the slowest hand-held shutter speed is 1/50\text{th} of a second.
3. Slow shutter speeds can render a moving subject as a blur, and convey a sense of motion.
4. Extremely slow shutter speeds (several minutes or more), will cause moving objects to not register on the film. As an example, a shutter speed of 10 minutes used to photograph a busy sidewalk at night will reveal only the subjects that do not move. People walking by will not be in the frame long enough to record on the film as anything but a faint blur.

**HOW DOES THE SHUTTER AND APERTURE SETTINGS WORK TOGETHER?**

First we have to answer how the camera can tell how much light the film requires for proper exposure. Remember our discussions on a “Quart of Light”? We’ve grown up now, so we’re going to assign this “quart of light” a value instead of trying to imagine what a quart of light would be. From this point on, quarts of light will be referred to as: **EXPOSURE VALUES** or **EV** for short. Remember this always. Carry it to your grave.
Exposure values are numerical terms that we can assign to a combination of shutter speeds and aperture settings. Below is a partial listing of shutter speed and aperture combinations that EQUAL the same exposure value:

- f1.4 @ 1 second
- f2 @ 2 seconds
- f2.8 @ 3 seconds

Because any of the above combinations will provide the correct exposure, the photographer is free to choose from them the settings that will work best for the image. You may wish to have a shallow depth of field, so you end up using the top setting. You may wish to blur the motion of a fast moving car, so you use the lower setting. All will result in correctly exposed film.

The above combinations of aperture and shutter speed all have an Exposure Value of 1. Below is a listing of exposure values that show a small number of possible combinations for each.

<table>
<thead>
<tr>
<th>EV</th>
<th>1/500 sec</th>
<th>1/250 sec</th>
<th>1/125 sec</th>
<th>1/60 sec</th>
<th>1/30 sec</th>
<th>1/15 sec</th>
<th>1/8 sec</th>
<th>1/4 sec</th>
<th>1/2 sec</th>
<th>1 sec</th>
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<tbody>
<tr>
<td>1</td>
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<td>F4</td>
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<td>F2.8</td>
<td>F2</td>
<td>F1.4</td>
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WHAT DOES THIS HAVE TO DO WITH FILM SPEED AND SETTING MY CAMERA?

Okay. That's a fair question. The camera has within it an electronic device which can measure the amount of light present on the scene you are going to photograph. It reads the available light, and then assigns an exposure value to the scene based upon the film speed that you have set on the camera. For instance, a typical scene in a café at night with 400 speed film could require an exposure value of 7. The same scene with 200 speed film would require an EV of 6. 100 speed film needs an EV of 5. Get the picture? Notice how film speed doubles or halves just like the shutter speed?

When you take the camera outside the next day with the same film, the meter might suggest and exposure value of 14 for 400 speed film.

What would 200 speed film require?
100 speed?
1600 speed?

LET'S GO BACK TO THE CAFÉ AT NIGHT

Alright, so you've brought your camera into the café, and you've loaded it with 400 speed film. You're using a 85mm lens with a maximum aperture of f1.4 and the meter says the scene is correctly exposed at 1/60th of a second with the lens wide open.

Based on the chart above, what is the EV for that scene using 400 speed film?

What other combinations of shutter speed and aperture could you use?
Would there be any risk of camera shake in the picture?
What about if you used a 35mm lens at f1.4?
What other combinations of shutter speed and aperture would you use then?

After you develop the film, you're disappointed in your results. They seem blurry and drab, with little contrast to show the subtle variations in lighting at the café. The instructor tells you to use the same film as before, but instead set the film speed to 1600. You return the next evening for more photos with the 85mm lens.

What shutter speed will you use at f1.4?
What is the EV for the scene?

Hopefully this isn't too much at once, and that it provides you with an understanding of exposure values, shutter speeds, apertures, and film speeds and how they work together. We'll discuss this throughout the semester in class to help reinforce this knowledge, and to give you a better understanding of how the elements of exposure work together.