Today: Focus, aperture, shutters

PHOTOGRAPHY FUNDAMENTALS

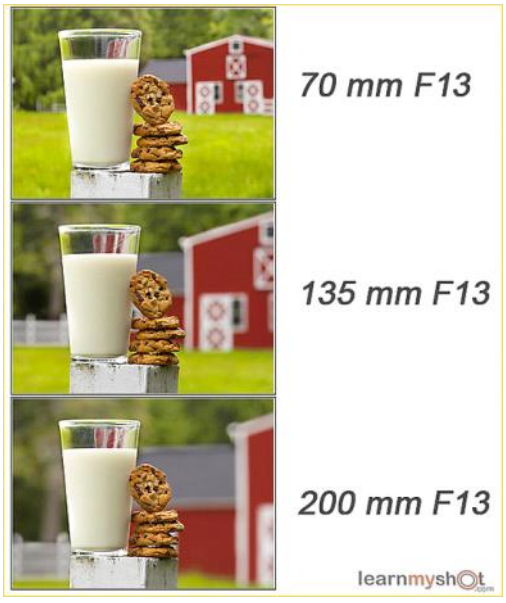
1) Framing
2) Camera
3) Lenses
4) Exposure Control
5) Resolution

3) LENSES

	DSLR	Mirrorless	Point and Shoot	Film	Phone camera only
	Digital Single Lens Reflex Optical viewfinder	Interchangeable lens but no viewfinder, just LCD	PHD Push Here Dummy. LCD viewer, fixed lens		
Sensor size	23.5x15.6 mm 22.2-14.8	Same as dslr 36X24			
Focal length range	18-55 70-300	16-50 24-105			

Impact of focal length on framing:

As f increases (longer lens), field of view narrows
'Telephoto compression' happens too



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https://www.youtube.com/watch?v=4yyFKNfRq_M

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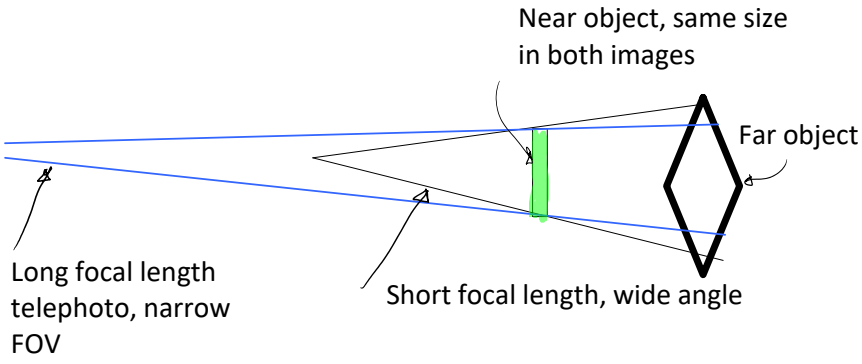
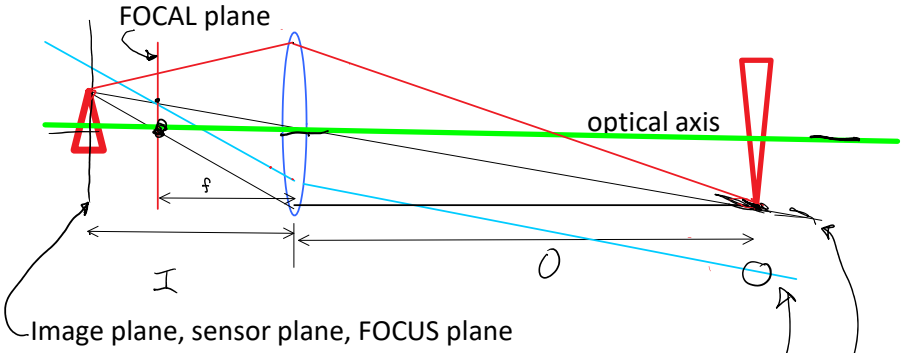


TRY THIS NOW
Make images at different lens focal lengths (zooms) and note the image compression effect.

FOCUS

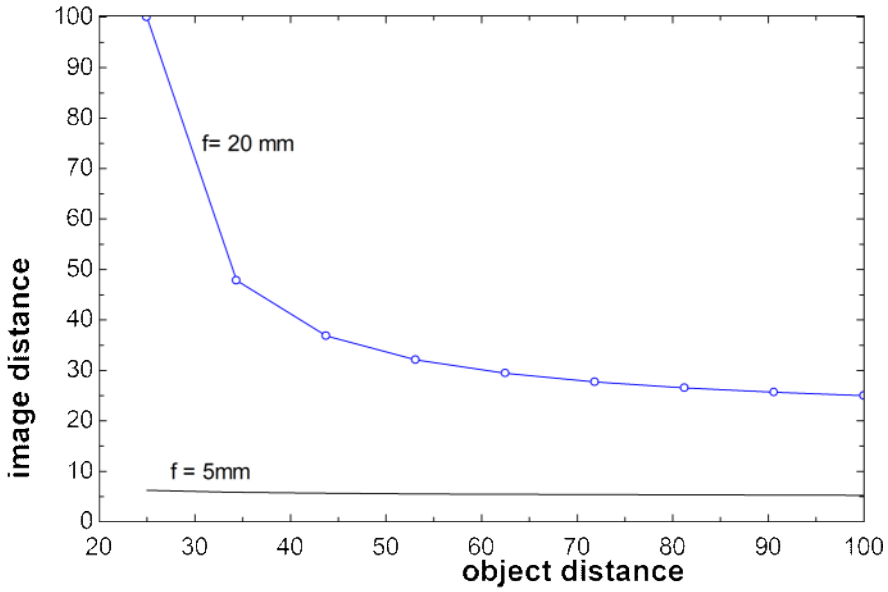
'In focus' when all collected light from a point on the object shows up at a single point in the image.



Lens laws:
1) light through center of lens is undeflected
2) light parallel to axis goes through focal point
3) all light entering lens at a given direction ends up at the same point in the focal plane

$$\frac{1}{f} = \frac{1}{Ob} + \frac{1}{Im}$$

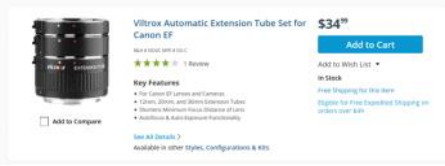
For a set focal length, as an object moves closer, lens must move away from sensor plane to keep focus plane at sensor. Mechanical limit defines closest possible object distance for focus.

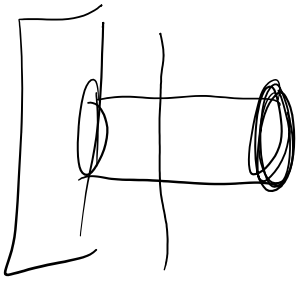


This is why small cameras with small sensors and short focal lengths have better macro capability than larger cameras. Hardly have to move the lens at all.

<file://C:\Users\hertzber\Documents\01CLASSES\FlowVis\Content\objectimagedistances.EES>

Extension tubes (for DSLR) allow lens to move further out and focus closer.





https://www.bhphotovideo.com/c/search?Ntt=Canon%20Extension%20Tube&N=0&InitialSearch=yes&ap=Y&gclid=CjwKCAjwn9v7BRBqEiwAbq1Ey4UGoJ7JL17VJ8nuohuDReoMd_oQrovcpFcIEQC8WZVny-elgAgaiRoC11AQAvD_BwE

Check that electronic capability for autofocus and auto exposure are there; wiring goes through tubes

"Reverse macro" adapters let you turn the lens around, or put a reversed lens at the end of your normal lens. $15.
Caution, interior lens element is now exposed, easily scratched.

'Close up' lenses allow close focus by changing system f . Long f lens, threads on to the outer end of main lens (threads standard, but need to match diameters).
Lower quality, though. Each additional lens element can lose 10% of light, introduce aberrations.
PHD cameras and cell phones often lack threads. You can just hold a close up lens out in front, or
mount to cardboard tube. Check focus often.
Inexpensive, $6 for set of 4. Available for camera phones too.

Spec'd in 'diopters' = 1/f in meters. Typically +1, +2, +4

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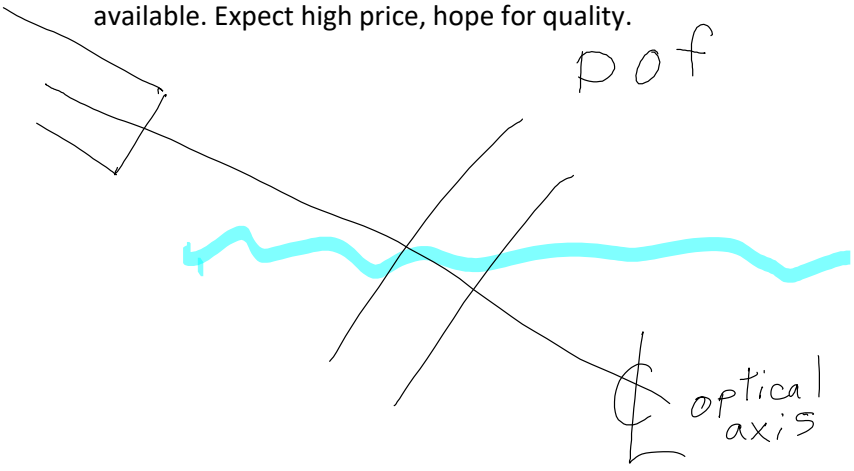
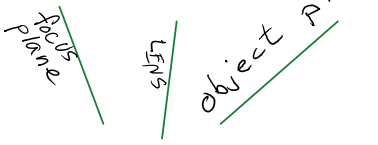
$$\frac{1}{f_{TOTAL}} = \frac{1}{f_1} + \frac{1}{f_2}$$

PHD cameras often have 'macro mode' =
Flower Button. Does yours?

For DLSRs, prime and zoom 'macro' lenses are available. Expect high price, hope for quality.



LensBaby: lets you angle the lens axis compared to the camera body axis. Effectively makes the object plane not parallel to the sensor plane. Same as 'swing' of field view camera
http://lensbaby.com/lenses



Sol 22
$199.95 USD

Got to here Friday Oct 2, 2020

Monday oct. 5

Homework Exercise:

1. Can you get the most magnification by zooming out and moving close, or by zooming in and moving back?
2. At which extreme can you focus closest? What is the minimum distance? What is the FOV there?
3. Make an image of a 25¢ coin. At what lens settings do you get the greatest magnification, where the coin is as large as possible in the image and still sharply in focus?
4. Make the same image with three f/stops: max, min and low medium. (Try to keep overall exposure and ISO the same, and use tripod or keep shutter time short.) Inspect the three images closely for focus, depth of field and overall sharpness. What happened?

Example: Iphone 8. Exported medium resolution image. Quarter size (1 inch, 24 mm) is 166/640 px=0.2594 , 26% of the image, at 3" image distance. No optical zoom.

Inspect the three images closely for focus, depth of field and overall sharpness. What happened?

Example: Iphone 8. Exported medium resolution image. Quarter size (1 inch, 24 mm) is 166/640 px=0.2594 , 26% of the image, at 3" image distance. No optical zoom.

Will be due in a google spreadsheet via a Canvas assignment Weds Oct 7

Last year

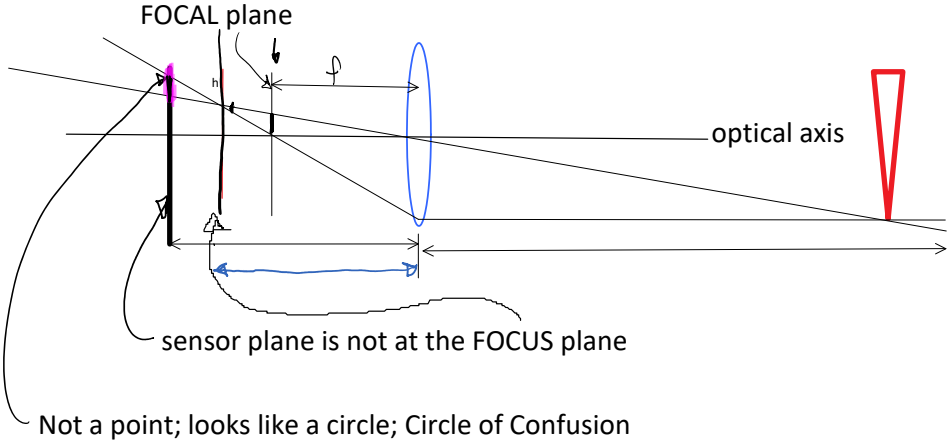
Homework Results: Can you get the most magnification by zooming out and moving close, or by zooming in and moving back? At which extreme can you focus closest?

Most have No optical zoom

Iphone X does

zooming out and moving close			by zooming in and moving back?		
Cell	~~PHD~~ small sensor	~~DLSR~~ Large sensor	Cell	PHD	DLSR
ϕ	2		8	12	

OUT OF FOCUS



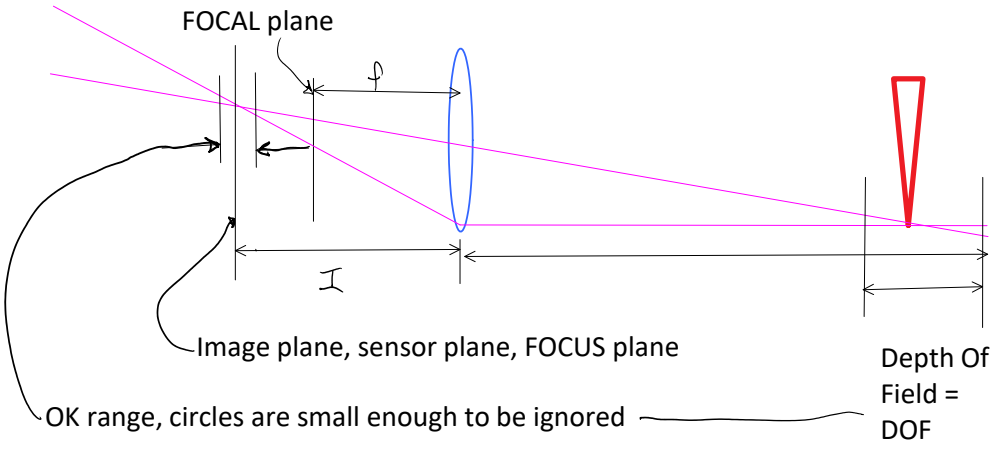
Bokeh

From Wikipedia, the free encyclopedia

For other uses, see Bokeh (disambiguation).
Not to be confused with Depth of field.

In photography, **bokeh** (/ˈboʊkə/ *BOH-kə* or /ˈboʊkeɪ/ *BOH-kay*;[1] Japanese: [boke]) is the aesthetic quality of the blur produced in out-of-focus parts of an image.[2][3][4] Bokeh has also been defined as "the way the lens renders out-of-focus points of light".[5] Differences in lens aberrations and aperture shape cause very different bokeh effects.[6] Some lens designs blur the image in a way that is pleasing to the eye, while others produce distracting or unpleasant blurring ("good" and "bad" bokeh, respectively).[6] Photographers may deliberately use a shallow focus technique to create images with prominent out-of-focus regions, accentuating their lens's bokeh.

Depth of Field



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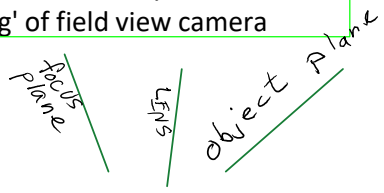
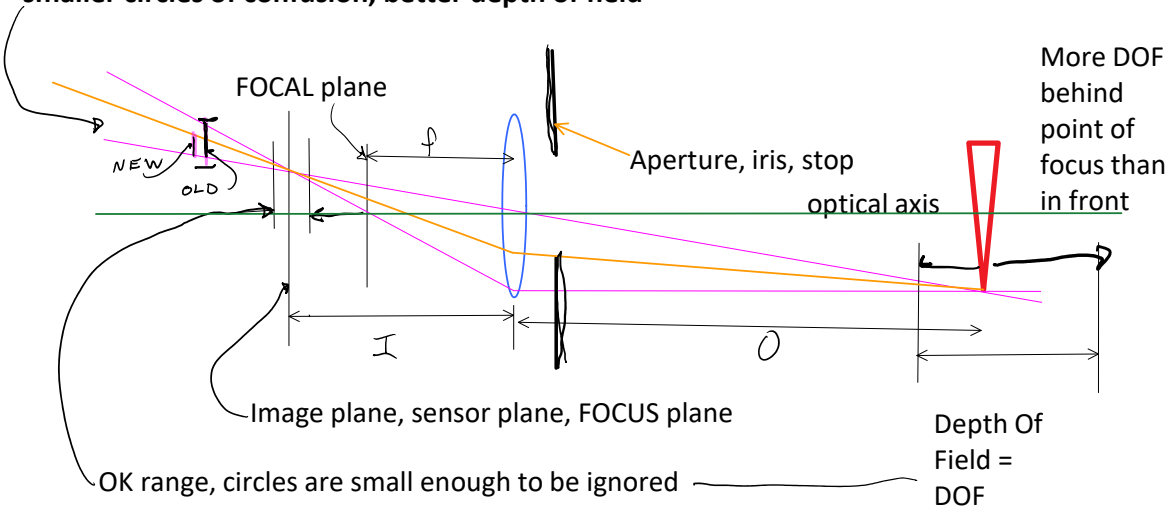
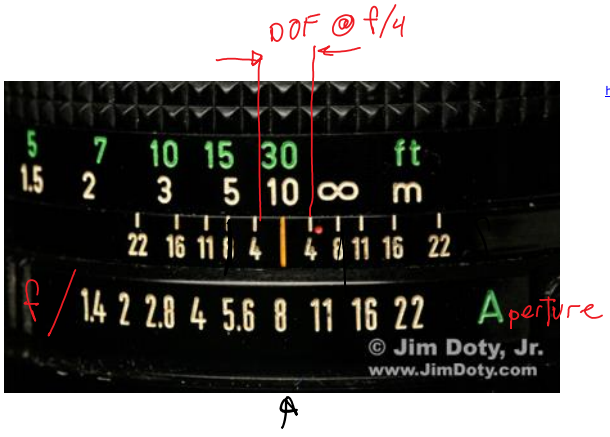


Improve DOF by reducing aperture diameter: smaller hole, smaller circles of confusion, better depth of field





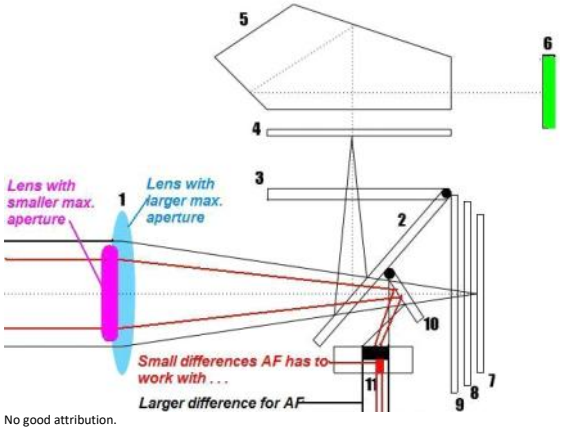
http://jimdoty.com/learn/exp101/exp_big3/exp_big3.html

More DOF behind best focus because of nonlinear lens equation

Detailed article on DOF:

http://www.largeformatphotography.info/articles/DoFinDepth.pdf

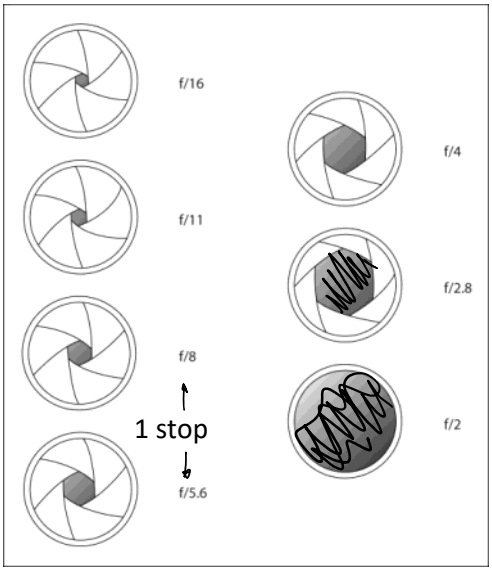
Worse autofocus performance at small apertures. Use a large diameter lens/ large aperture for low light levels.



No good attribution.
https://www.canonrumors.com/forum/index.php?topic=15521.0

BUT, what else happens as aperture gets smaller? What is the problem with tiny apertures?
Think, pair, share

LESS LIGHT



2.8, 3.5, 4, 5.6, 8, 11, 16, 22, 32, 45, 64

http://media.wiley.com/assets/1007/41/0-7645-9802-3_0213.jpg

Aperture (iris) mechanism made from overlapping pivoting leaves.

Aperture has impact on exposure too, how much light total hits the sensor.
Units: 1 stop = 1 EV Exposure Value = factor of 2 in area, light.
Camera adjustments in 1/3 stops

Stop used to be a metal plate with hole punched in it. It stopped light.

$f/ = \frac{f}{D}$

or f#

http://media.wiley.com/assets/1007/41/0-7645-9802-3_0213.jpg

$f/\# = \frac{f}{D}$

Ansel Adams founded f/64 club. Tiniest hole, maximum DOF. Modern lenses often best sharpness at f/5.6 or design point. We will come back to this when discussing resolution.

Part 2 of Homework Exercise: Make the same image with three f/stops: max, min and low medium. (Keep ISO the same, and use tripod or keep shutter time short.) Inspect the three images closely. What happened?

4. EXPOSURE

For a given light intensity, exposure = (aperture area) X (time shutter is open)

Shutter speeds: 30 = 1/30th of a second etc.
5 = 1/5th of a second
30" = 30 seconds
T = time, click to open shutter and again to close
B = bulb, shutter stays open as long as button is pressed (or bulb is squeezed)

Check your camera shutter speed options. What is the range?
Tv or S = Time priority; you set the shutter speed and ISO, camera AE will choose the aperture.
Av = aperture priority. You choose the aperture, camera will choose shutter speed.

Equivalent exposures: f/5.6, 1/100 sec
f/8, 1/50 sec
f/11, 1/25 sec
1 EV

1/4000 – 30 sec Nikon
1/24,000 – 10 Camera phone
1/8000 – 36 sec Canon full frame EOS R5
1/32,000
electronic shutting

Mechanical vs Electronic (rolling) Shutters

Advantages to Using A Mechanical Shutter

- Sync better with flash – mechanical shutters tend to allow you to operate the flash at higher speeds than an electronic shutter
- The reduce noise that you in shutterless cameras
- Reduce Rolling Shutter distortions – Rolling shutters (a type of electronic shutter) can often result in lateral distortion of images especially when the camera is panned quickly, or a subject is on motion.
- They cope better than electronic shutter with flickering light sources

Disadvantages of Using A Mechanical Shutter

- Reduced Top Shutter Speed – The mechanical nature of these kinds of shutters means that the maximum speed is usually less than electronic shutters
- They have a life span – as mechanical shutters feature moving parts these are obviously prone to wear and tear and may stop working overtime. Most cameras that come with a mechanical shutter system will have a "shutter count" or number of times the shutter can be used before it might start to fail.
- Camera shake – The movement of the shutter doors and mirrorbox can cause minor camera shake although inbuilt image stabilisation can help reduce this.
- Response Time – Again due to the mechanical nature of the shutters there can be a minor delay between pressing the shutter button and the camera taking the photo.

Advantages to Using Electronic Shutters

- They are silent – without the moving parts of a mechanical shutter the camera is silent which is great for wildlife photographers and other situations when you need to not make any noise.
- Faster shutter speeds – electronic shutters eliminate the mechanical shutter delay meaning that a shutter speed of 1/32000th second is not that unusual.
- Higher continuous shooting rates – as the camera doesn't need to wait for the mirror and shutters to physically reset it can be ready to take the next photo quicker.
- No more blackout – as these cameras use an electronic viewfinder you can continue to see through the viewfinder through the shot which is great for long exposures, panning and continuous shooting.

Disadvantages of Using Electronic Shutters

- Potential for Banding and jelly-like distortion in rolling shutters – this is especially prevalent in fast moving subjects and during panning.
- Flickering light banding – electronic shutters don't always cope with flickering light sources and often banding can be seen which is difficult to remove.
- Slow flash sync speeds – while you can still sync flashes with cameras using electronic shutters the top sync speed is generally much lower.
- Obstructed use – in some cameras, using the electronic shutter can stop you from using some features of the camera.

https://photodoto.com/here-is-why-mirrorless-cameras-have-shutters/