Twelve significant photographs in any one year is a good crop.
- Ansel Adams

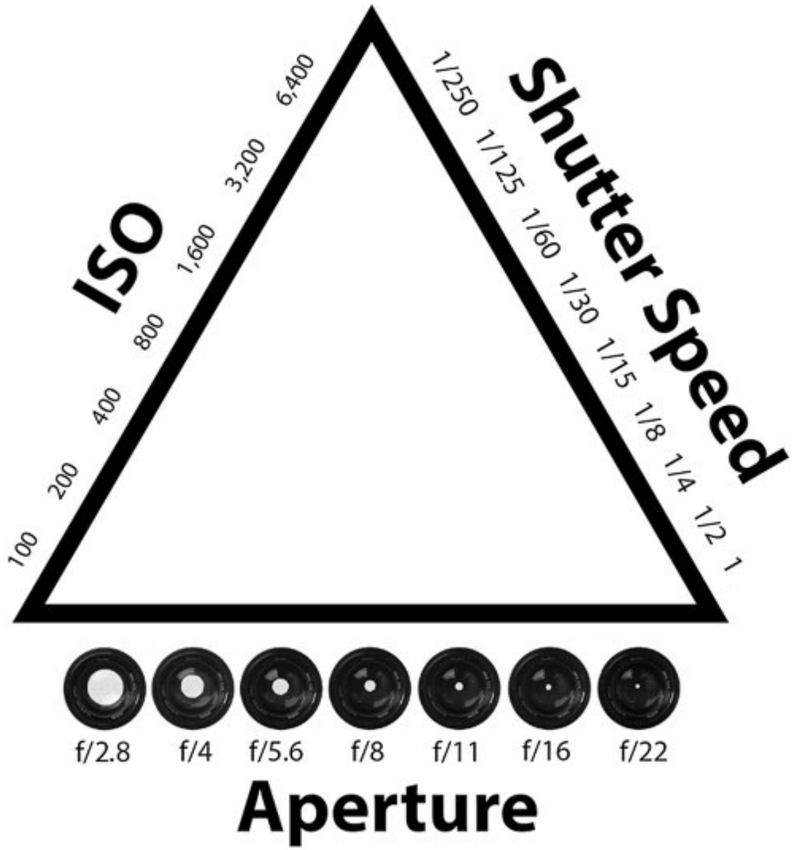
The Exposure Triangle

Introduction to Digital Photography

Lecture Outline

- The Exposure Triangle
  - ISO
  - Shutter speed
  - Aperture
  - Shutter speed / aperture relationship

The Exposure Triangle



The Exposure Triangle: ISO

- ISO
  - International Organization of Standards
    - Adopted 1980s by Kodak, other film makers
  - ASA (American Standard Association) [Kodak (America)]
  - DIN (Deutsche Industrie Norm) [Agfafilm (Europe), Fujifilm (Japan)]
  - Standardization of film speed (e.g., ASA 100 / DIN 21)

The Exposure Triangle: ISO

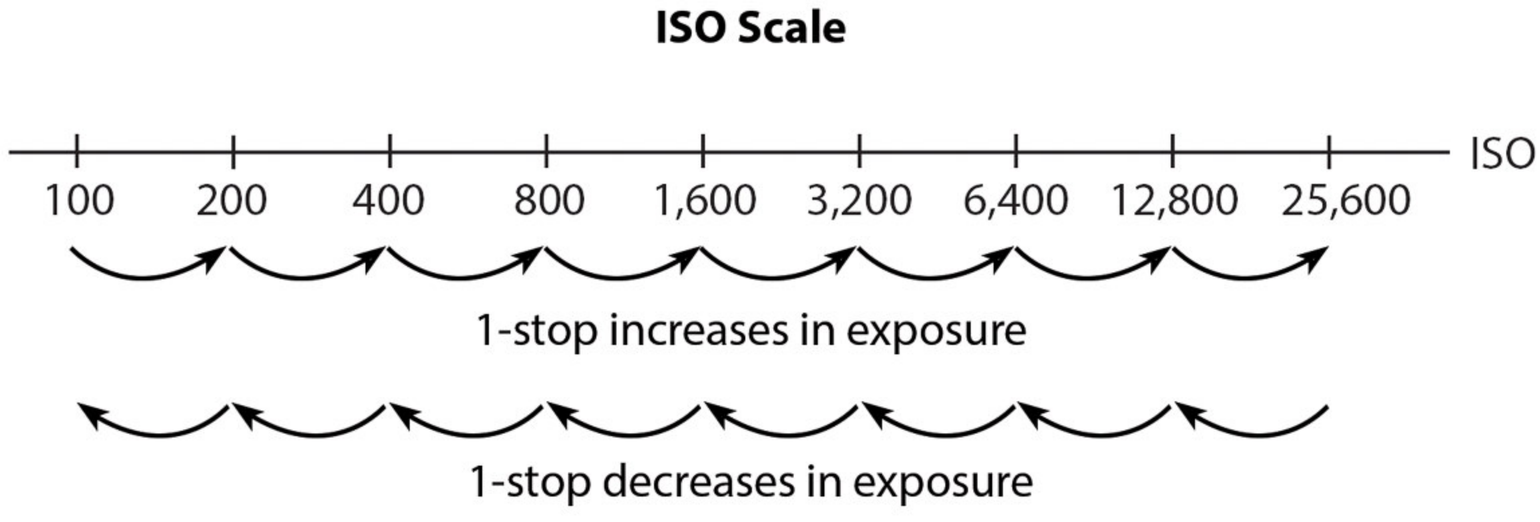
- ISO
  - Film speed = sensitivity of film to light
  - Higher the ISO number
    - More sensitive to light
    - Less exposure time needed
    - More graininess (larger grains = larger surface area = shorter exposure time)
  - Push / Pull process
    - Exposing film outside normal ISO boundary
    - Selectively exposing film [under (pull) / over (push)]

The Exposure Triangle: ISO

- Digital ISO
  - Don’t have to change rolls of film to change ISO
  - Cameras have an inherent native ISO value
    - Example: Nikon D200 = ISO 100; Nikon D300 = ISO 200
  - Sensor noise ≈ film graininess
    - Some noise can be reduced in post processing
    - Color noise reduced by converting to B & W

The Exposure Triangle: ISO

- ISO and exposure
  - Changing ISO
    - Going smaller: more light needed
      - Factor of 2 for each full ISO increment
    - Going larger: less light needed
      - Factor of ½ for each full ISO increment



The Exposure Triangle: Shutter speed

- Shutter speed
  - How long the shutter stays open
  - Time ranges from “bulb” to 1/200 - 1/8000 second (depending on camera)
    - Bulb = how long can you keep the shutter pressed?
  - Shutter release
    - Mechanical (cable) or electronic remote (wireless / controlled by phone)

The Exposure Triangle: Shutter speed

- Common shutter speeds (in full stops)

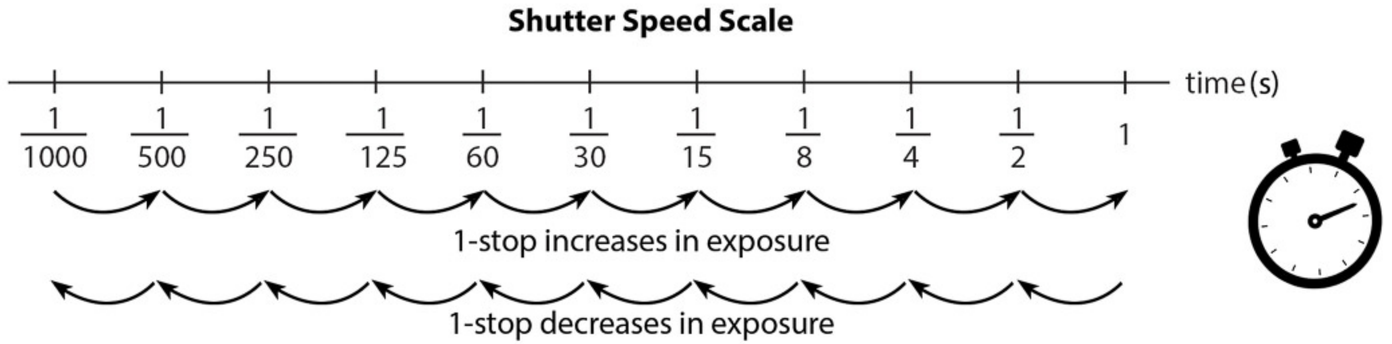
30 seconds	15 seconds	8 seconds
4 seconds	2 seconds	1 second
½	¼	1/8
1/15	1/30	1/60
1/125	1/250	1/500
1/1000	1/2000	1/4000

Tip for handholding:

Minimum shutter speed = reciprocal of lens focal length. Example: 50 mm lens = 1/50 of a second shutter speed to remove any motion blur; 200 mm = 1/200 of a second

The Exposure Triangle: Shutter speed

- Shutter speed and exposure
  - –Changing shutter speed
    - Going slower: more light collected
      - –Factor of 2 for each increment
    - Going faster: less light collected
      - –Factor of ½ for each increment



The Exposure Triangle: Aperture

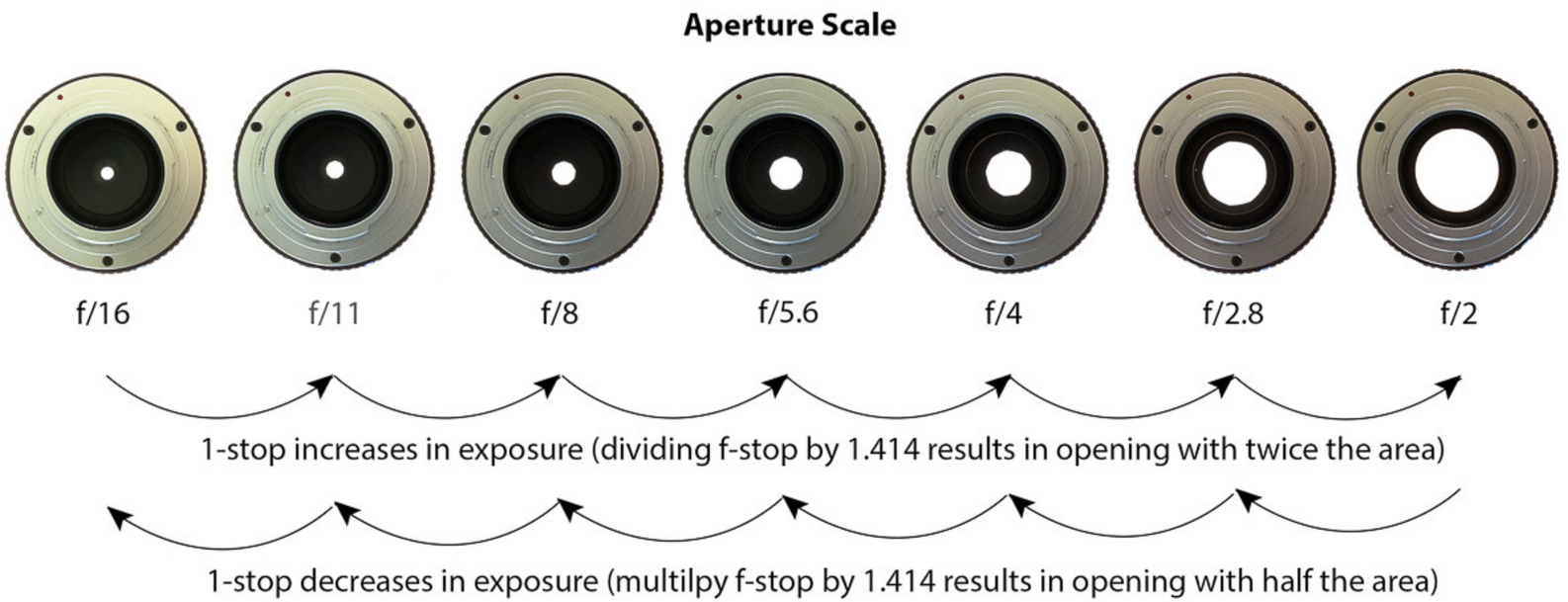
- Aperture
  - Diameter of the aperture stop of a lens
  - Diameter controlled by diaphragm
  - Different lenses have different aperture diameters for the same *f*-stop value

The Exposure Triangle: Aperture

- Aperture
  - For each full stop (*f*/stop) of aperture:
    - The diameter of the aperture
      - Doubled or cut in half
    - Resulting in
      - 2x or 1/2x the amount of light allowed

The Exposure Triangle: Aperture

Larger aperture (smaller *f*-stop number)



Smaller aperture (larger *f*-stop number)

The Exposure Triangle: Aperture

- Aperture
  - –Expressed in numbers (*f*2, *f*2.8, *f*4, *f*5.6...*f*22)
    - Larger the number, smaller the aperture
  - –Fractions
    - *f*2 = ½, *f*4 = ¼, *f*8 = 1/8, *f*16 = 1/16
  - –Stopping down = closing aperture (smaller)
  - –Opening up = opening aperture (larger)

The Exposure Triangle: Relationship

- Shutter speed / aperture (*f*/stop) relationship