



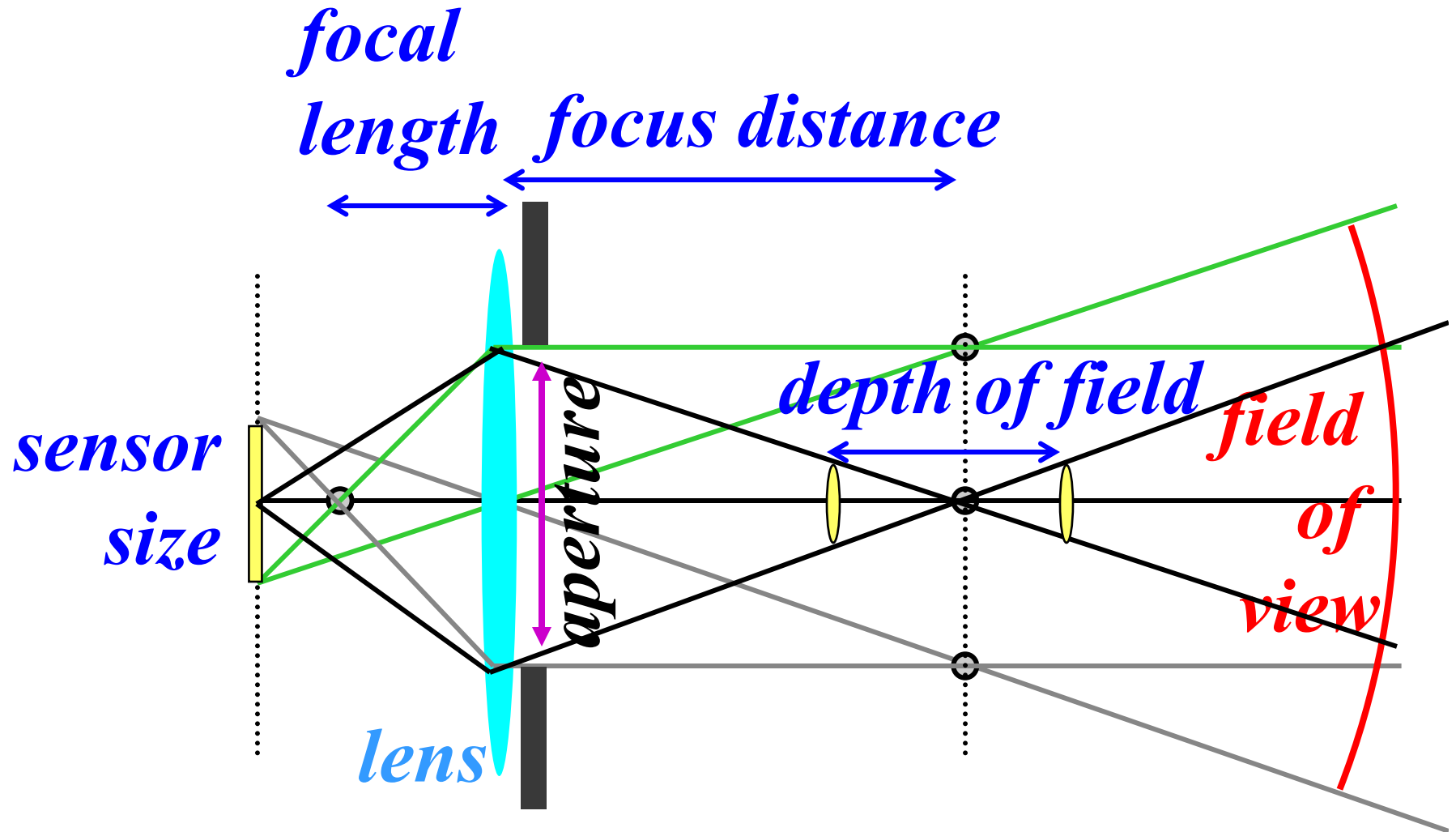
6.098 Digital and Computational Photography
6.882 Advanced Computational Photography

Photography Survival Kit

Bill Freeman
Frédo Durand
MIT - EECS

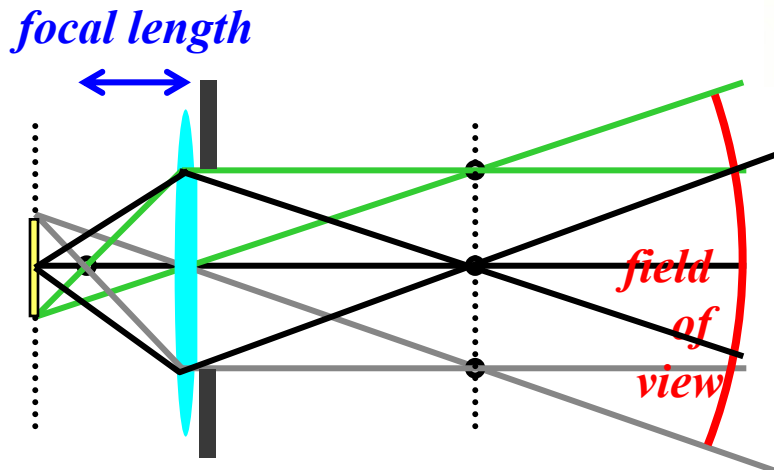
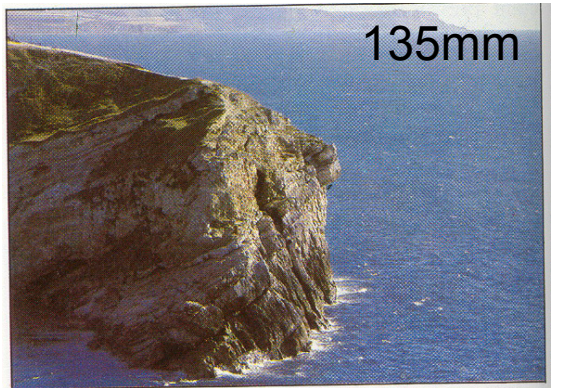
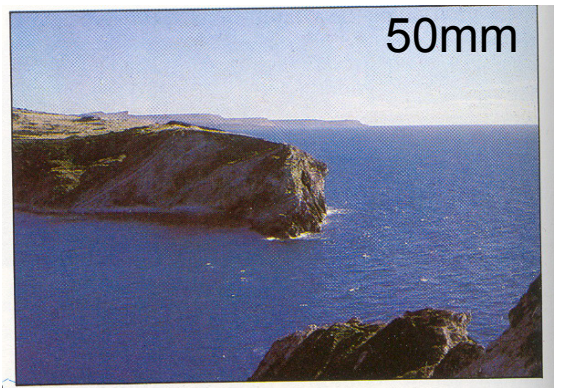
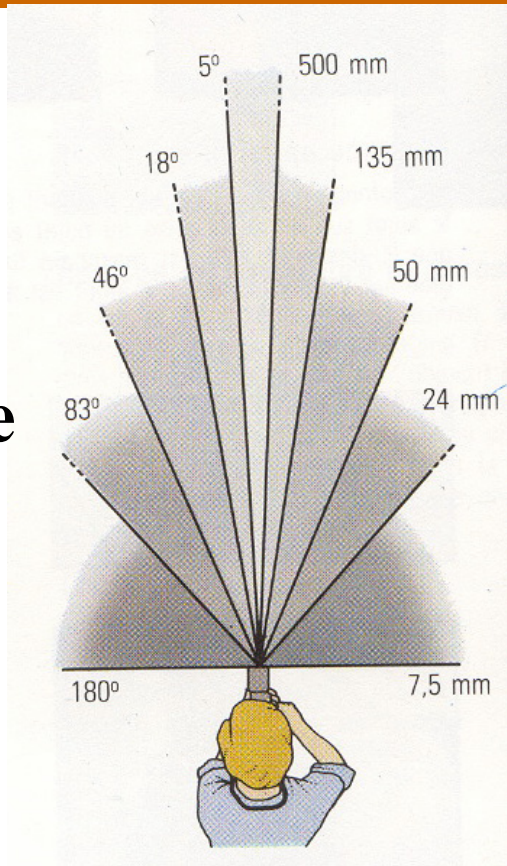
- **Focal length (in mm)**
 - Determines the field of view.
wide angle (<30mm) to telephoto (>100mm)
- **Focusing distance**
 - Which distance in the scene is sharp
- **Depth of field**
 - Given tolerance, zone around the focus distance that is sharp
- **Aperture (in f number)**
 - Ratio of used diameter and focal lens.
Number under the divider → small number = large aperture
(e.g. f/2.8 is a large aperture, f/16 is a small aperture)
- **Shutter speed (in fraction of a second)**
 - Reciprocity relates shutter speed and aperture
- **Sensitivity (in ISO)**
 - Linear effect on exposure
 - 100 ISO is for bright scenes, ISO 1600 is for dark scenes

Quantities



Focal length

- <30mm: wide angle
- 50mm: standard
- >100mm telephoto
- Affected by sensor size
(crop factor)



Exposure

- **Aperture (f number)**

- Expressed as ratio between focal length and aperture diameter:
diameter = $f / \langle f \text{ number} \rangle$
- f/2.0, f/2.8, f/4.0, f/5.6, f/8.0, f/11, f/16 (factor of sqrt (2))
- Small f number means large aperture
- Main effect: depth of field
- A good standard lens has max aperture f/1.8.
A cheap zoom has max aperture f/3.5

- **Shutter speed**

- In fraction of a second
- 1/30, 1/60, 1/125, 1/250, 1/500 (factor of 2)
- Main effect: motion blur
- A human can usually hand-hold up to 1/f seconds, where f is focal length

- **Sensitivity**

- Gain applied to sensor
- In ISO, bigger number, more sensitive (100, 200, 400, 800, 1600)
- Main effect: sensor noise

Reciprocity between these three numbers:

for a given exposure, one has two degrees of freedom.

Depth of field

- **The bigger the aperture (small f number), the shallower the DoF**
 - Just think Gaussian blur: bigger kernel → more blurry
 - This is the advantage of lenses with large maximal aperture: they can blur the background more
- **The closer the focus, the smaller the DoF**
- **Focal length has a more complex effect on DoF**
 - Distant background more blurry with telephoto
 - Near the focus plane, depth of field only depends on image size
- **Hyperfocal distance:**
 - Closest focusing distance for which the depth of field includes infinity
 - The largest depth of field one can achieve.
 - Depends on aperture.

Equipment

- **Do get an SLR, compacts are way too limited**
- **Don't worry about brand**
- **Don't worry about the body, get the cheapest one**
- **Worry about lenses**
 - Zooms are convenient but quality can be a problem
 - avoid the basic zoom, but the one above is usually great
 - Maximum aperture matters (the smaller the number, the better)
 - Get a prime in the 35-85mm range
(cheap, high quality, wide aperture)
50mm f/1.8 (both Canon & Nikon)
- **Get a tripod**
- **Get an external flash if you want to take “event” pictures**
 - And orient towards ceiling
 - Good flash photography is very difficult
- **Count ~1k for camera+standard zoom+50mm**

Nikon

Tends to be a tad cheaper

- **D50 is a great body. D70 is a little better.**
- **18-70**
- **55-200 is surprisingly not so bad and super cheap**
- **Get the 50mm f/1.8**



Canon

- **Rebel XT or 20D**
- **17-85**
- **70-200 f/4.0**
(amazing lens)
- **50mm f/1.8**
- **100mm f/2.8 macro**
(great also for portraits)



Other brands

Not as big a range, future not always clear (see Minolta), have been slower to get to digital SLR

- **Olympus**
 - Good system, but smaller sensor
- **Konica-Minolta**
 - Just announced they stop photography!
- **Pentax**
 - Good entry camera
- **Sigma**
 - Intriguing sensor (Foveon)
- **Fuji**
 - One-trick pony (the sensor)
 - Nikon body
- **Sony**
 - Interesting hybrid, the R1
 - Very silent, good images, crappy viewfinder, no interchangeable lenses

Shooting

- **Use aperture priority, work on depth of field**
- **Change your viewpoint**
- **Don't center things**
- **Learn to adjust ISO**

- **Shoot raw**
- **Check your histogram**

Editing (Photoshop)

- **Crop to improve composition**
- **Manage contrast using curve and adjustment layers**
- **Sharpen a bit**
- **Convert to black and white with gradient map**