

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: MWF afternoons, by appointment.
  - D2L discussion OK?
  - The ME seminar today is from 6:30pm-9pm, at Math 100. This 2 and half hour seminar will talk about the gulf oil spill at Deepwater Horizon. A dessert reception will follow the seminar in the Engineering Lobby.

[http://www.colorado.edu/mechanical/news/seminars/Deepwater\\_Horizon January 26 2011.pdf](http://www.colorado.edu/mechanical/news/seminars/Deepwater_Horizon_January_26_2011.pdf). Flow Vis was used to measure flow rate.

NOT SAVING  
RATING  
Feedback link

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>

## 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

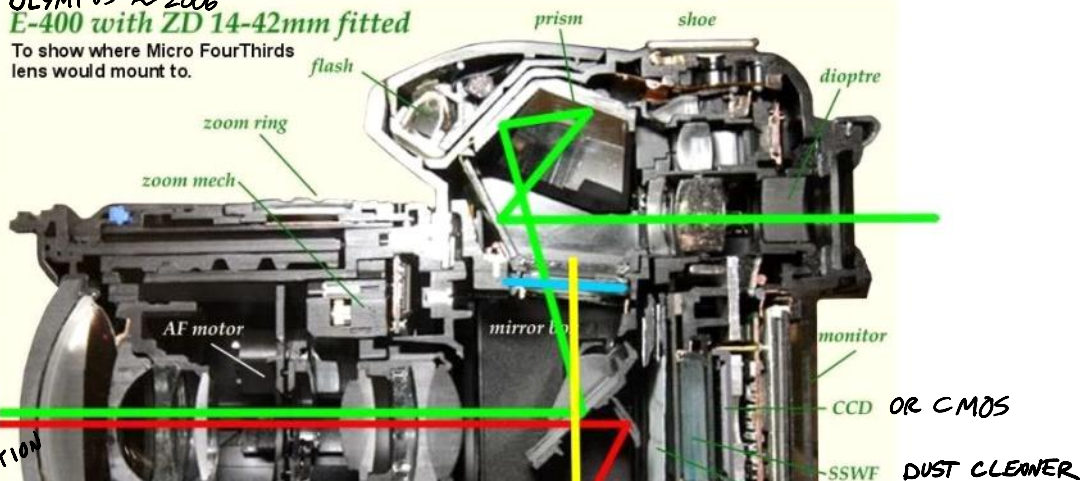
- Change the lighting.
- Try time lapse
- Consider the motion: Capture the whole track, and also zoom in on a particular moment/location
- Plan a second try. Look at results at full resolution first, not just on camera LCD. Takes time.

## 2)Cameras: Roughly 3 common types

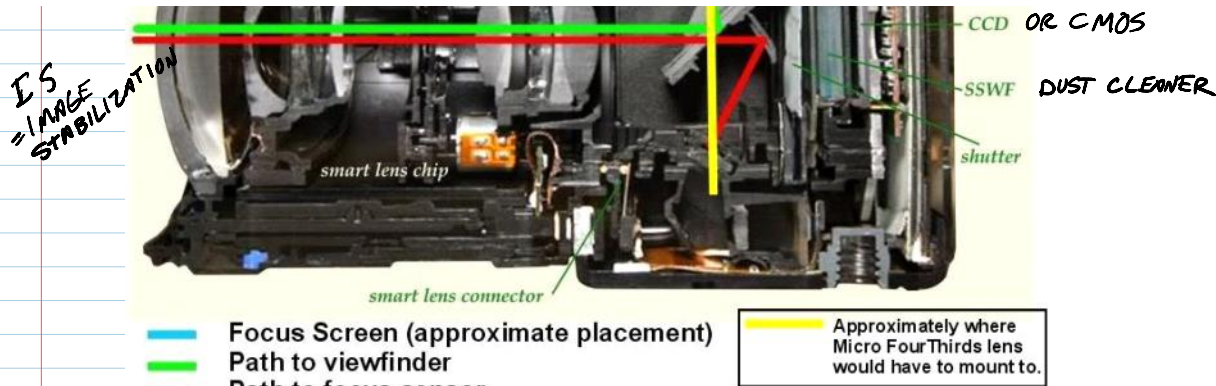
DSLR	Point and Shoot	Camcorders
Digital Single Lens Reflex	PHD	
	Push Here Dummy	

### DSLR

OLYMPUS ~ 2006  
E-400 with ZD 14-42mm fitted  
To show where Micro FourThirds  
lens would mount to.



DSLR



\*I don't know who created the original E-400 cutaway image, my only intention in editing this image is to educate Olympus users, not degrade the amazing work of the original creator. If you are the owner of the image and wish it removed, or have a correction please contact me.

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

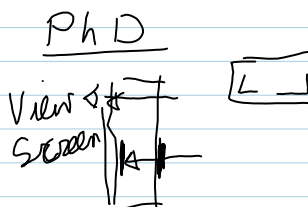
*AE = auto Exposure  
 AF = Auto Focus*

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*

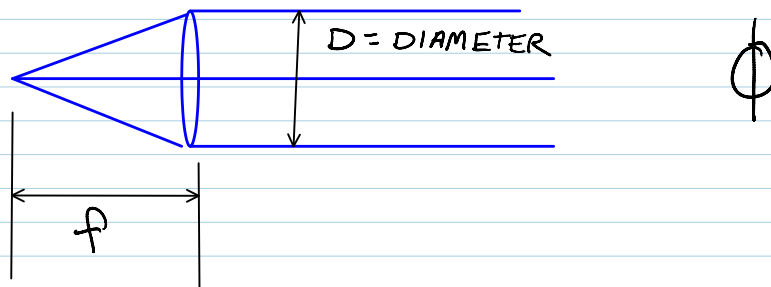
Camera technology is changing rapidly. Lines between designs are shifting. Superzooms, for example.

### 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.

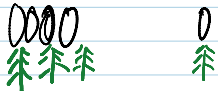
PHDs have small sensors, so focal lengths and diameters are smaller:

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

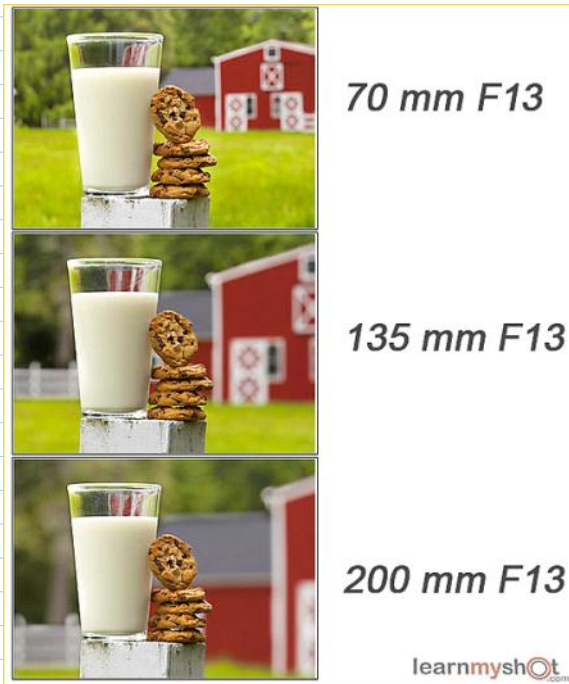
$f = 18 - 60$  mm,  $f/\# = 1.8 - 22$

NUMBERS  
2.8 - 5.2 / 6.3 - 18.9 mm  
f NUMBER RANGE  
Wide angle  
Telephoto  
ZOOM

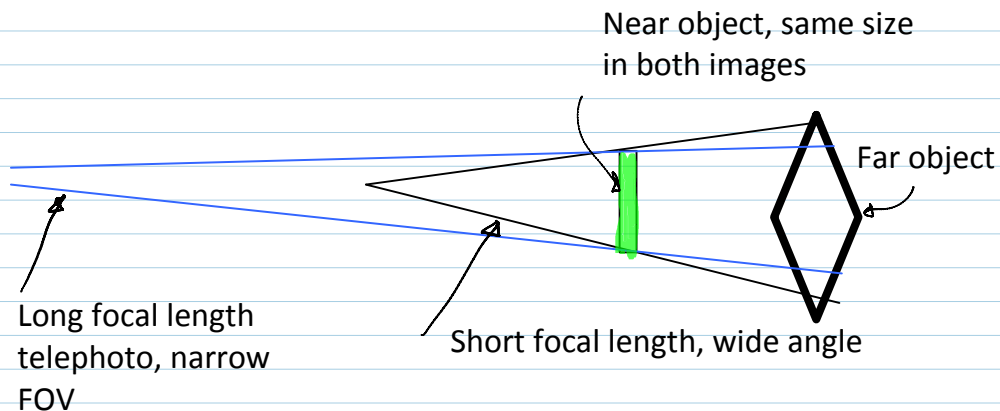
f NUMBER RANGE \ zoom

### Impact of focal length on framing:

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



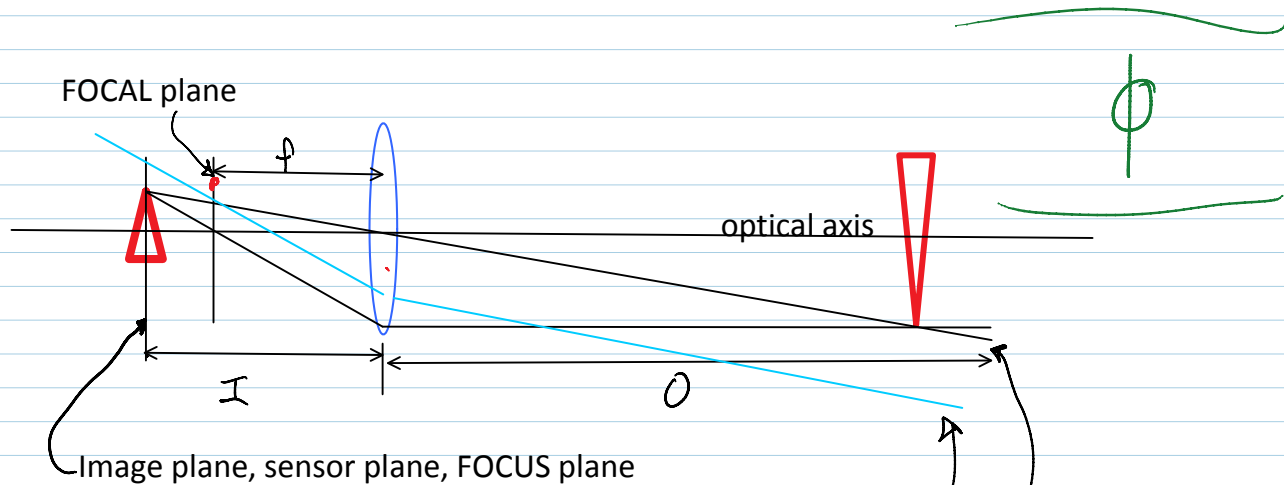
<http://www.learnmyshot.com/Telephoto-Lens-Perspective-Compression-and-the-Angle-of-View>



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

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

Here 1/26 Thurs