07.Photog2

Saturday, January 22, 2011
2:53 PM

Today: Finish lenses
Focus
Aperture
Exposure
Shutter speed
ISO

Bring to class:
Closeup lenses
Iris
View camera

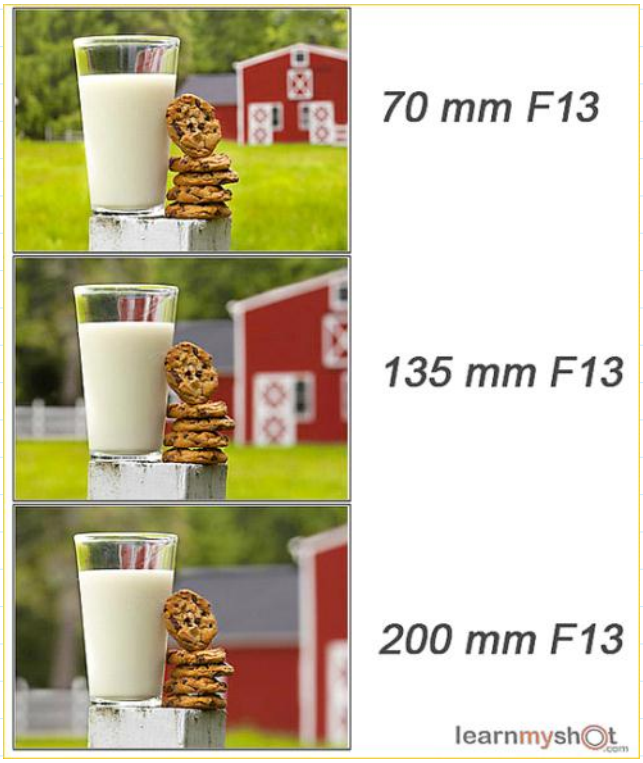
Good digital photography reference:

David Fearon, *The Ultimate Guide to Digital Photography 4*, 4th ed. (Dennis Publishing, 2010).

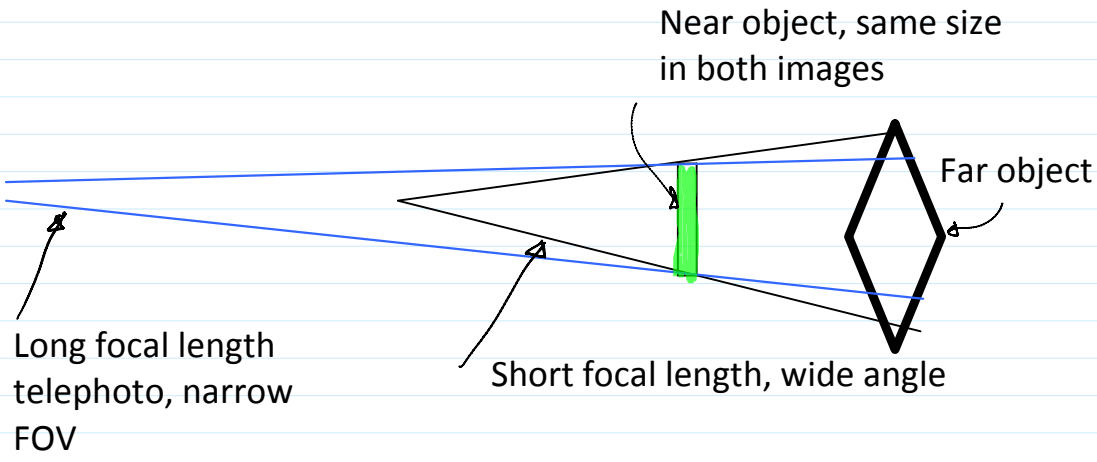
http://www.docstoc.com/docs/8819795/The-Ultimate-Guide-To-Digital-Photography
Free download (ads)
http://magbooks.org/post-10428/the-ultimate-guide-to-digital-photography-4

Impact of focal length on framing:

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



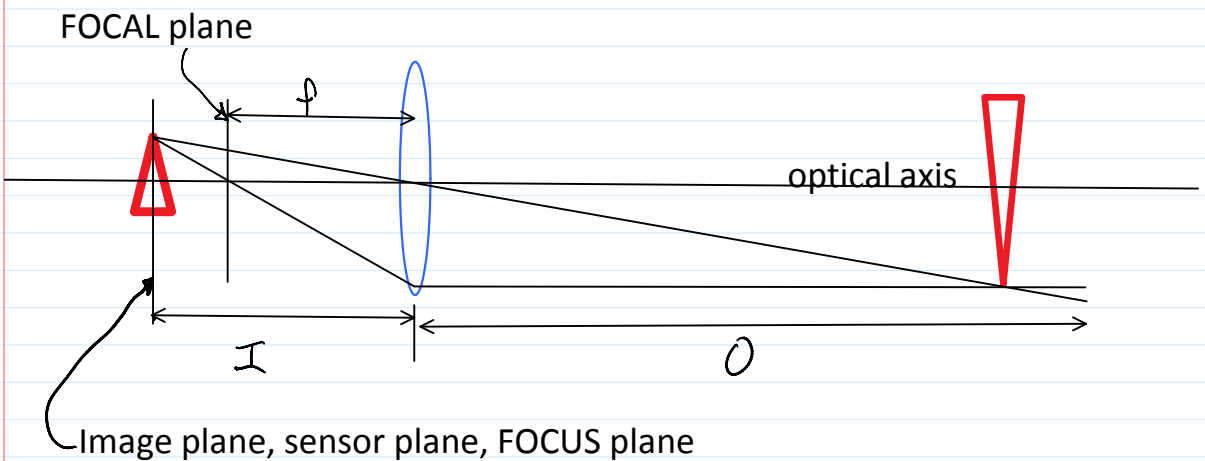
http://www.learnmyshot.com/Telephoto-Lens-Perspective-Compression-and-the-Angle-of-View



TRY THIS NOW

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

$$\frac{1}{f} = \frac{1}{O} + \frac{1}{I}$$

As object moves closer, lens moves away from sensor plane. Mechanical limit defines near focus distance. Extension tubes (for DSLR) allow lens to move further out and focus closer. $75 set of 3

'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 often lack threads. Just hold it out in front, or mount to cardboard tube. Check focus often. Inexpensive, $6 for set of 4

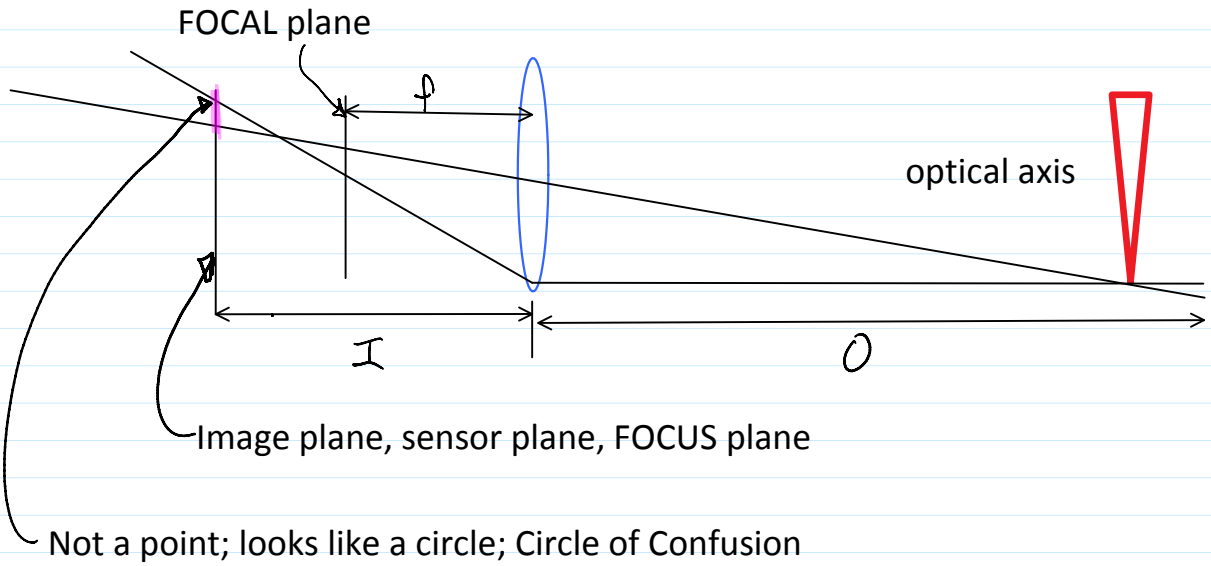
Spec'd in 'diopters' = 1/f in meters. Typically +1, +2, +4

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

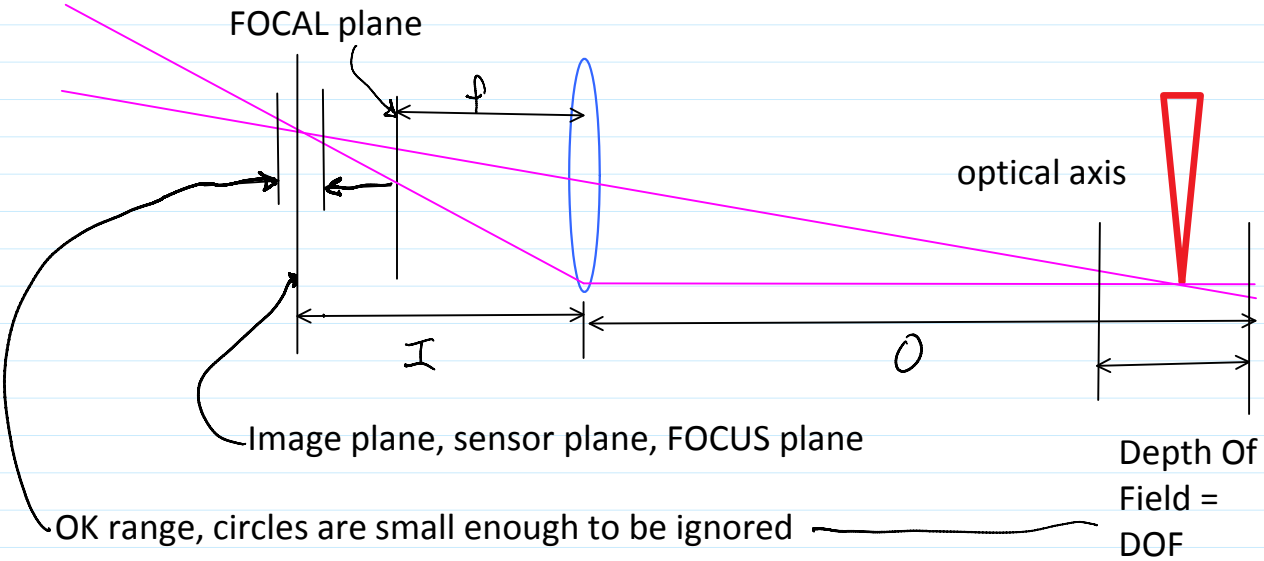
PHD cameras often have 'macro mode' =
Flower Button. Does yours?

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

OUT OF FOCUS

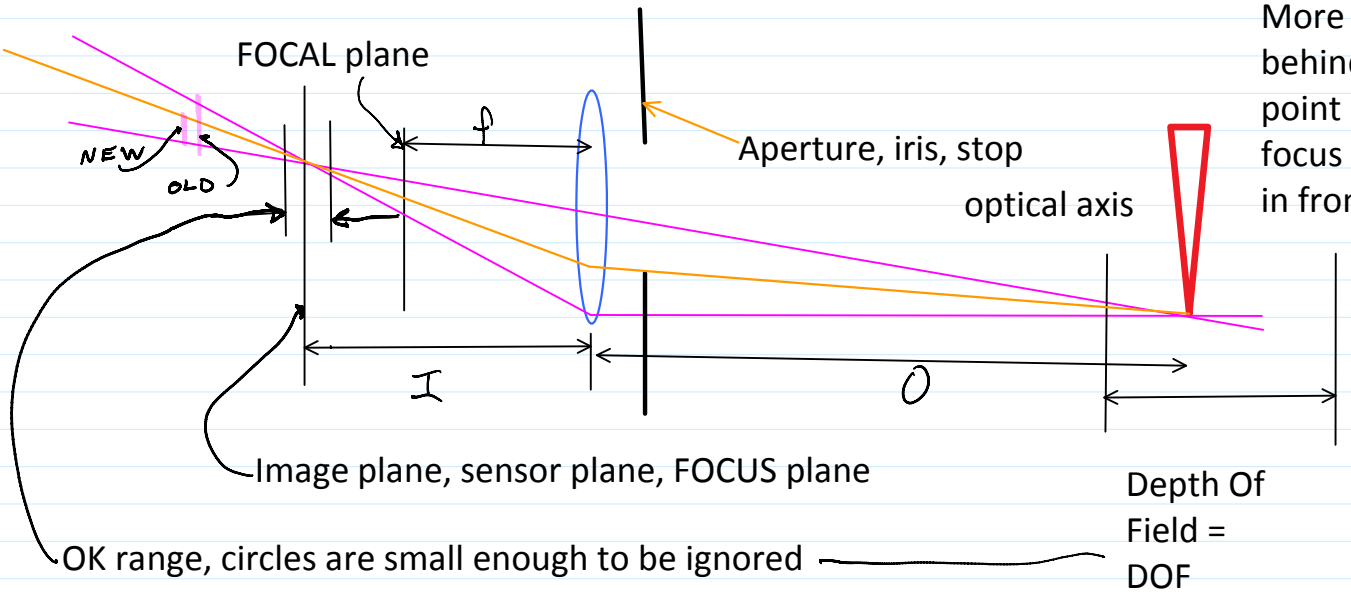


Depth of Field

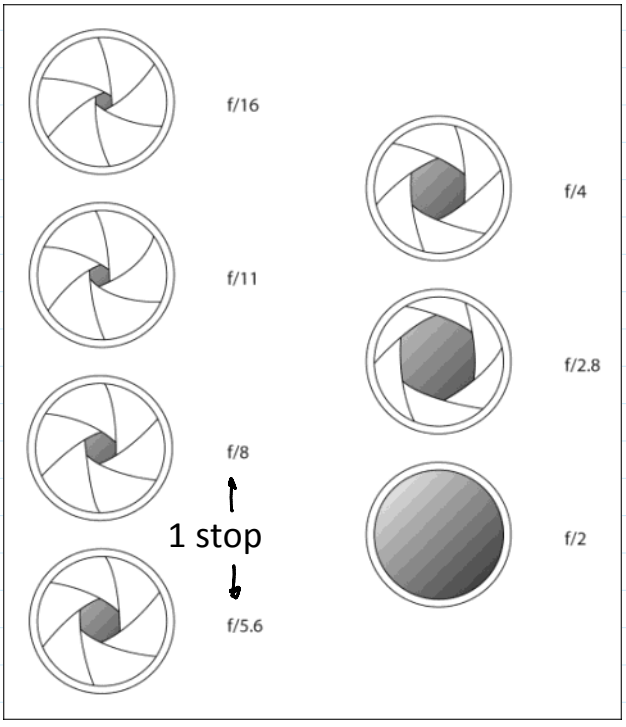


Improve DOF by reducing diameter: smaller hole, better depth of field

hole, better depth of field



Camera OBSCURA



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.

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

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

Ansel Adams founded f/64 club. Tiniest hole, maximum DOF. Modern lenses often best sharpness at f/5.6 or design point.

4. EXPOSURE

For a given intensity, ~area X time shutter is open

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For a given intensity, ≈ area X time shutter is open

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

Image 'density', average pixel values also depends on sensor gain, sensitivity: ISO (ASA historically)

1 EV, stop = factor of 2 in ISO

Same image density f/5.6, 1/100 sec, ISO 200
f/8, 1/100 sec, ISO 400
f/4, 1/200 sec, ISO 400

How to choose?

Minute paper: list pros and cons of

1) small aperture vs large aperture
2) short shutter (high shutter speed) vs long (slow)
3) high ISO vs low

1) Aperture: large f/ = better DOF, but less light, maybe less sharpness overall
2) Short shutter = freeze the flow, minimize motion blur, but less light
3) High ISO adds noise

http://upload.wikimedia.org/wikipedia/commons/3/3b/Noise_Comparison.JPG

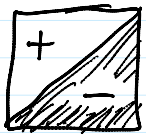
Usually, set ISO for overall conditions, then choose

Av = aperture priority, let AE (auto exposure) choose

shutter
or
Tv = shutter priority, AE chooses aperture

Got To Here

Shutter nomenclature:
2 = 1/2 sec, 20 = 20 1/20th sec etc.
2" = 2 sec
T = time = actuate open, actuate closed
B = bulb = open as long as actuated. Rare now.



To change exposure,
lighten image, overexpose compared to AE suggestion +++
Darken, underexpose compared to AE, -----

Other considerations of shutter speed:
Short enough to 'freeze' flow, or long enough to get desired particle tracks.

If long shutter is needed, might be too much light. Try a
NDF = Neutral Density Filter. Neutral = all wavelengths equally. Gray.
NDF 1 = 1 /10 light transmission.
NDF 2 = 1/100 etc. Log scale.
http://en.wikipedia.org/wiki/File:Strickland_Falls_Shadows_Lifted.jpg
30 seconds. NDF 8x

Need a tripod for macros, or shutters > 1/30 sec
Full size start at $25. Highly recommended.
Several available for checkout.

Estimate motion blur *in pixels* to guide choice of shutter speed.

Example:
Field of view = 10 cm
Fluid moving at 0.5 m/s
10 Mpx sensor

Minute paper: what shutter speed will 'freeze' this flow?

Can tolerate maybe 5 px blur?
10 Mpx ~ 3750 X 2750
0.1 m / 3750 = 2.6 e-5 = 0.000026 m/px = 26 μm/px
5 px = 1.3 e-4 m = 0.00013 = 0.13 mm estimated acceptable object displacement *x*
time *t = x/velocity*
1.3e-4 m / (0.5 m/s) = 2.6e-4 seconds
2.6e-4 sec = 1/3750 Very short. Can your camera do this?
5/3750 = 0.0013 = 0.13% of image width

Do this analysis for each image. Motion blur is surprisingly common and annoying.

Inspec demo?