Intro to Photography

Ross den Otter

Session 4

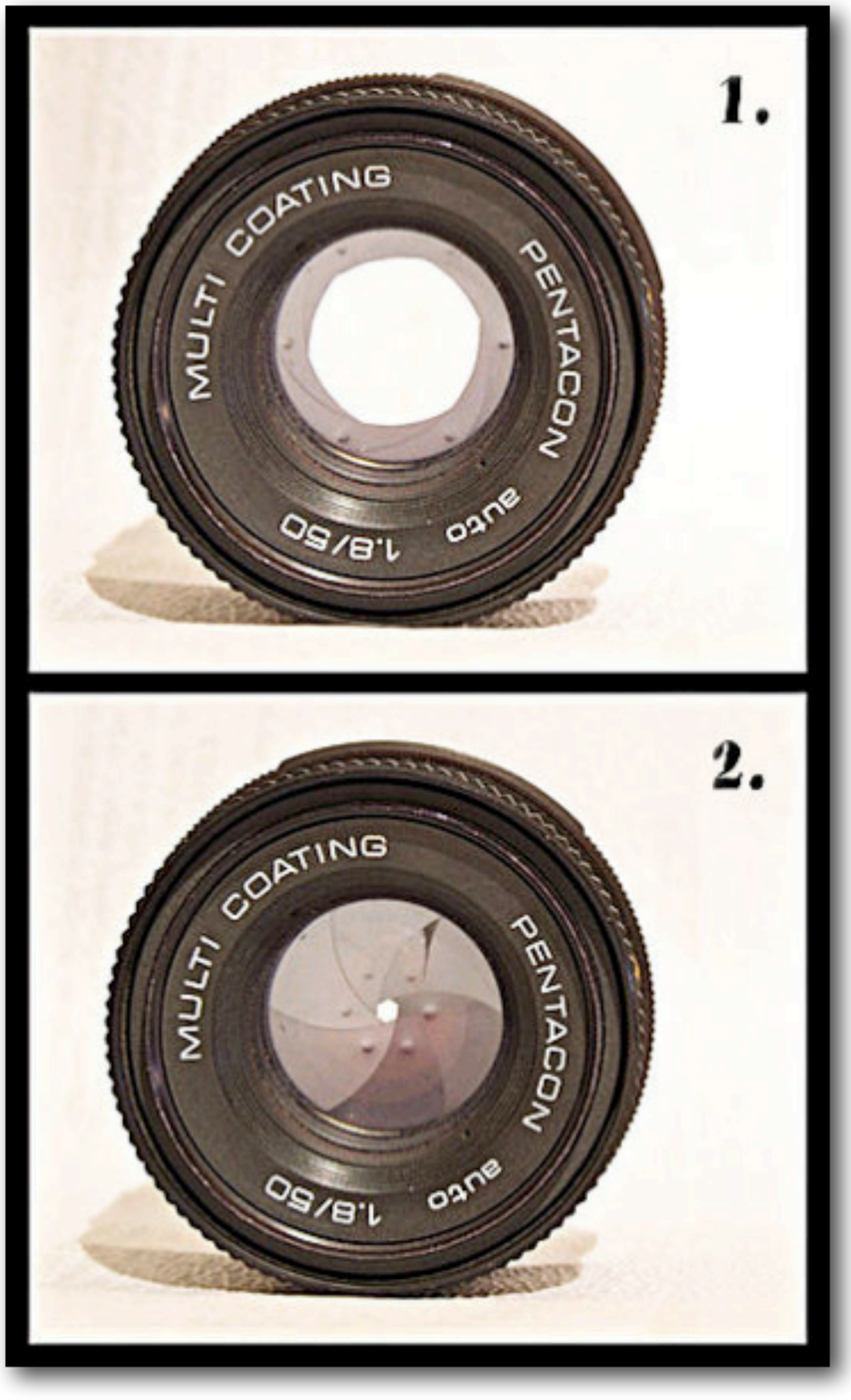
Recap . . .

light transmitted

depth of field

Aperture

Aperture

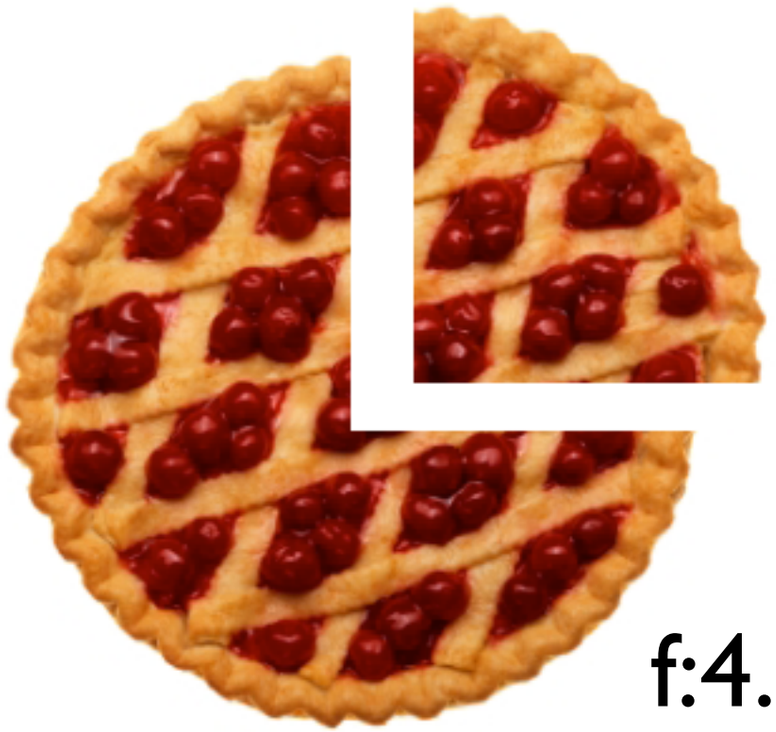


f:4.0

f:22

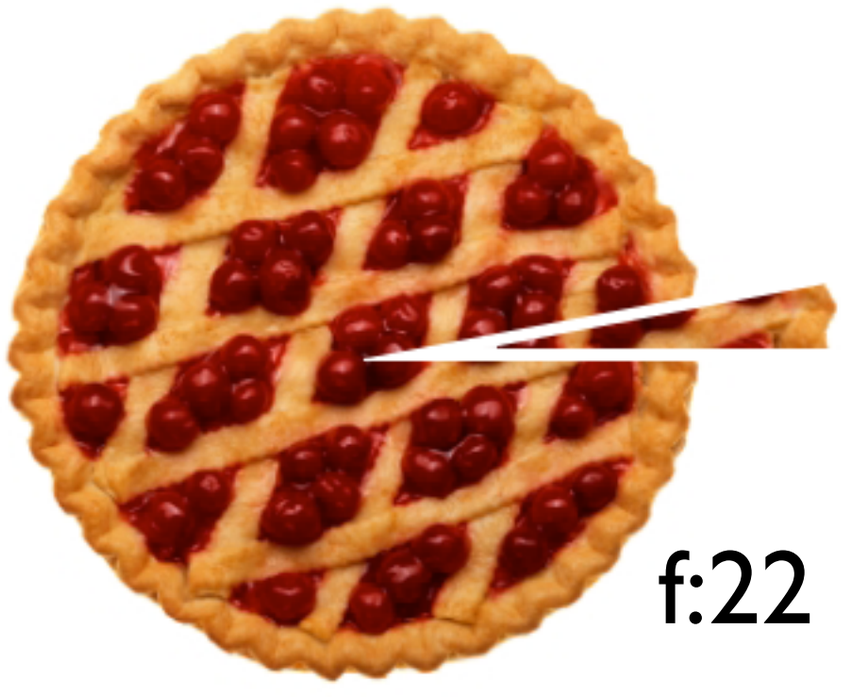
Why such weird numbers?

Making sense of the numbers.



f:4.0

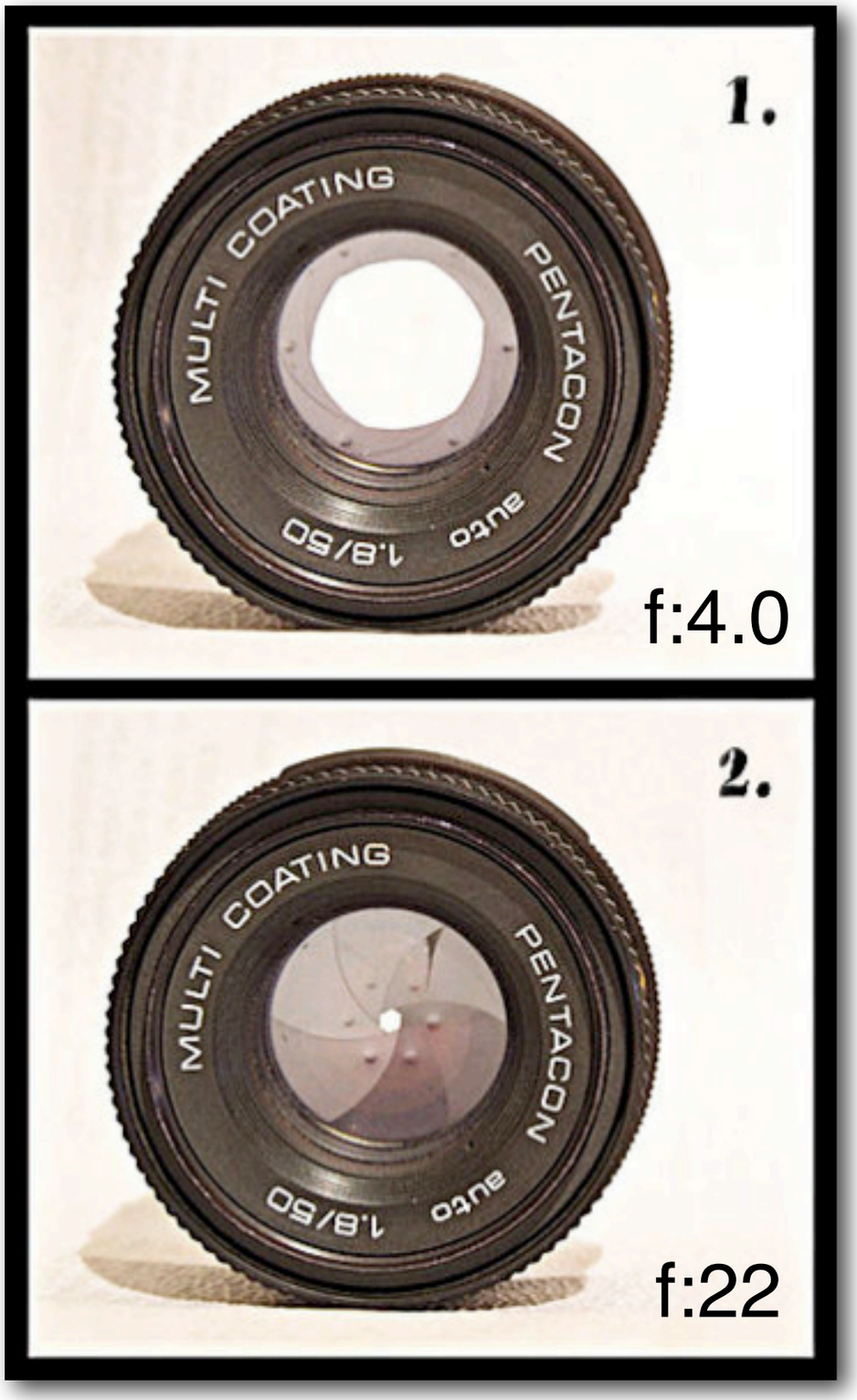
$$\frac{1}{4}$$



f:22

$$\frac{1}{22}$$

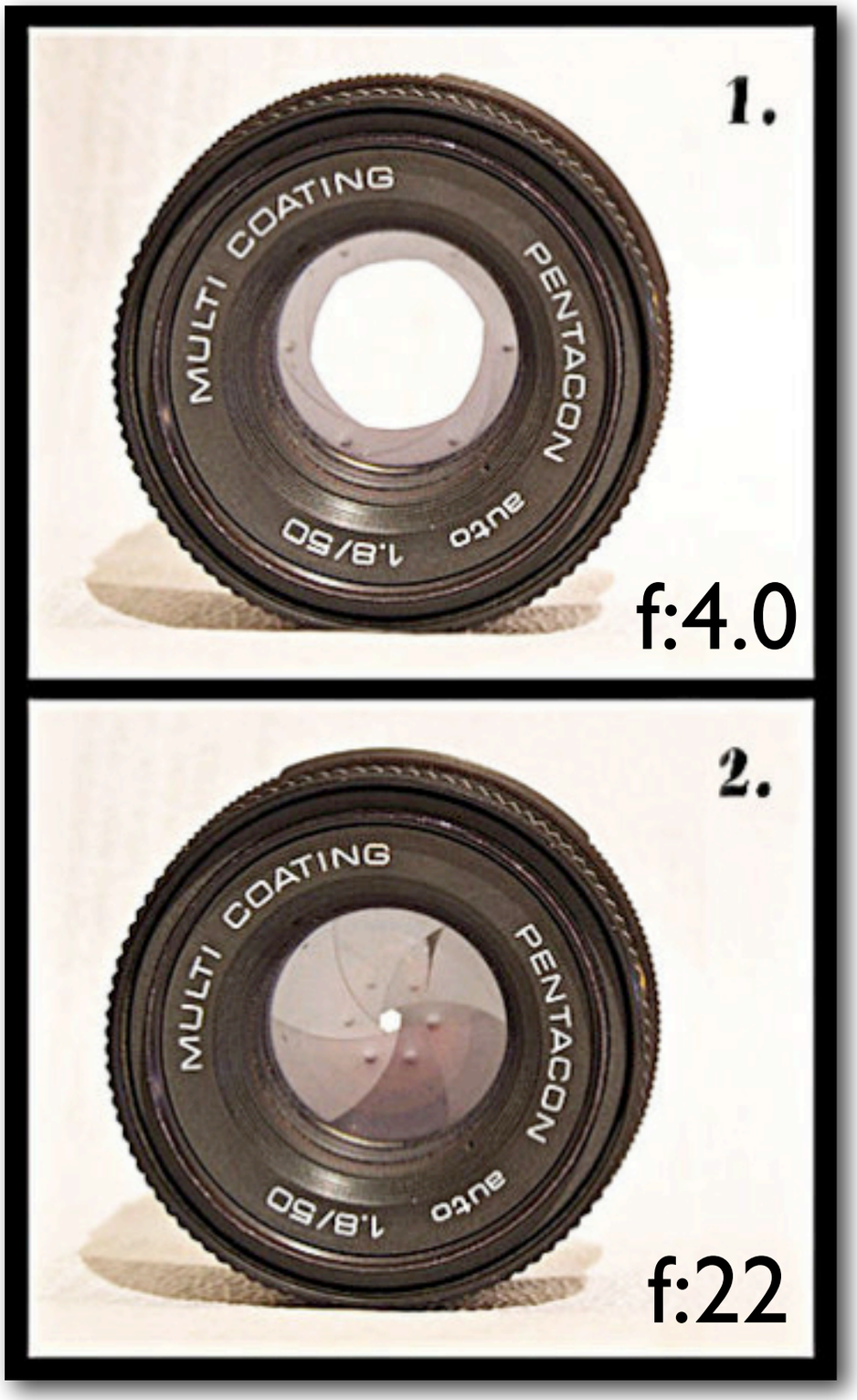
Making sense of the numbers.



At first the F-stop scale makes no sense. Smaller numbers mean larger openings and larger numbers mean smaller openings. It makes a bit more sense when you realize how these numbers come about.

$$\text{F-Stop number} : \frac{\text{focal length of the lens (in mm)}}{\text{diameter of entrance pupil (in mm)}}$$

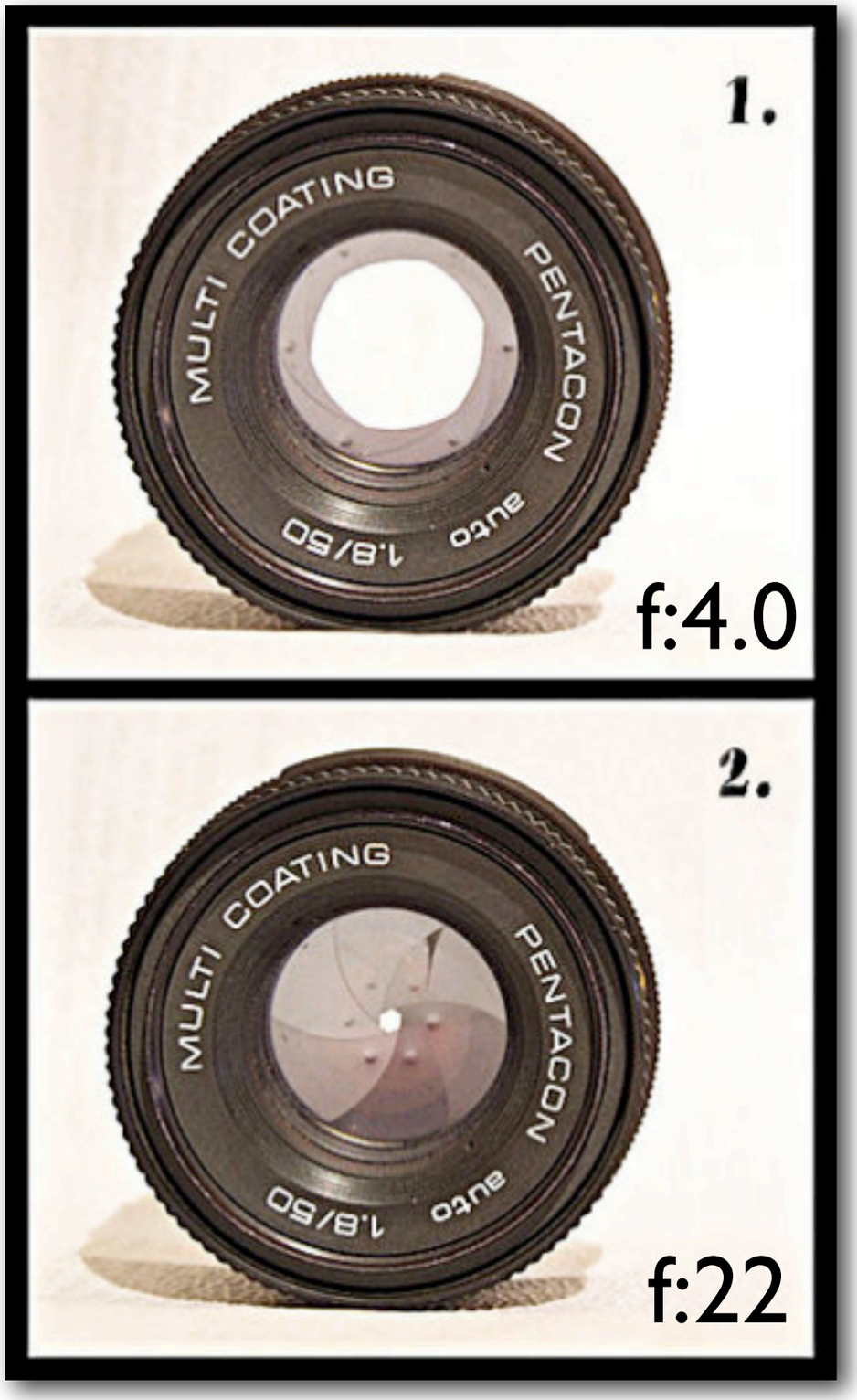
Making sense of the numbers.



$$F{:}4 = \frac{\text{50 mm focal length}}{\text{12.5 mm diameter of pupil}}$$

$$F{:}22 = \frac{\text{50 mm focal length}}{\text{2.27 mm diameter of pupil}}$$

Making sense of the numbers.



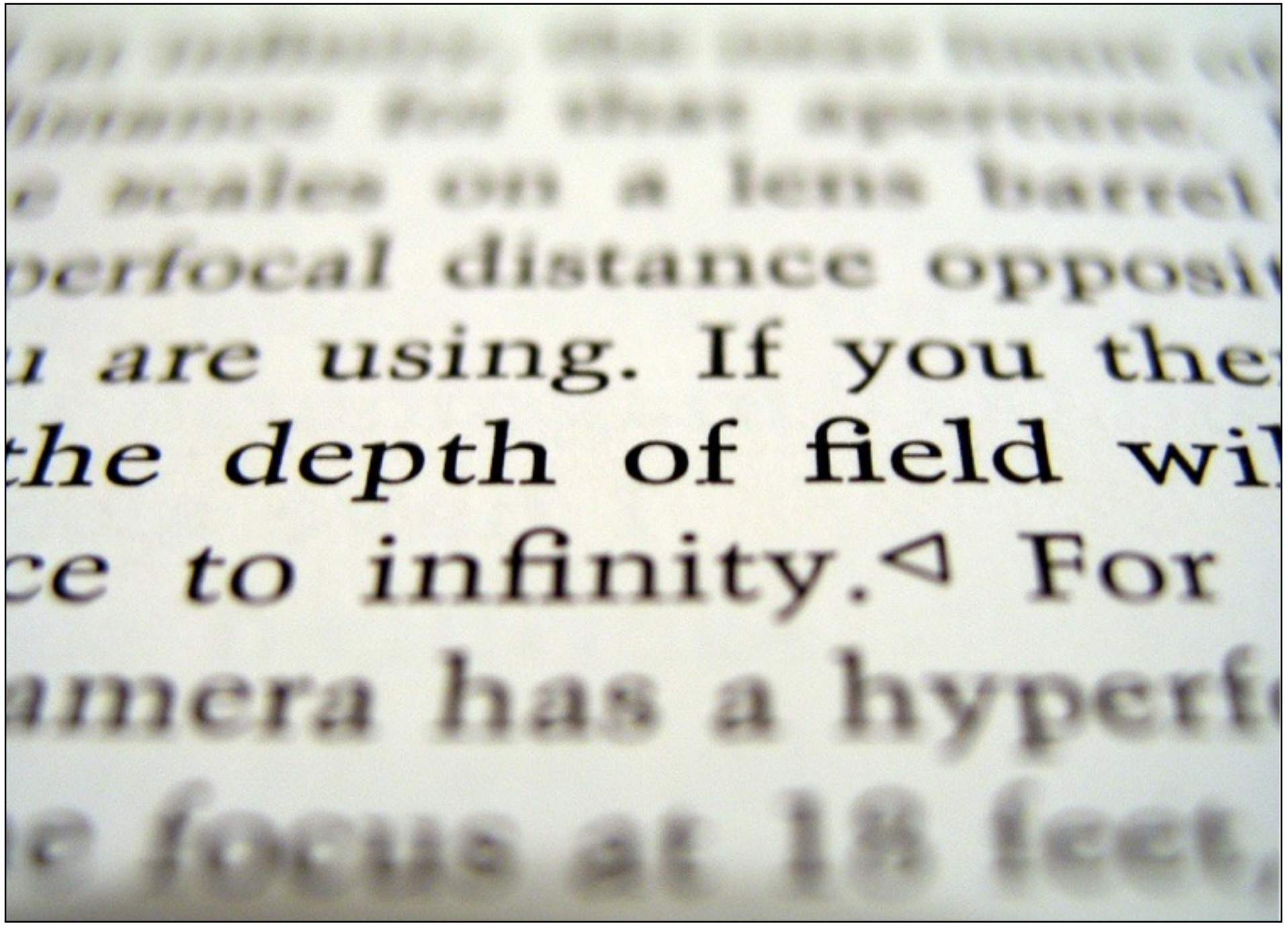
So... the F-stop is just an expression of a fraction

$$f{:}4 = 1{:}4 \text{ or } \frac{1}{4}$$

$$f{:}22 = 1{:}22 \text{ or } \frac{1}{22}$$

Aperture and Depth of Field

Aperture and the circles of confusion



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f:2.0

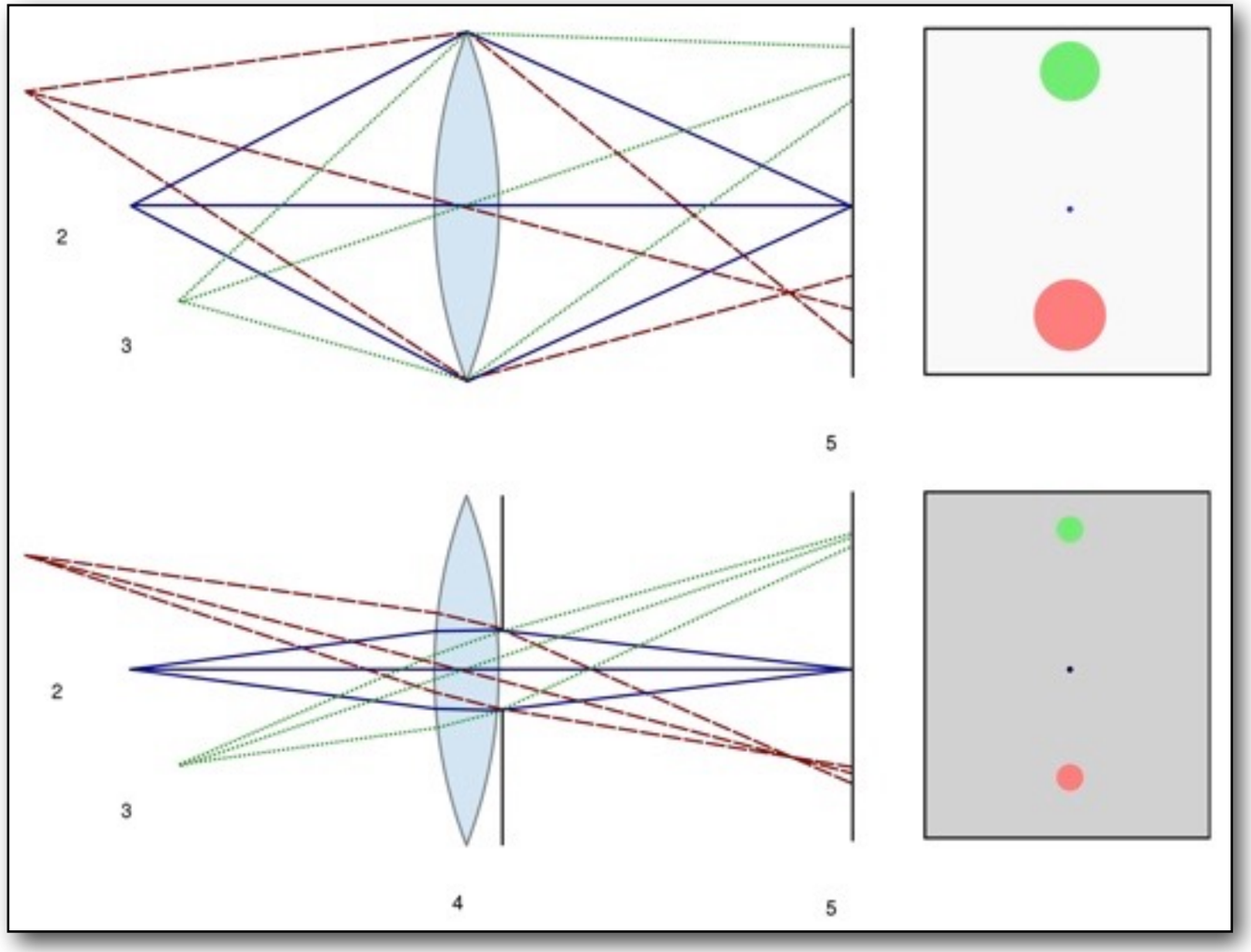
f:4.0

f:8.0

f:16

Aperture and depth of field

A lens can only focus at a single point and area of acceptable sharpness in front and back of that point is called the “depth of field”. The aperture on a lens not only varies the amount of light transmitted by a lens, it also plays a role in determining the depth of field in a photo. As an aperture is closed on a lens, the zone of focus in the scene increases in depth. Depth of field is the distance between the nearest and farthest objects in a scene that appear acceptably sharp in an image when viewed from correct viewing distances. It’s used creatively in a number of ways. In portraiture shallow depth of field is used to isolate a subject from a distracting background. In landscape work greater depth of field is used to show an expanse of space or to give a sense of place to a subject in a scene.



In both examples above, the lens is focused on point 2. This illustration shows the effect of aperture on focus as the aperture is closed. When the lens and image plane are parallel depth of field increases in parallel to those planes.

Moving along from where we left off last week

Metering Patterns

Metering

Your meter sees everything as 18% or middle grey.

matrix, evaluative or multi segment

Scenes that include a bright light

Lenses

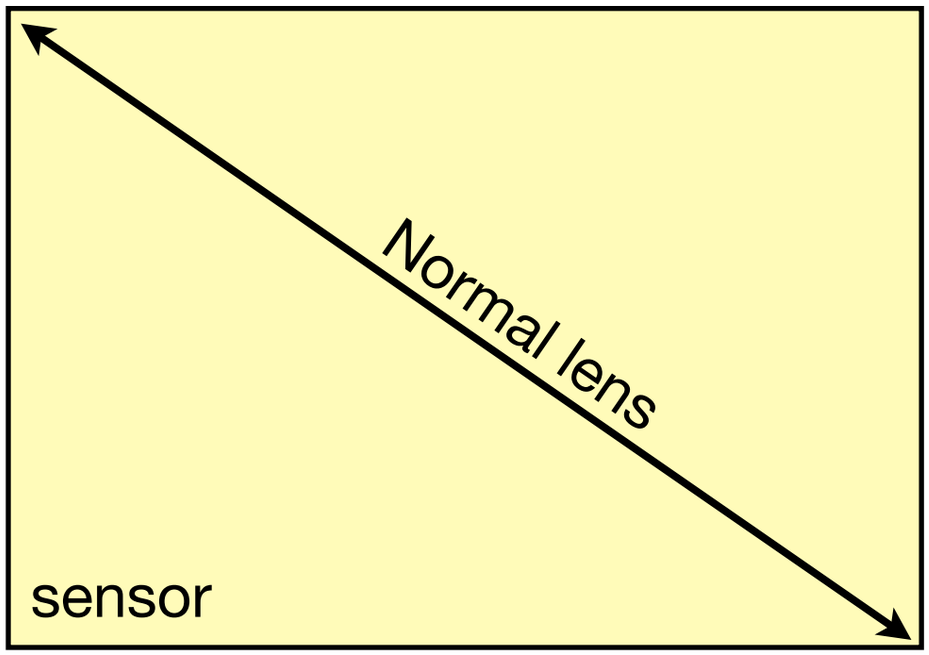
The lens is the photographic tool you use to build the story with. It establishes the intimacy or the respect you have for your subject.

When I was a teenager I worked in the darkroom for my hometown's newspaper. A bear walked into the city. One of the writers grabbed the staff camera thinking he might get a newsworthy shot. This particular camera always had a wide angle lens on it because it was the camera we used to shoot groups of people indoors.

The writer, coincidently also named Ross, came back with photos of the bear far, far, far, off in the distance walking down the street. Because of the forced perspective, we couldn't tell what it was. Was it a bear? Was it a rat? We couldn't tell from the photos.

The lens didn't give any magnification and Ross wasn't willing to move in close enough to fill the frame with the bear; a respect thing in this case.

Wide angle. Normal. Telephoto.



These are the three typical types of lenses used on cameras. Let's start with the normal lens first.

A normal lens is one that most closely approximates the angle of view of the human eye.

To calculate the normal lens for a particular format you take the diagonal measurement of the sensor.

Sensor type	Sensor dimensions	Sensor diagonal	Normal lens focal length
Four Thirds	17.3 × 13 mm	21.63 mm	22 mm
4/3"	18.0 × 13.5 mm	22.5 mm	23 mm
APS-C	22.7 × 15.1 mm	27.3 mm	27 mm
DX	23.7 × 15.8	28.4 mm	28 mm
FX or (35 mm film)	36 × 24 mm	43.3 mm	50 mm

Table of format measurements and normal lenses for popular camera sensors sizes.

Lenses

APS-C or DX Cameras

Telephoto

- 135mm +

Portrait

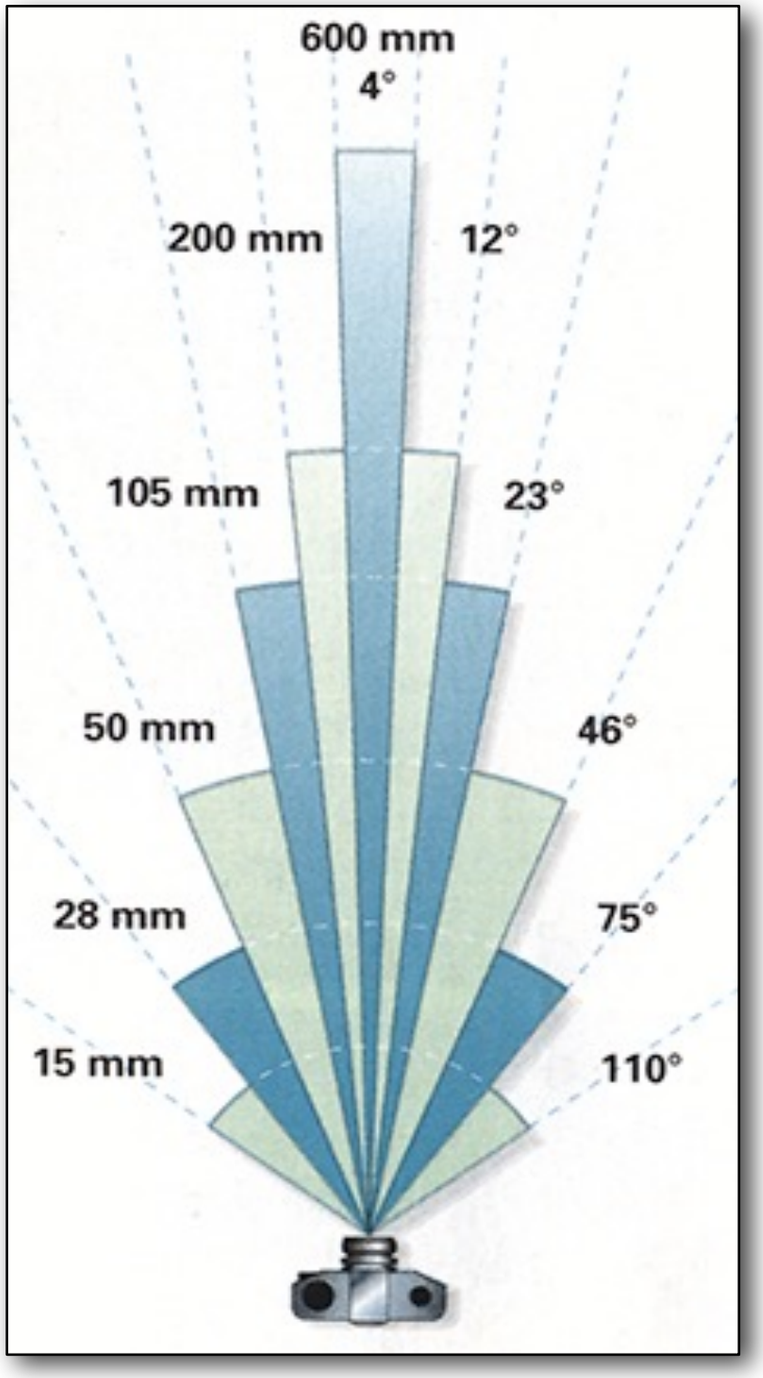
- 55mm to 105mm

Normal

- 30mm

Wide Angle

- 10mm to 28 mm



Full Frame Cameras

Telephoto

- 135mm to 500mm

Portrait

- 85mm to 105mm

Normal

- 50mm

Wide Angle

- 18mm to 35 mm

SLR Camera Lenses

Fixed Lenses:
(also called 'prime lenses')

28mm Wide-angle
50mm Standard
85mm Portrait
200mm Telephoto

Zoom Lenses:

17-35mm Wide-angle
28-70mm Standard
70-200mm Telephoto
28-300mm Long Range

Specialty Lenses:

Tilt Shift Lenses
Macro Lenses
Fisheye Lenses
Ultra-Wide/ Long Lenses

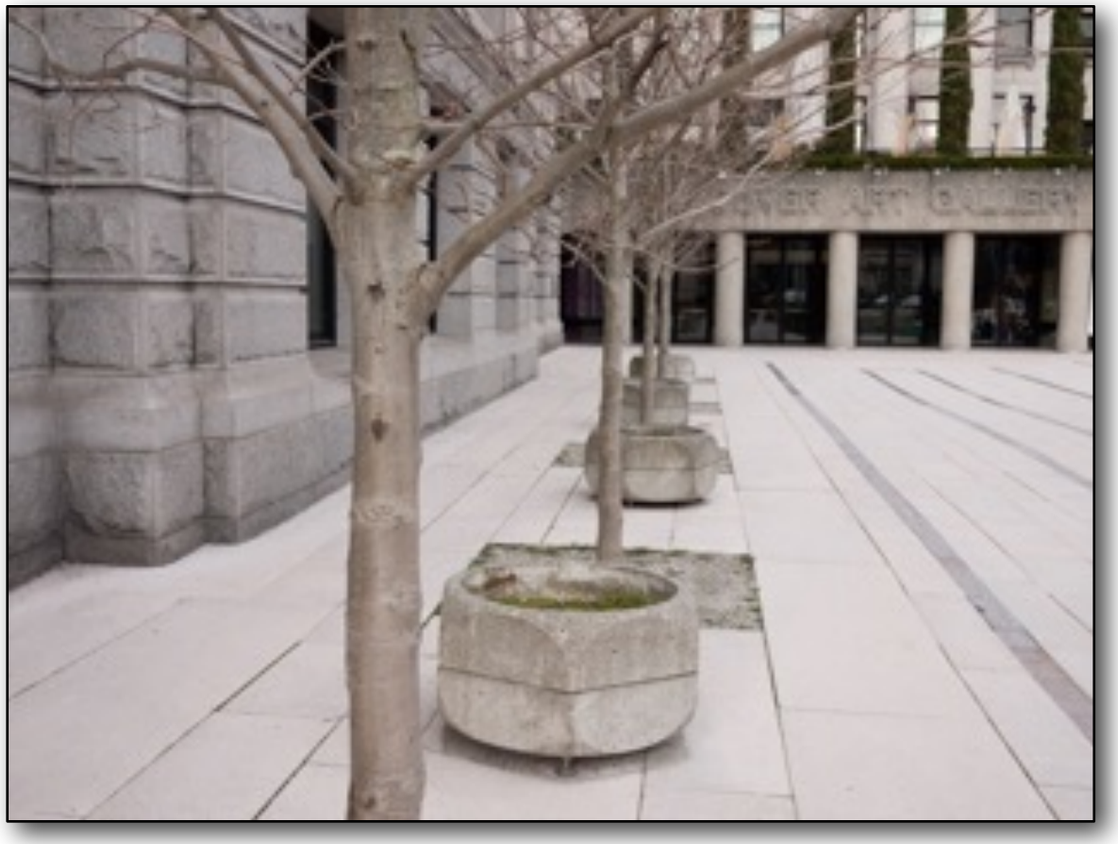
All of the exposures were made at f5.6 from the same spot.
Angle of view changes, perspective does not.

When you crop the photo to match the 200mm framing the images share the same perspective. The depth of field is different and so is the resolution.

The camera position was changed to keep the front tree the same size from photo to photo. This is when the perspective changes.

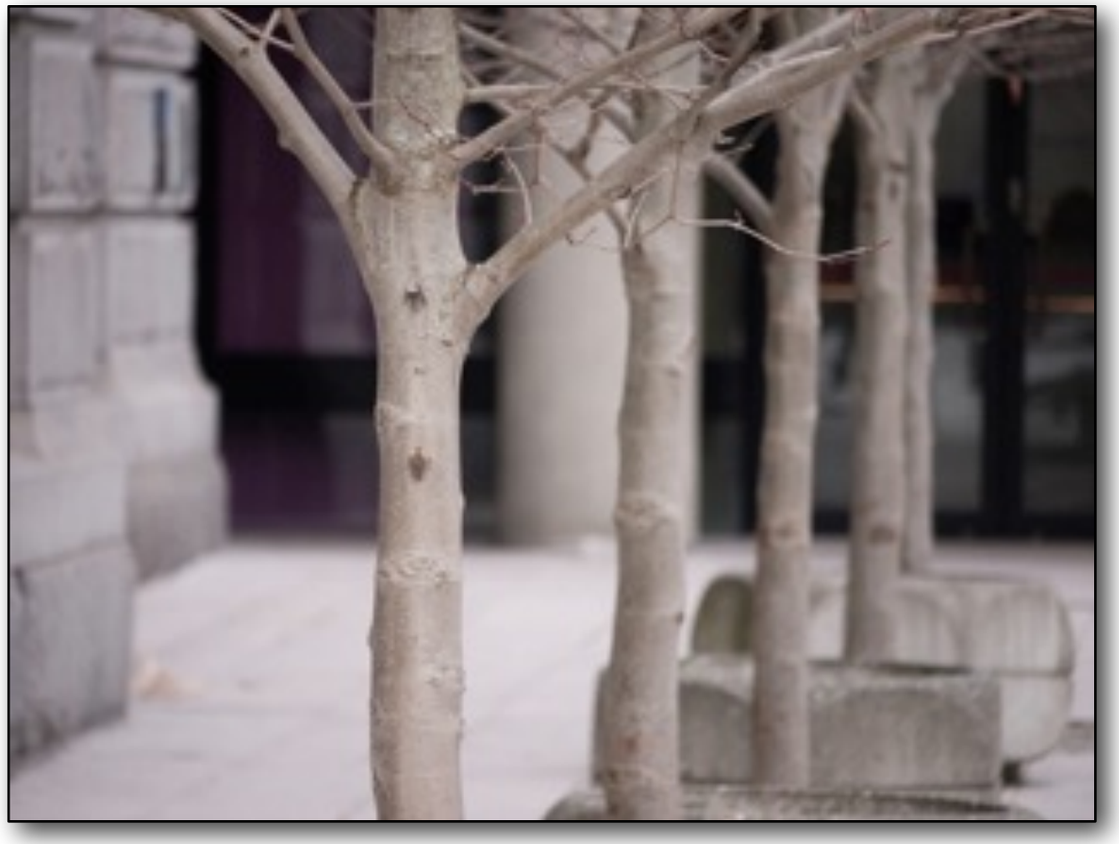
Lens Behaviour

Wide Angle



Expansion

Telephoto



Compression

expansion

compression

compression

Perspective

Vertical and horizontal lines

Most straight lines are man made, except the horizon. We have expectations for straight lines; skyscrapers that don't appear to be falling backward and rail lines that converge in the distance, and keep the horizon level. Each of these elements are controlled by camera placement and lens selection. Converging and parallel lines are governed by intersecting planes. If lines in the scene intersect with the plane of the sensor those lines in the scene will converge. If lines in the scene remain parallel to the plane of the sensor, then those lines will remain parallel in the photograph.

In plain english, if you tip your camera up to fit the top of the building in, the building will look like it's tipping back.

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In plain english, if you tip your camera up to fit the top of the building in, the building will look like it’s tipping back.

They built this tower on soft ground with a shallow foundation of only 3 metres and it started tilting after the addition of the second floor.

They waited 100 years or so for the soil to compact; settling some scores with Genoa, Lucca, and Florence in the meantime. When they got back to work on it they added another six stories; curving them to compensate for the lean.

Here's the dilemma, do you keep the horizon straight or do you correct the lean of the tower in the photo by rotating your camera?

Myself, like most tourists to Pisa, choose to mess around with "forced perspective".

An optical illusion, forced perspective is a technique that makes an object’s relative appearance larger, smaller, closer or father away than it actually is. The technique is used in photography, filmmaking, sculpture and architecture.

Forced perspective was used to make a statue of the lion on the steps of the loggia seem much larger than the giant copy of David standing outside the entrance of the Palazzo Vecchio in Florence Italy. From my memory the lion is substantially less than half the size of David.

Michelangelo used forced perspective in the creation of his masterpiece David. David’s hand and head are disproportionally larger than his body to make those elements more prominent. Some have thought David was intended to be placed on Florence’s cathedral roofline and was to be viewed from below.

The architects that designed this mosaic pattern use forced perspective to create an undulating wave pattern, symbolic of the oceans the nation of Portugal controlled during its Golden Age.

Forced perspective.
Me in New York, thinking about home.

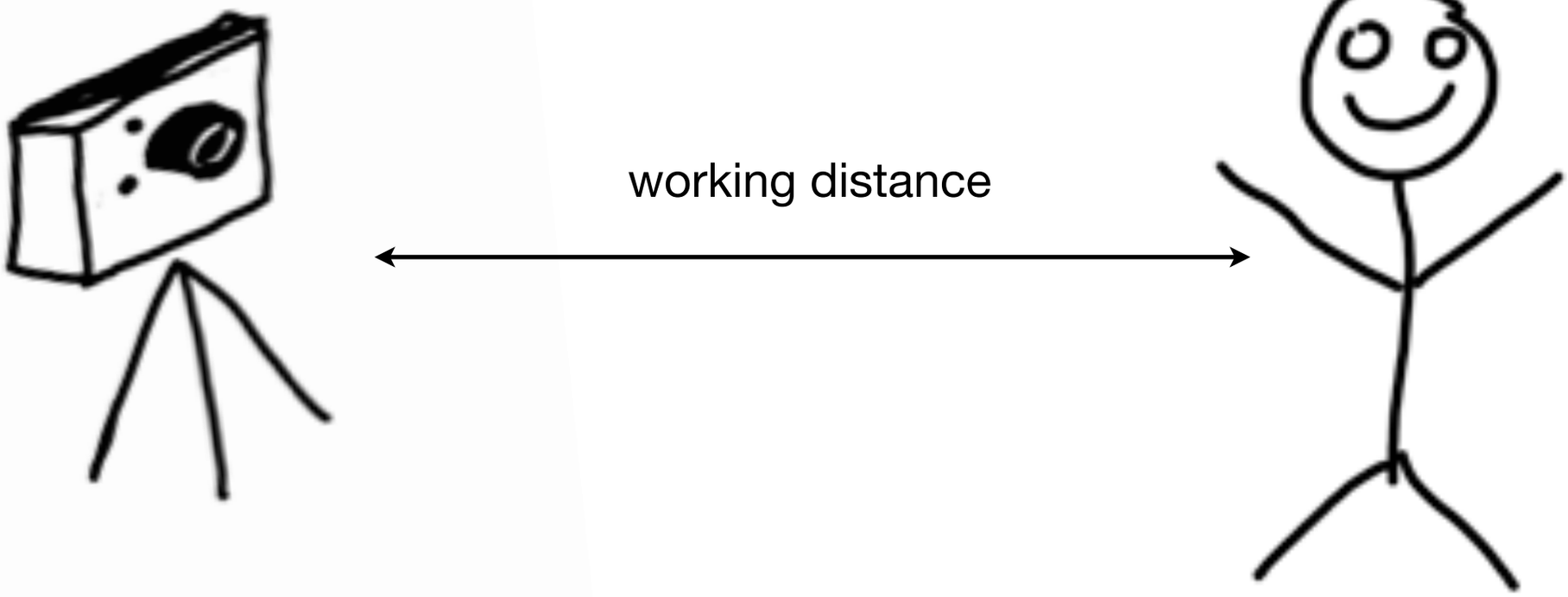
This photo was taken with a short focal length lens where the working distance was less than three feet. Notice the immense hand holding the glasses that are too large for his head which is too large for his body.

You may also note he's wearing a shirt where GENIUS is misspelled; not everyone does...

Forced perspective in photography is achieved by placing objects in the frame at varying depths and manipulating the relationship of the objects through lens selection, angle of view and proximity to the camera and the other objects.

Forced perspective can be used to exaggerate the relationship of a subject's features. Generally the distorted relationship of those features create comedic characterizations.

When you fill the frame with your subject while using a wide angle lens on your camera you get forced perspective. It might be fine for some purposes but you won't score high for beauty.



If your goal is to make a flattering photograph of someone, take it from a respectful distance.

A head and shoulders portrait taken with a lens that has a focal length double diagonal of your camera sensor measurement, which is considered the perfect portrait lens, will need a camera to subject distance of between 4 and 6 feet. This combination of lens and working distance gives a perspective to your subjects face that is close to how we see people. For simplicity sake I call the distance from camera to subject the working distance.

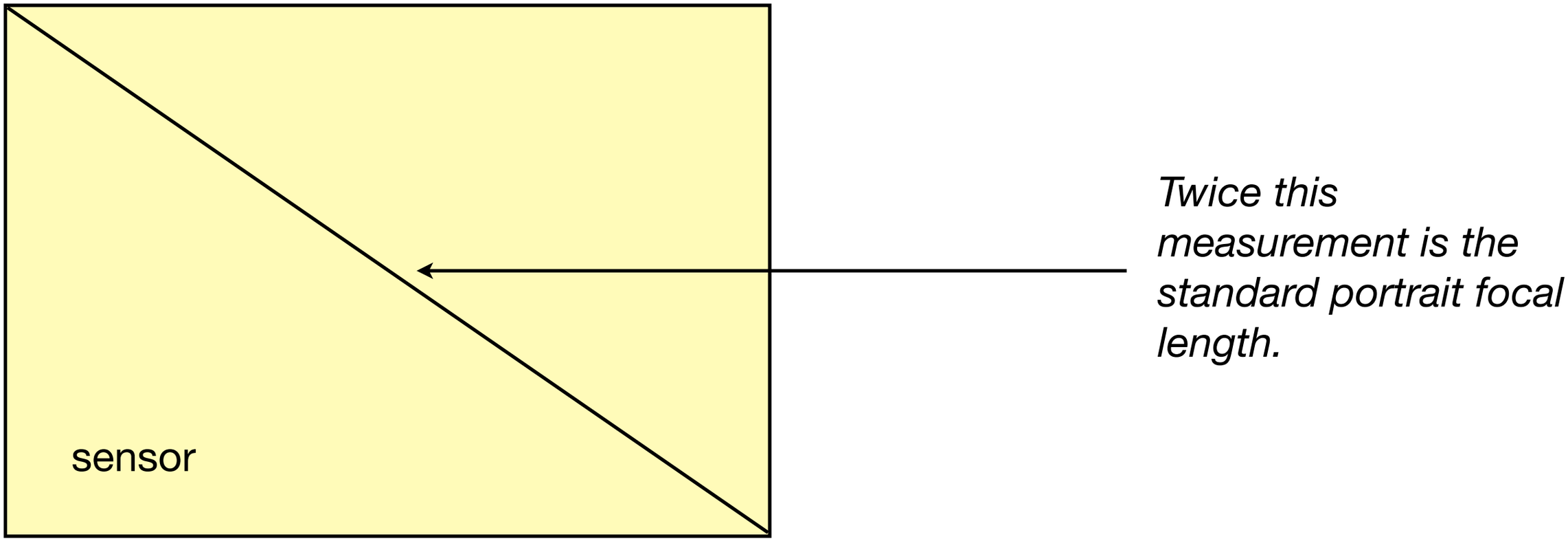


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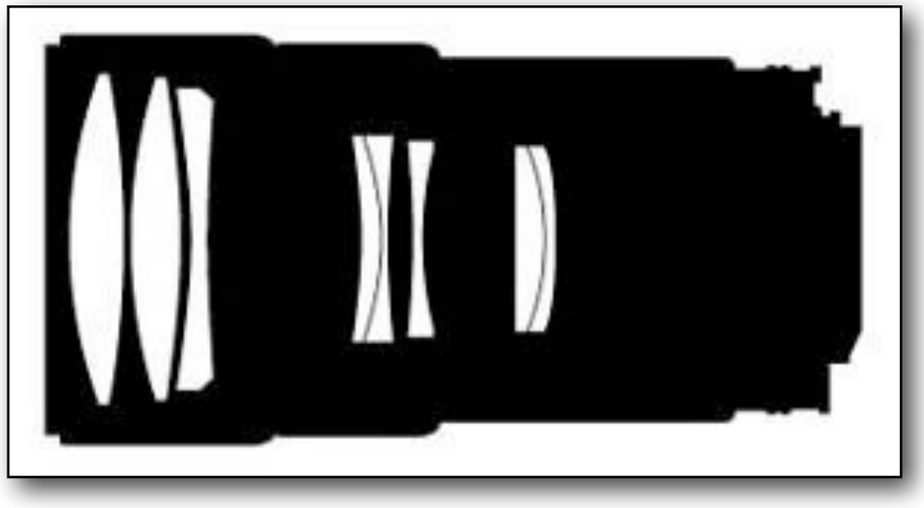
Table of format measurements and normal lenses for popular camera sensors sizes.

By using a long lens to make these photo of Stefano Giulianetti he’s isolated from the background and the features of his face are flatteringly compressed. In both cases the lens was a 180mm on a Nikon D2x the aperture was set to f 6.7

Same Guy



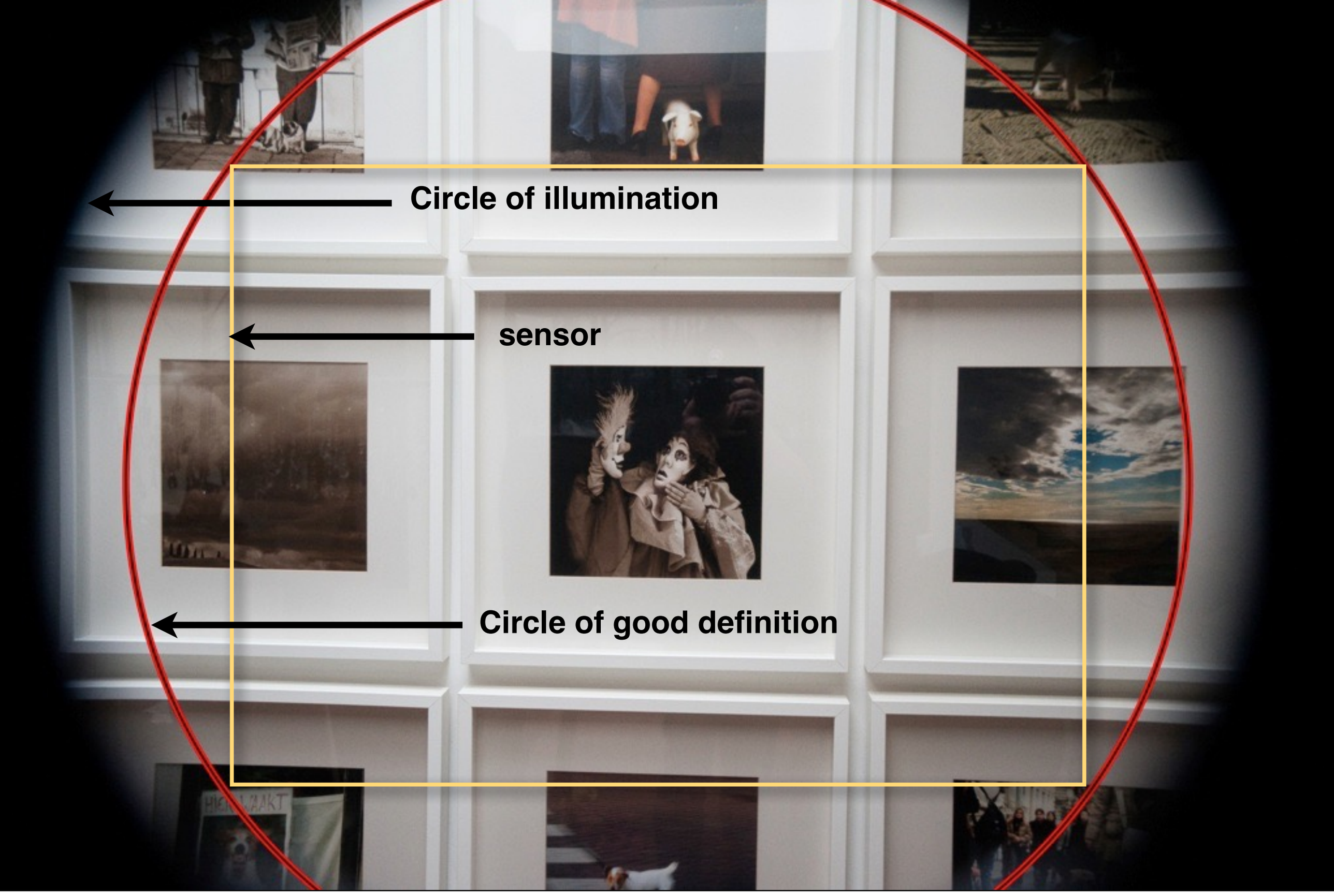
Nikon 180mm f2.8 lens
(8 elements in 3 groups)

Nikon 80-200mm f2.8 lens
(18 elements in 4 groups)

Lenses and light transmission

With light, not every f2.8 is created equal.

What an f-stop doesn't tell you is the amount of light actually transmitted by the lens. I have three lenses: a 180mm f2.8 lens, an 80-200 f2.8 lens and a 28-70 f2.8 lens. They all have the same maximum f-stop but the 180mm lens transmits almost a stop more light than my zoom lenses. Lenses are made with a series of glass pieces called elements. Zoom lenses are more complex in design than lenses of a single focal length; with every air to glass surface of the optical elements in a lens a little bit of light is lost to reflection and absorption.



Lens design

minimum focus
distance