Today:

- Admin
- Framing
- Cameras
- Lenses
  - Lens laws
  - Typical lenses
  - Focal lengths
  - Aperture, depth of field

JH Bring to class:
Closeup lenses
extension tubes
Iris
View camera

- Admin:
  - Office hours: TWF afternoons, and by appointment.
  - D2L discussion OK?

Good digital photography reference:

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

New link:

http://www.gfxtra.com/ebook-photographt/209963-the-ultimate-guide-to-digital-photography-4th-edition-hq-pdf.html

Free download (ads)
http://extabit.com/file/2crkahmwqn3hm or can pay for 'premium'

PHOTOGRAPHY FUNDAMENTALS

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

1) Framing
   a. #1 rule of photography: Make The Subject Fill The Frame
      Image dimensions of less than 700 pixels won't be accepted.
   b. Know your scale. Take an extra image with a ruler in it.

You'll need to specify your FOV = Field of View
i.e. "top to bottom was 10 cm"
Sometimes the image will supply the scale, such as the diameter of a jet.

c. Work it. Take many images, from varied POV = Points of View

- Get close, pull back. Move around the sides.
- Try a mirror to see the back.
- Consider making a stereo image
- Try video, a few seconds or minutes

Video tutorials
http://vimeo.com/videoschool/101

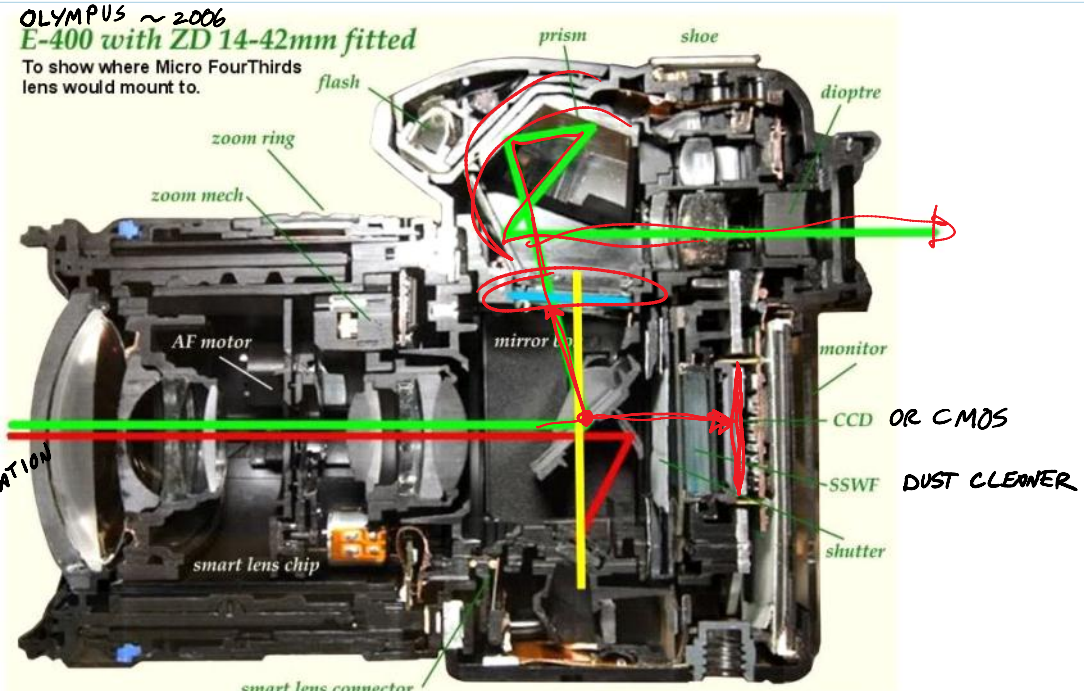
Vimeo = upscale YouTube.
FV videos will be posted there
by FlowVis@CUBoulder

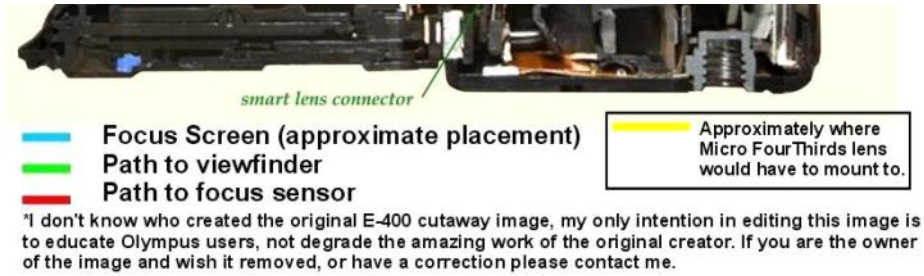
- Change the lighting.
- Try time lapse
- Consider the motion: Capture the whole track, and also zoom in on a particular moment/location
- Plan a second try. Look at results at full resolution first, not just on camera LCD. Takes time.

2)Cameras: Roughly 3 common types

DSLR	Point and Shoot	Camcorders
Digital Single Lens Reflex	PHD Push Here Dummy	

DSLR



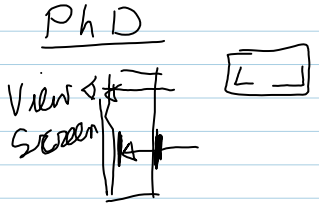


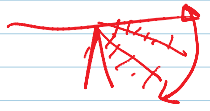
http://media.photobucket.com/image/dslr%20optics%20diagram/Mikefellh/E-300Stuff/WhereM43lensWouldBe.jpg

AE = auto Exposure
AF = Auto Focus

Mirror flips up when shutter triggered = REFLEX.
For long exposures, lock mirror up to prevent vibration.
Use circular polarizers on lens front to get past partial mirrors into AF and AE sensors

PHD: Small sensors; lower resolution even if mpx the same; diffraction limits approached?
No lens choices. Can still add close-up lens.
Composition is harder. LCD screens tough to use in sun, don't show fine focus. Can't preview depth of field. Optical view finders are inaccurate when close up.
Much lighter, more portable.
Comparable performance at prosumer level.





CAMCORDERS: primarily for video.
Records to ~~Digital Video tape~~, disk or solid state memory. Usually longer record time than still cameras. Built-in effects, maybe editing. Quieter mechanisms, set white balance

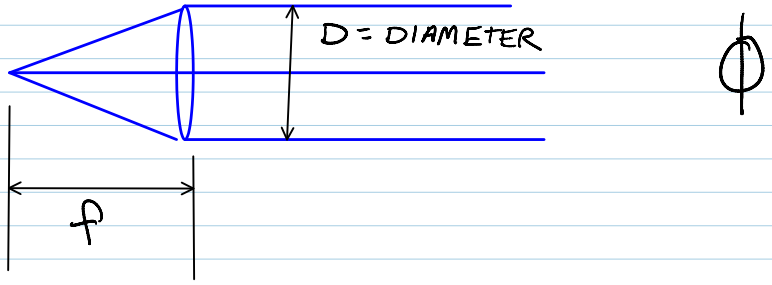
Camera technology is changing rapidly. Lines between designs are shifting. Superzooms, for example.

3) LENSES

Minute paper. What are the numbers on your lens? What do they mean?

Lenses are defined by FOCAL LENGTH and APERTURE

f = focal length = distance from center of lens system to sensor when focused at infinity

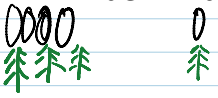


Variable focal length = ZOOM lens.
Now is default. Non-zoom are called 'prime' lenses.

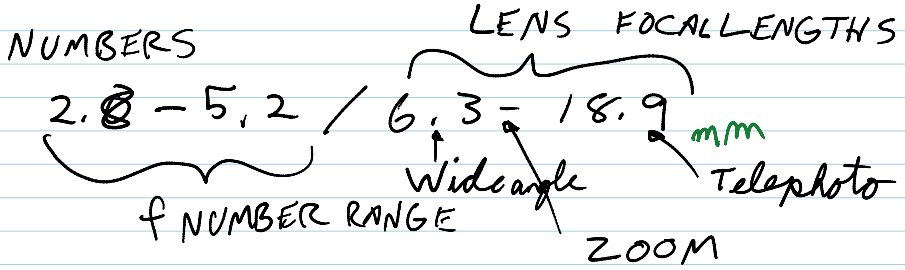
10 years ago, 35 mm film cameras were standard, and the standard lens was 50 mm. f> 50 mm = telephoto
f < 50 mm = wide angle

Aperture defined as f/D = f/ = f number = f#
INVERSELY related to diameter.
Nondimensional. More about aperture later.

PHDs have small sensors, so focal lengths and diameters are smaller:
Common values for PHD cameras:
f = 5 - 60 mm, f/ = 4 - 8
28-336 mm equivalent to 35 mm, i.e. same FOV
w = wide T = tight, or telephoto

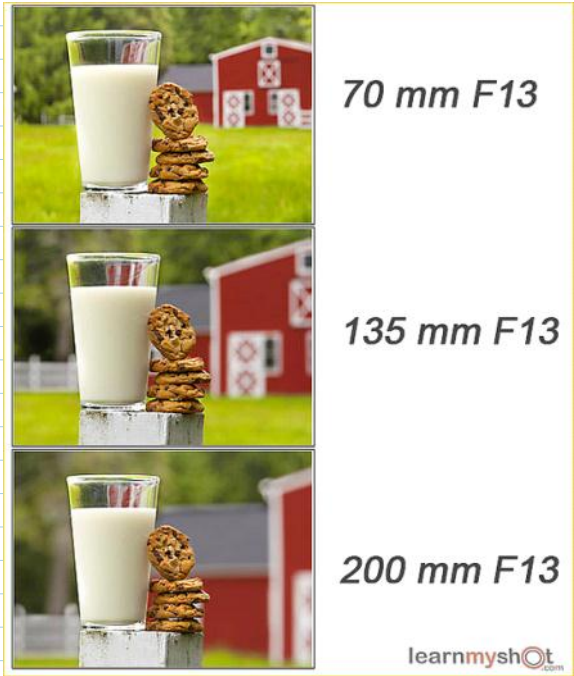


For DSLR, bigger sensors, up to 'full frame' 35 mm
f = 18- 60 mm, f/ 1.8 - 22

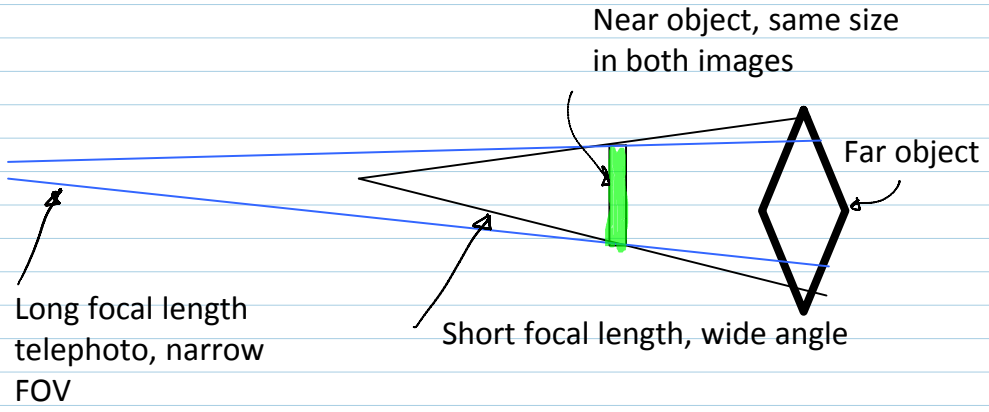


Impact of focal length on framing:

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

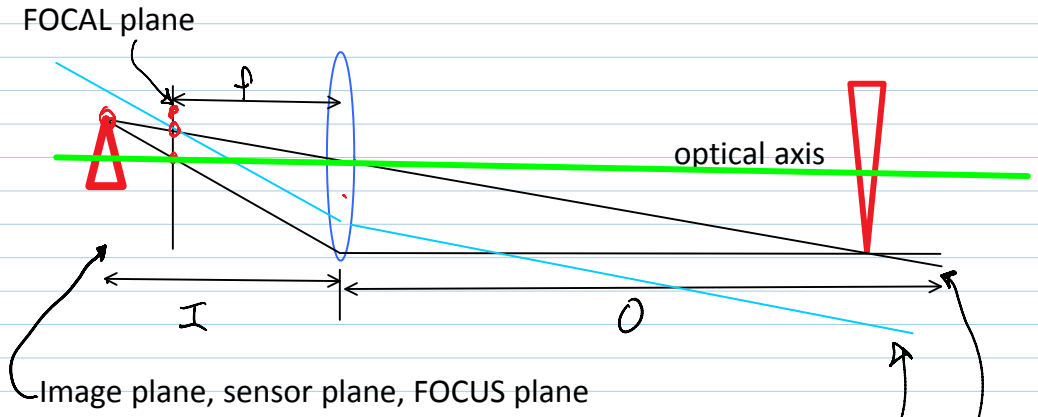


TRY THIS NOW

FOCUS

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

FOCAL plane

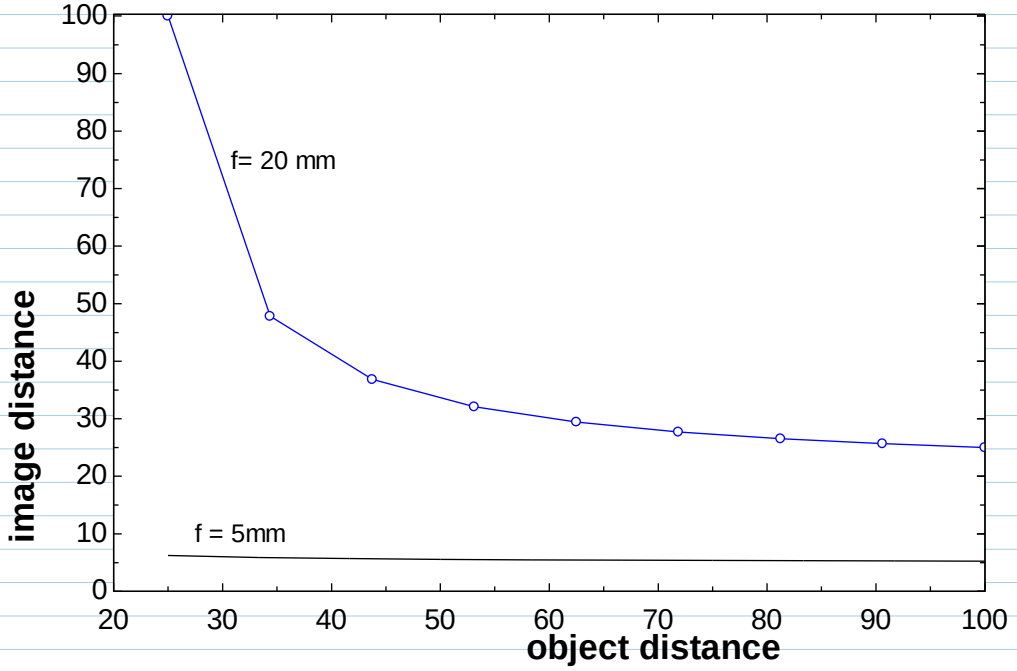


Lens laws:

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.



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

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

focus closer. $75 set of 3

"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 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

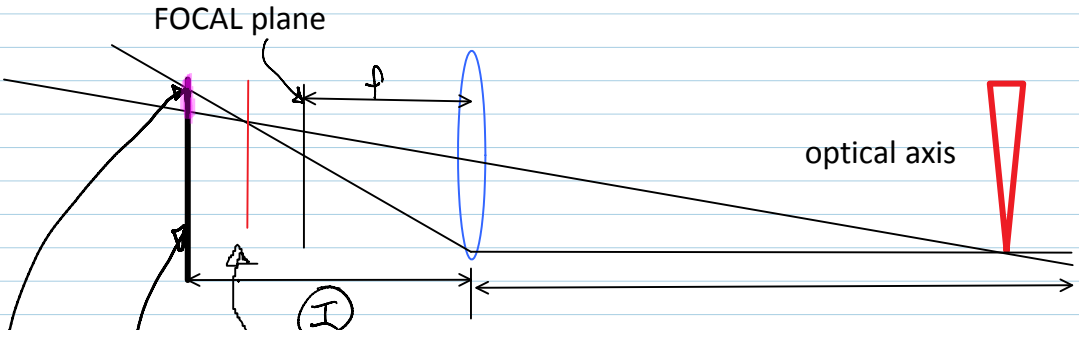
$$\frac{1}{f_{TOTAL}} = \frac{1}{f_1} + \frac{1}{f_2}$$

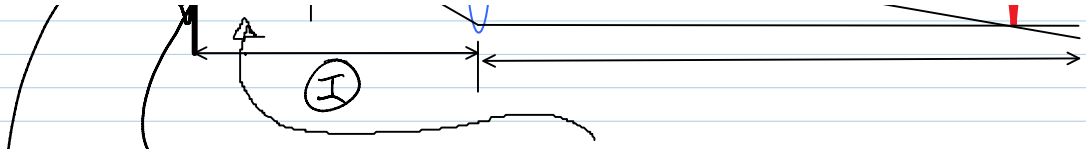
PHD cameras often have 'macro mode' =
Flower Button. Does yours?

Exercise: 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?

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

OUT OF FOCUS

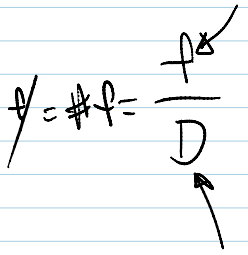




sensor plane is not at the FOCUS plane

Not a point; looks like a circle; Circle of Confusion

Depth of Field



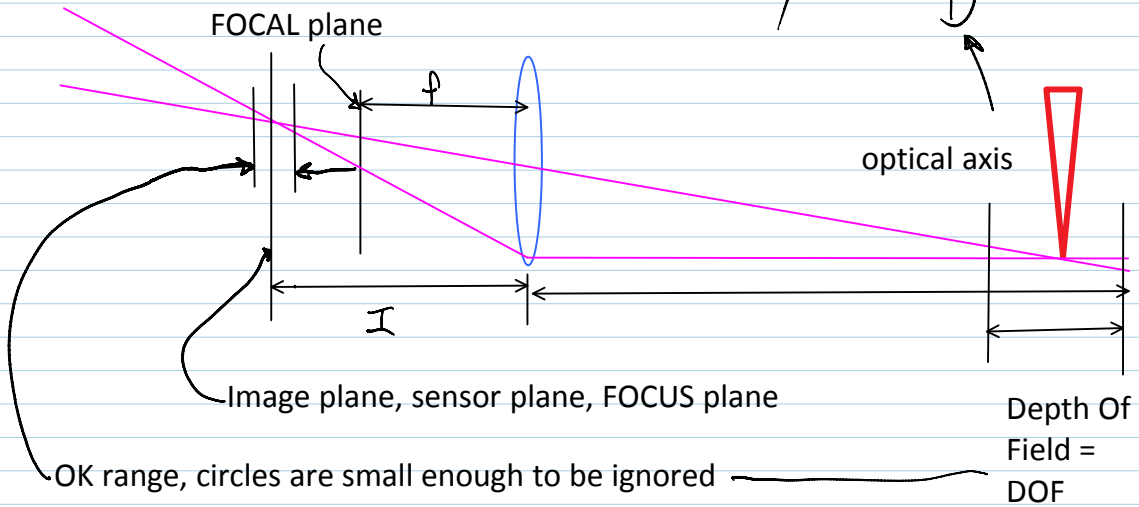
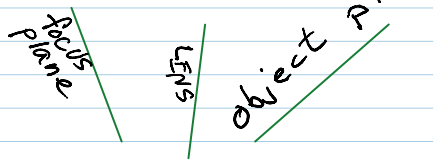


Image plane, sensor plane, FOCUS plane

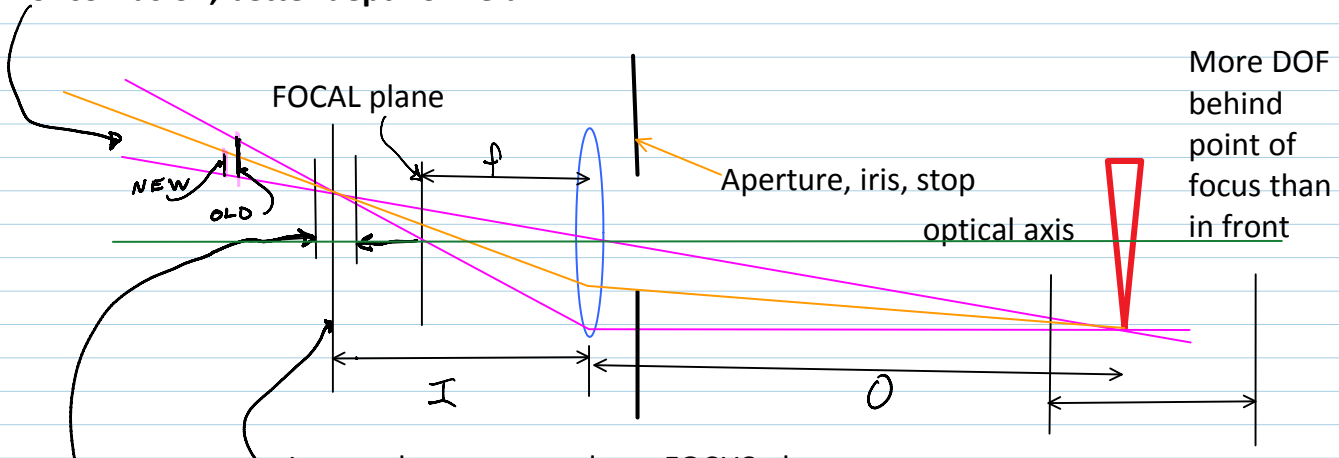
OK range, circles are small enough to be ignored

Depth Of Field = DOF

LensBaby: lets you angle the lens axis compared to the camera body axis. Effectively makes the object plane not parallel to the sensor plane



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

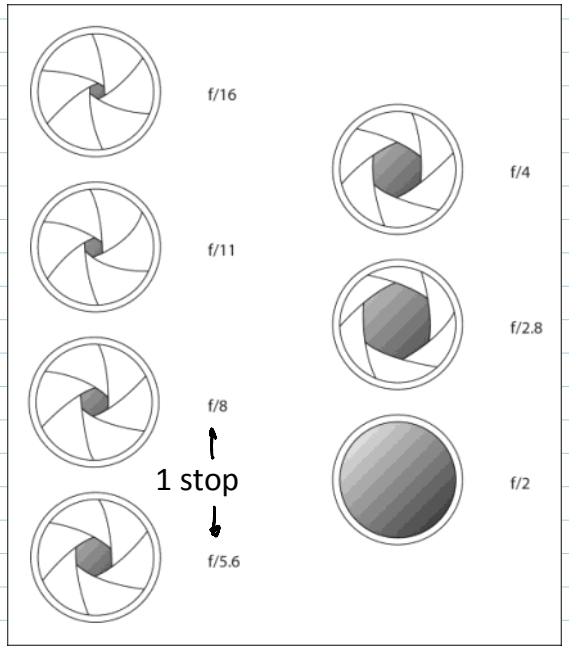


More DOF behind point of focus than in front

Image plane, sensor plane, FOCUS plane

OK range, circles are small enough to be ignored

Depth Of Field = DOF



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.

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?