



It's just light. You can bend it, it won't break.

<https://robshootspeople.com/flash/>

Speedlights

Advantages:

- **Compact.** They come in a variety of sizes to suit most needs.
- **Versatile.** They have features not found on larger, more powerful flashes.
- **Inexpensive.** They are available at many price points and you can spend more money to get more automation.
- **Battery powered.** Some use AA batteries, and others have a rechargeable battery. Either way, you can plan ahead to always have power.



Studio Strobes

Advantages:

- **Power.** They provide power beyond what is possible from speed lights.
- **Modifiers.** There are tons of different modifiers available so that you can shape light just the way you need it.
- **Flexibility.** Some are battery powered, some plug into a wall outlet, and others are small heads powered by a remote battery pack.
- **Standards.** If you happen to travel to do studio shoots, you can rent popular brands rather than traveling with your own equipment, and then hire local assistants who will likely already know how they work.



Umbrellas

Advantages:

- **Light.** Easy to carry.
- **Simple.** Easy to set up.
- **Flexible.** They come in a variety of sizes, and configurations.
- **Soften and diffuse light.**



Grids

Advantages:

- Simple.** They just attach to the front of your flash or the modifier you're using.
- Control.** They allow for creative shaping of light.
- Flexible.** They come in different “angles” that, in some cases can be combined to create a smaller pool of light. (Think spotlight)



Soft Boxes

Advantages:

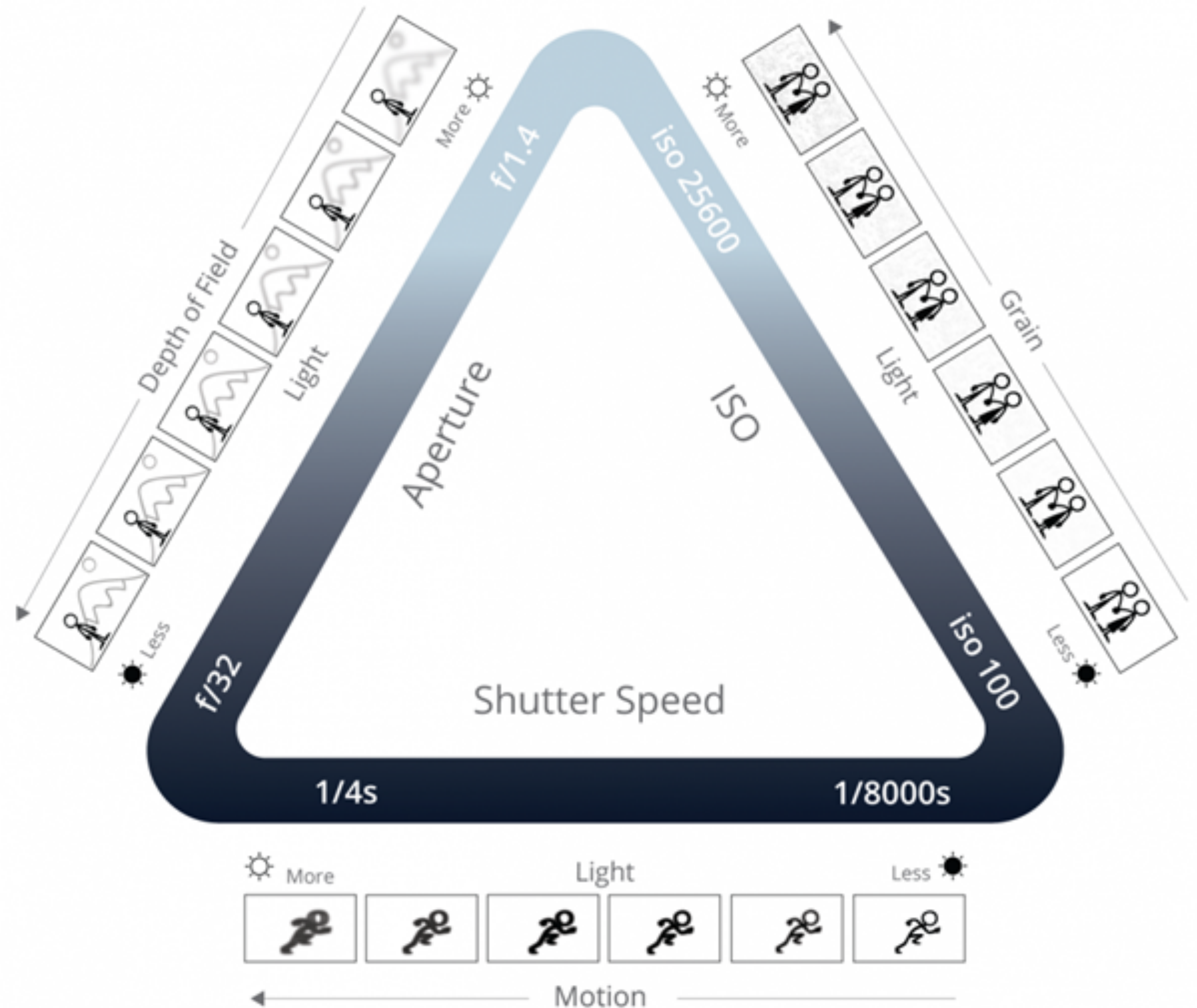
- **Variety.** There are tons of shapes and sizes so you can shape and soften light as needed.
- **Accessories.** There are tons of diffusion and grid options to fine tune the light.
- **Control.** Unlike umbrellas, soft boxes allow you to control the spill of light so you only get it where you want it.



Exposure

Exposure Triangle:

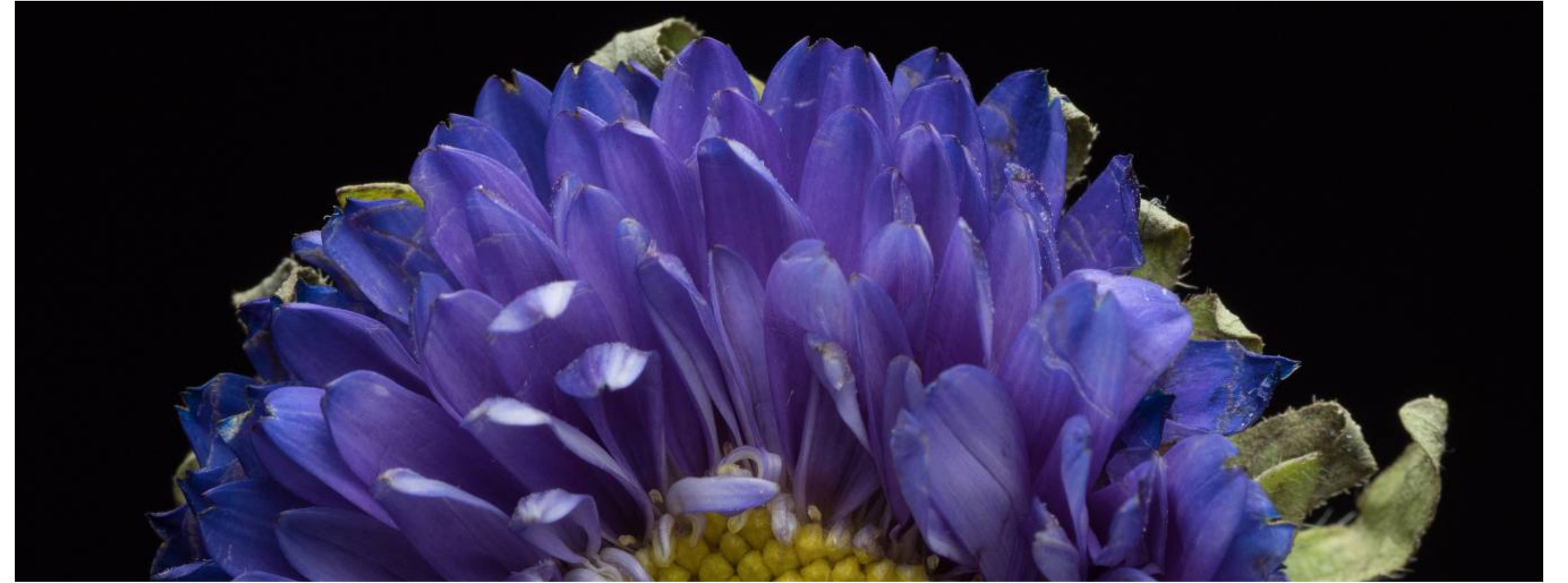
- **Aperture.** Controls the size of the opening through which light can pass. It also affects the depth of field.
- **Shutter Speed.** Controls the time during which light can get through the aperture. It also affects the ability to freeze motion, or to allow motion blur.
- **ISO.** The measure of the sensitivity to light of the sensor or film. In the case of digital, we can change it on the fly to suit our current need. Whether film or digital, the higher the ISO, the more grain you'll see in your images.



Aperture

Some nerdy details

- **Stop.** A stop is a doubling or halving of the light in a photo. Twice as much light -> one stop brighter.
- **Aperture.** Aperture is the opening the light passes through. It is expressed as a ratio of the focal length to the diameter of that opening. For example a 50mm lens at F:2 aperture has an opening of 25mm.
- **1, 1.4, 2, 2.8, 4, 5.6, 8, 11, 16, 22 ...**
These are the “whole stops”



Why the weird numbers?

Because the area of a circle is πr^2 , and the diameter of the opening is $2r$. So to double the area of a circle, you have to multiply the radius by the square root of 2. Doing that decreases the ratio of the focal length to the diameter of the opening by the same amount. For example $2.8 / \sqrt{2} \approx 2$.

Shutter speed

Some nerdy shutter details

There are two (common) types of mechanical shutter:

Leaf shutters and **focal plane** shutters. Most of our SLR and Mirrorless cameras use focal plane shutters. There are some exceptions, but typically not at consumer level prices.

A focal plane shutter is made up of two “curtains”. Each curtain is made up of multiple leaves that allow them to open and close while keeping your camera body small. Those curtains move at the same speed *regardless of your shutter speed*. However the time that the second curtain waits after the first curtain moves varies. The **flash sync speed** of your camera is the fastest shutter speed at which the sensor (or film) is fully exposed between the first and second curtains.

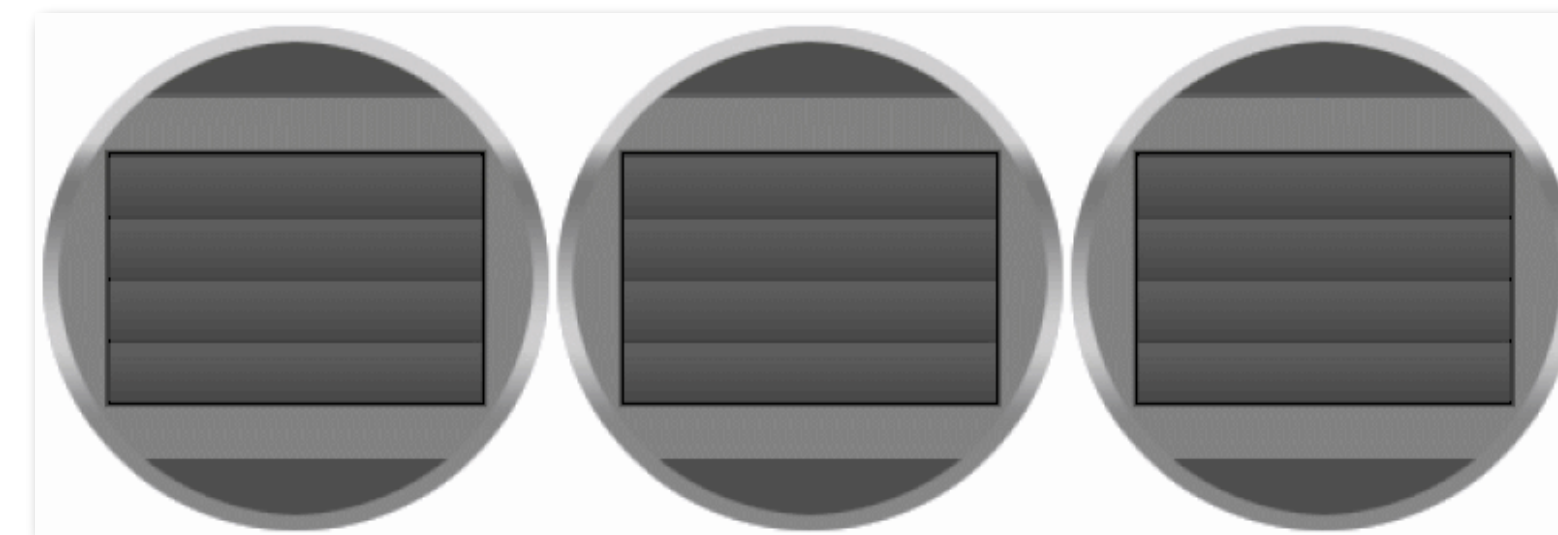
Setting your shutter speed higher than that when using flash will result in one of the curtains casting a shadow on your image.



f/16 2 sec 20mm ISO 200

First vs Second curtain flash

You can tell your camera whether to fire your flash immediately after the first curtain opens, or immediately before the second curtain begins to close. The creative use of this is to allow you to have motion blur *and* a sharp image, with the action frozen, in a single photo. This requires learning to balance ambient light with your flash, and to time the motion of the action you’re capturing.



Light: 4th side of the triangle

What about light? (The exposure triangle ignores the amount of light present)

- **Ambient.** The light in the room, or outdoors. It's just the light you have without adding any.
- **Constant.** Lights that you set up for the specific purpose of photography, that are on all the time. These have a couple of advantages.
 - You can see the light and have a pretty good idea of what the scene will look like when photographed.
 - When photographing people, having low light causes the pupils to dilate, so there is less iris visible in the eyes. Bright constant light reduces this effect and you get more of the eye color in your portraits.
- **Flash.** Very brief, bright pulse of light that you trigger with your camera. The effect of flash in your photo is entirely controlled by the aperture you choose*. Flash offers some creative advantages too.
 - You can freeze motion independent of your shutter speed, so it's possible to have a single photo that contains both motion blur and a sharp image.
 - Usually much brighter than constant lights, so using shutter speed and iso you can eliminate the effect of ambient light in your photo and have complete control of the light hitting your subject.
 - Using the right combination of shutter speed and aperture, you can blend ambient (or constant) and flash light for creative effect.

* Kinda. If you choose a shutter speed that is faster than your camera's maximum flash sync speed you will impact the effectiveness of the flash.



Light: Inverse square law

Taking the fun out of photography with more math

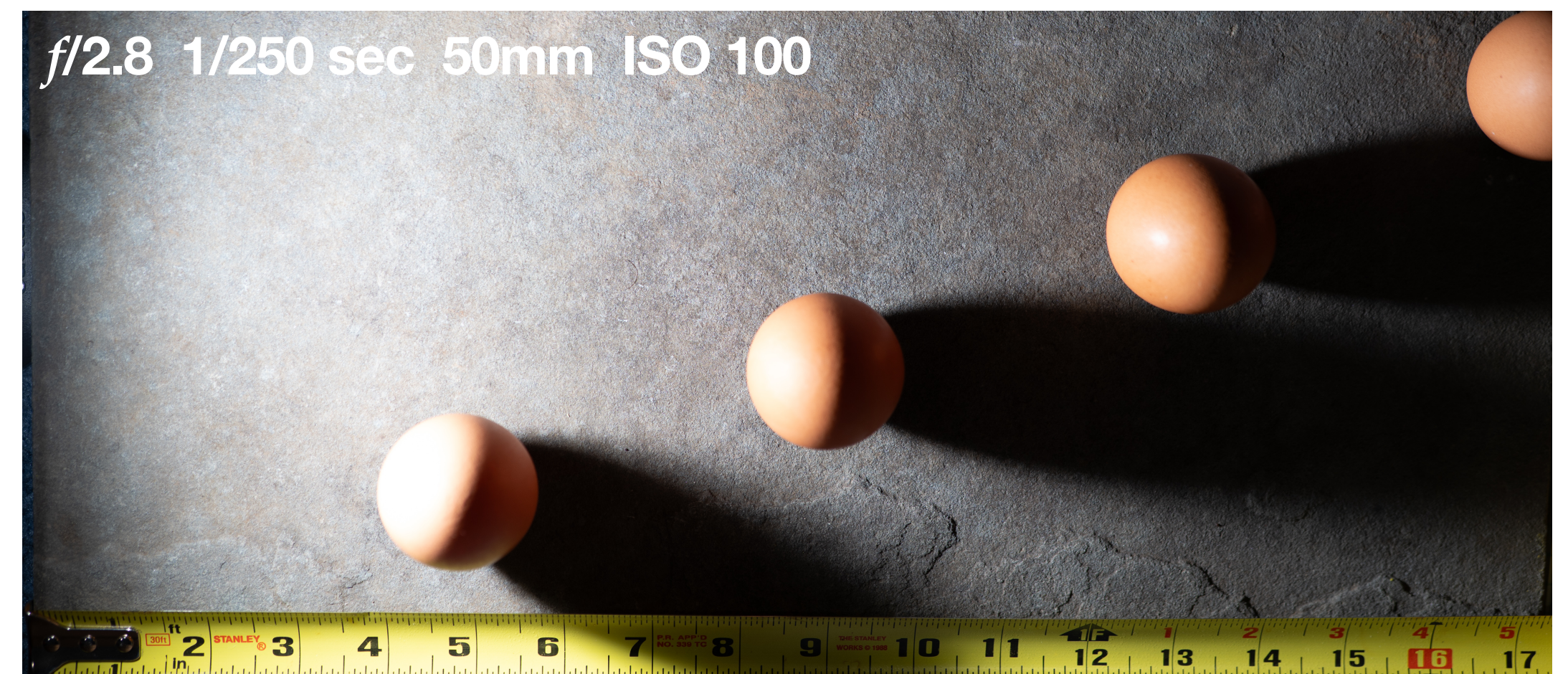
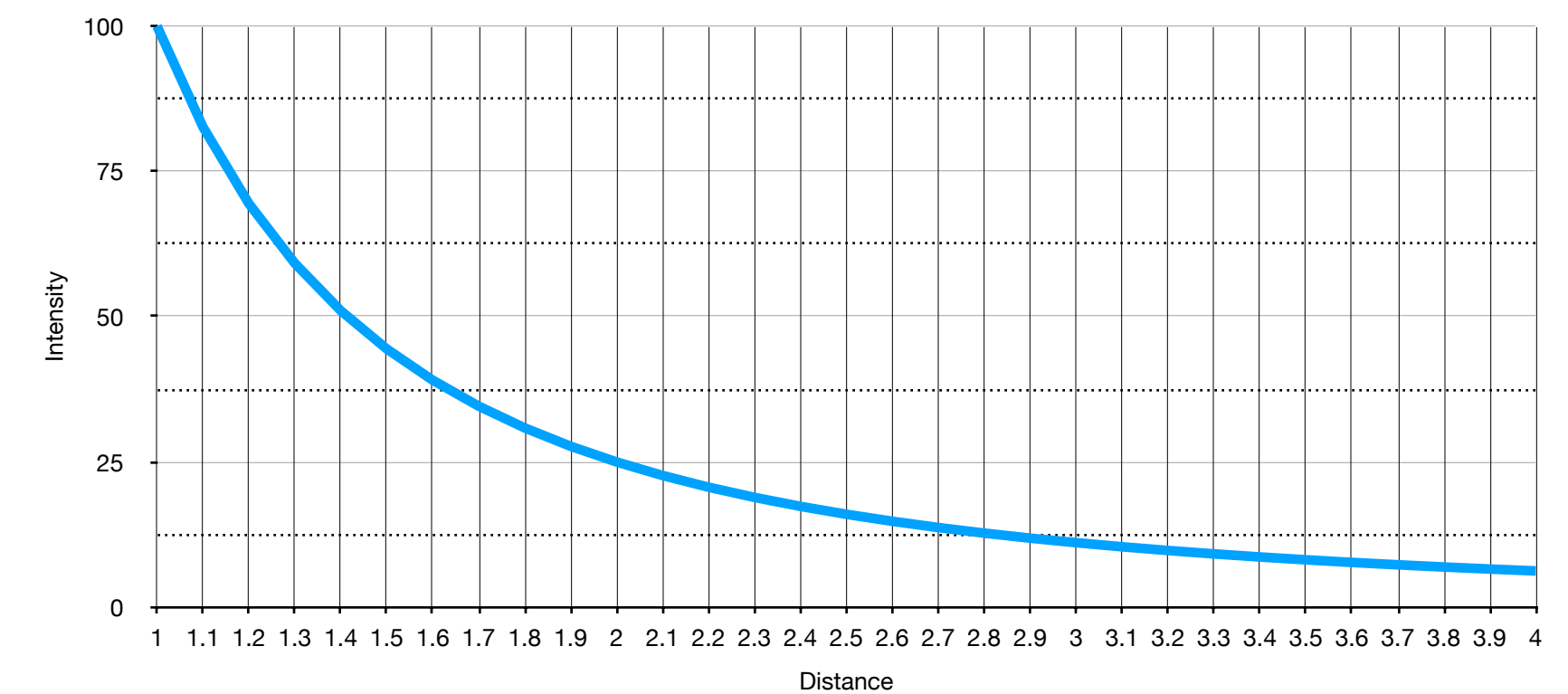
- This law describes the way the intensity of light decreases based on the relative distance of subjects to the light source. However, it is not a linear relationship. The general formula is:

$$I_2 = I_1 / (d_2 / d_1)^2$$

- To the right is an attempt to illustrate the decrease in intensity, along with example images showing light fall off across a scene.
- Given the formula above, for the second egg from the left in both those images:

$$I_2 = I_1 / (8 / 4)^2 = I_1 / 4 = 0.25 * I_1$$

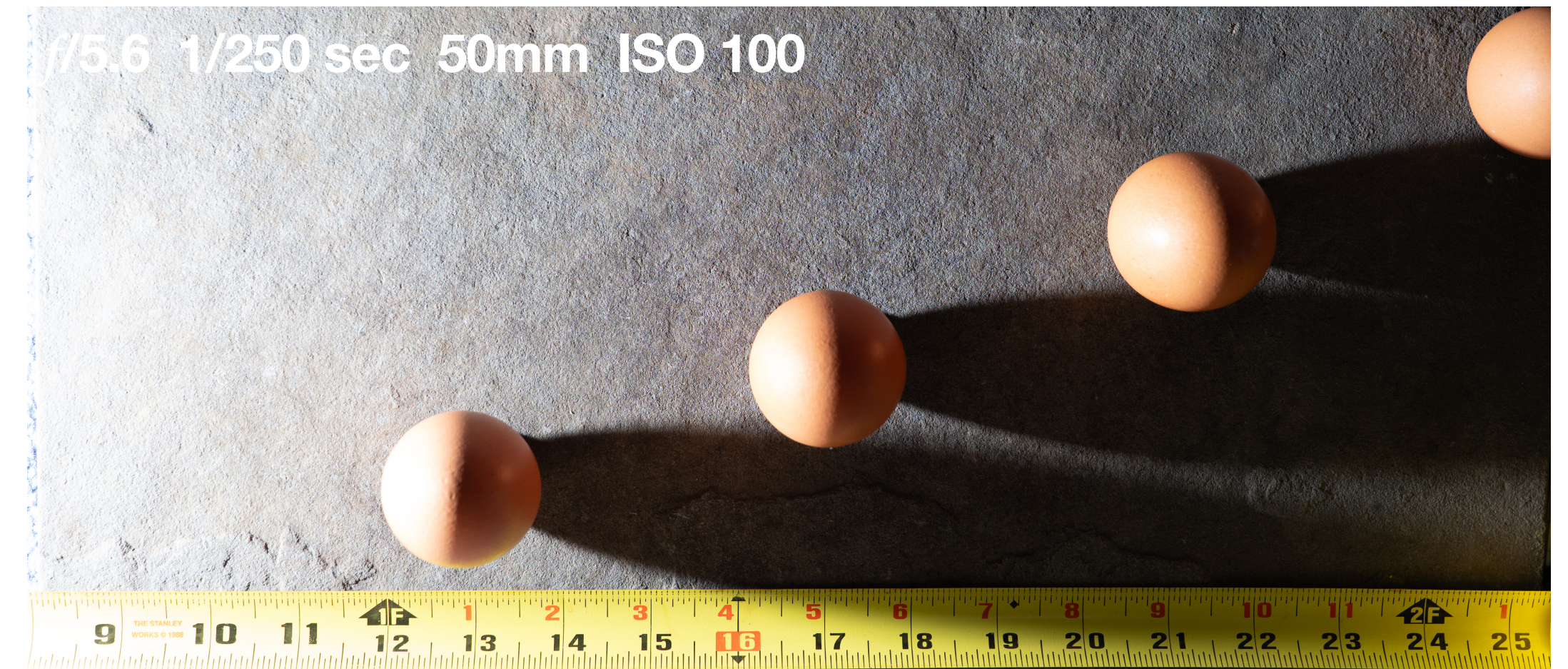
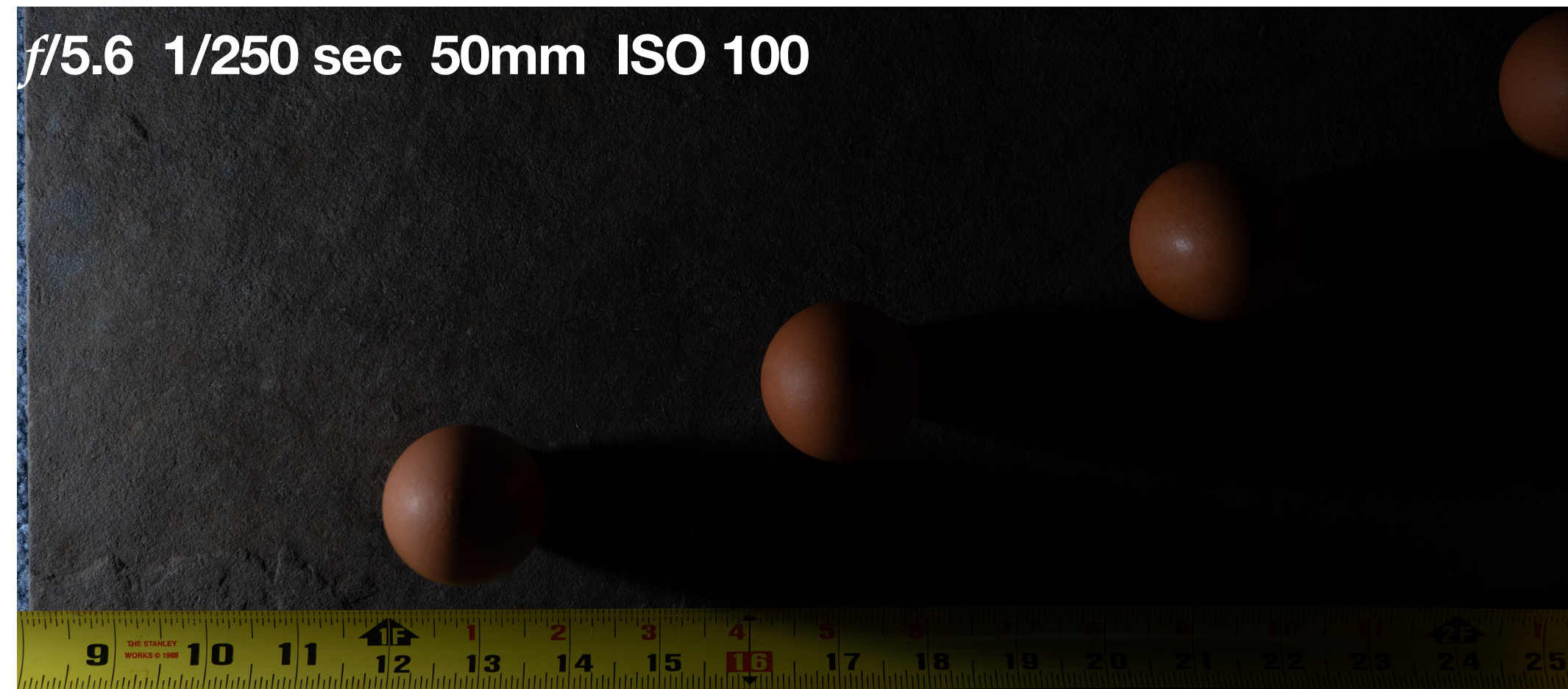
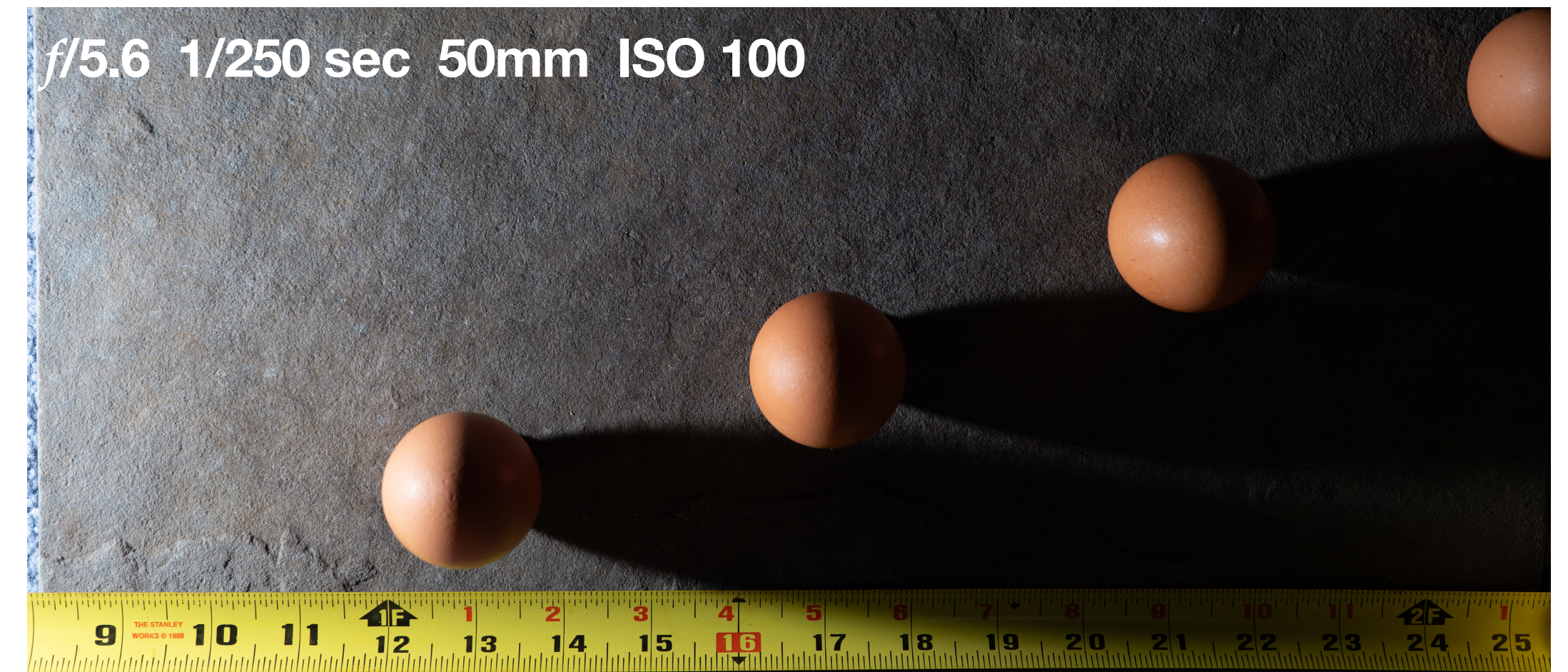
- Notice how, with the light source on the left edge of the photo, each subsequent egg is darker as you move further right.
- The second egg from the left is approximately twice as far from the light as the first egg, and the light hitting it is 1/4 as intense.



Light: Inverse square law

Compensating for lost light

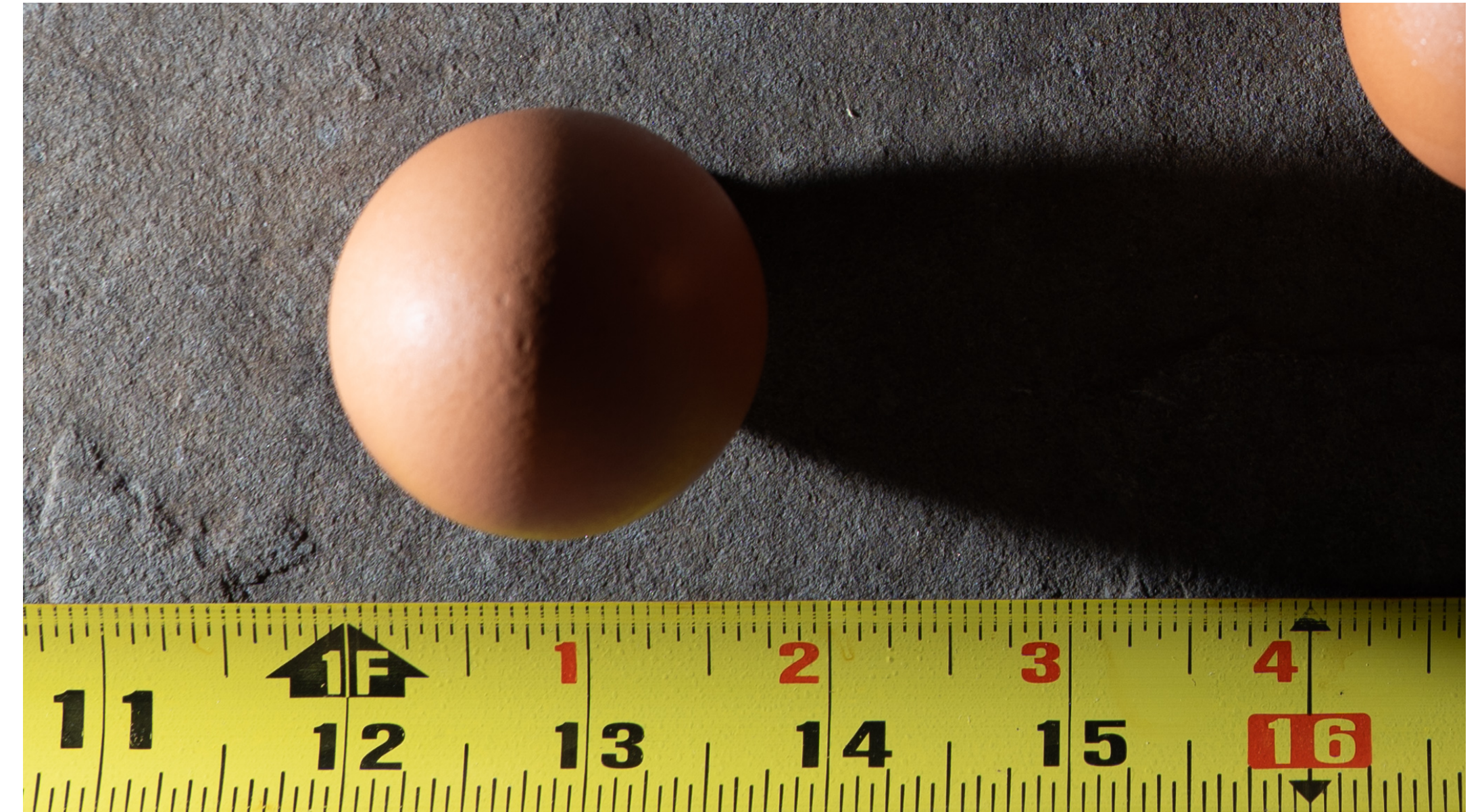
- What matters is the *difference* in distance between the light source and the subjects.
- All three photos on this page are shot with the same exposure values, but with increasing flash levels. (1/128, 1/32, and 1/8, or two stop increments)
- In these images, the light source is moved eight inches to the left, away from the edge of the frame.
$$I_2 = I_1 / (16 / 12)^2 = I_1 / 1.778 = .5625 * I_1$$
- The intensity of the light still falls off, but the amount of fall off is less than in the previous example because the difference in distances is lower.
- This time, the distance from the first egg to the light is 12 inches, and the distance from the last egg to the light is 24 inches, so the difference in illumination is the same as it was between the first and second eggs on the previous slide.



Quality of light

Photography is full of compromises

- When moving the light away from our subject(s), we say that we are “opening the shadows”. And it makes sense because the difference in light intensity hitting our subjects goes down as the relative distance to the light source goes down.
- One of the considerations that make up the “quality of light” is the hardness or softness. This is determined by the size of the light source relative to the subject.
- Think of the sun. We all know that it’s many times bigger than the earth (109 times the earth’s diameter), but relative to us, it appears very small. We can cover it with one or two fingers. It’s because of this relative smallness that the sun casts such crisp, sharply defined shadows. This is a characteristic of hard light.
- In the images on this page the illumination on the egg is about the same, but the edge of the shadow on the upper image is sharper because the light source is farther away, and therefore smaller relative to the egg. (This is a bad example because they’re both taken with a bare flash, no modifier)
- This is a compromise to keep in mind. Moving the light source away will make the illumination more even on multiple subjects, but doing so will change the quality of the shadows.



Examples

Flash only



f/11 1/250 sec 60mm ISO 200



f/22 1/200 sec 40mm ISO 200

Examples

Mixed ambient and flash



f/2.8 1/50 sec 100mm ISO 200



f/3.2 1/60 sec 47mm ISO 400