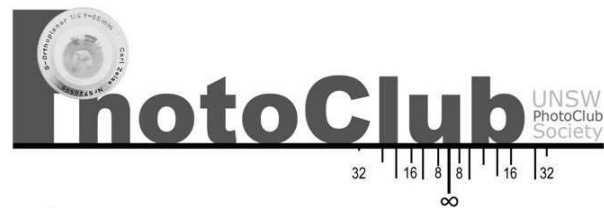




Camera Principles Part I

Matthew Chapman

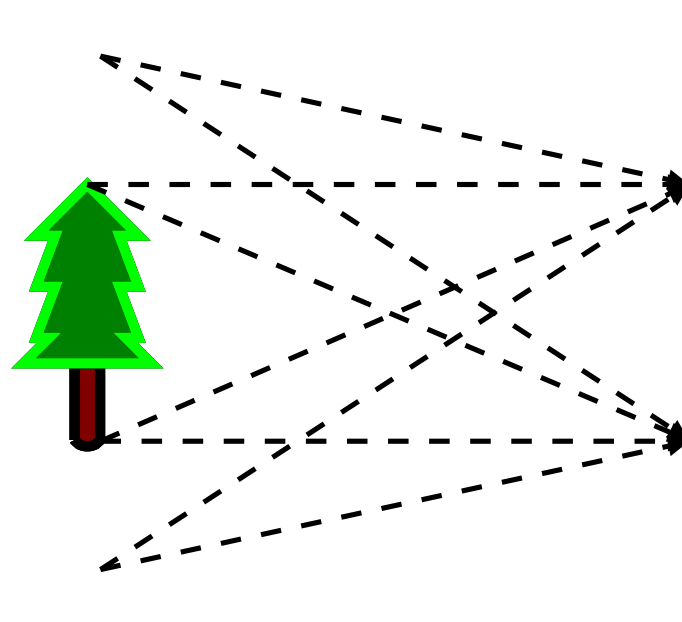
UNSW Photography Club
matthew.chapman@unswphotoclub.org



PHOTOGRAPHY

Goal: record an image onto a recording medium

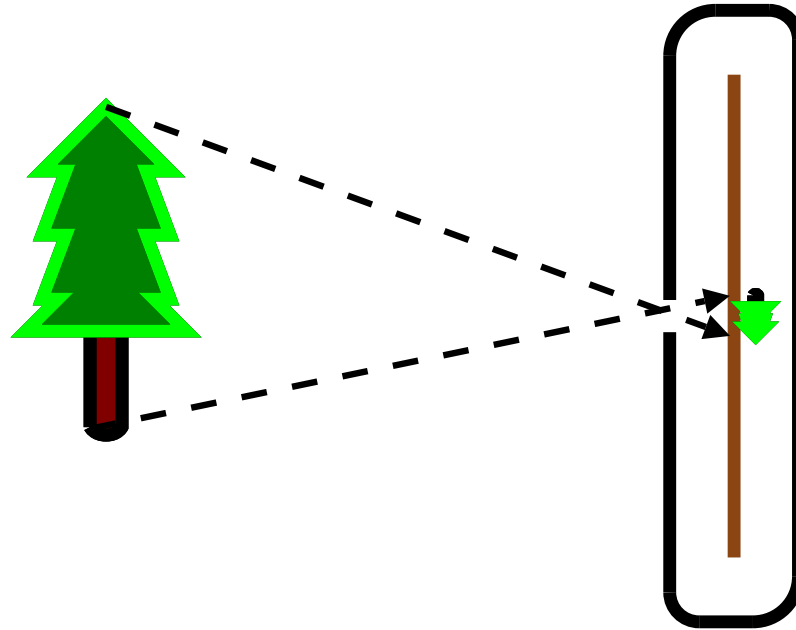
First attempt:



Problem: light from everywhere arrives at every point

Solution: put film in an enclosed box with only one entrance
(*camera obscura*: dark chamber, or *camera* for short)

THE PINHOLE CAMERA

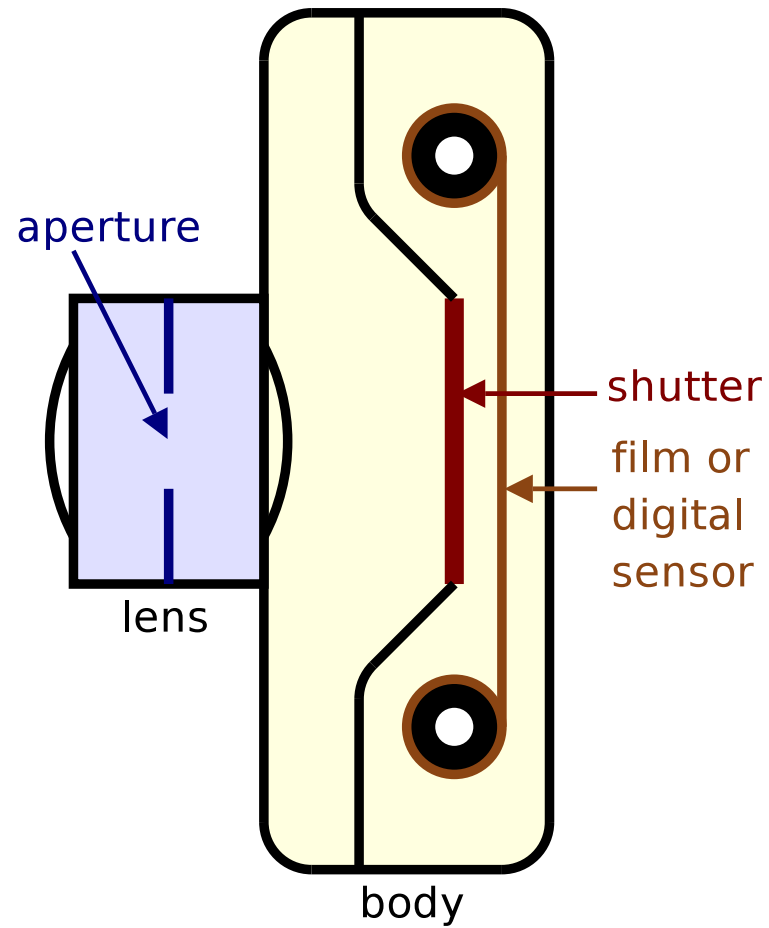


Problems:

- Long exposure necessary
(not much light passes through pinhole)
- Poor quality due to diffraction effects

Solution: the lens, which collects light from a larger area

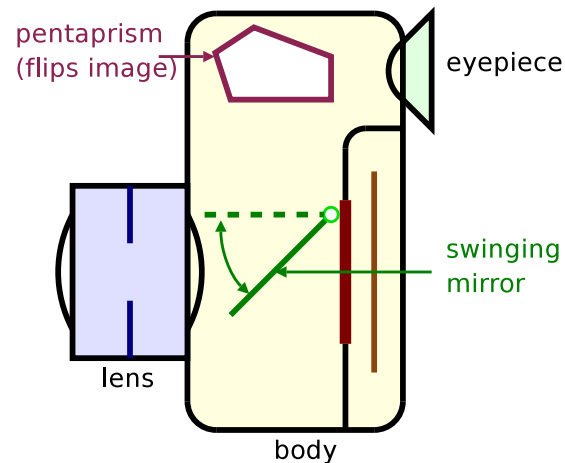
THE MODERN CAMERA



ASIDE

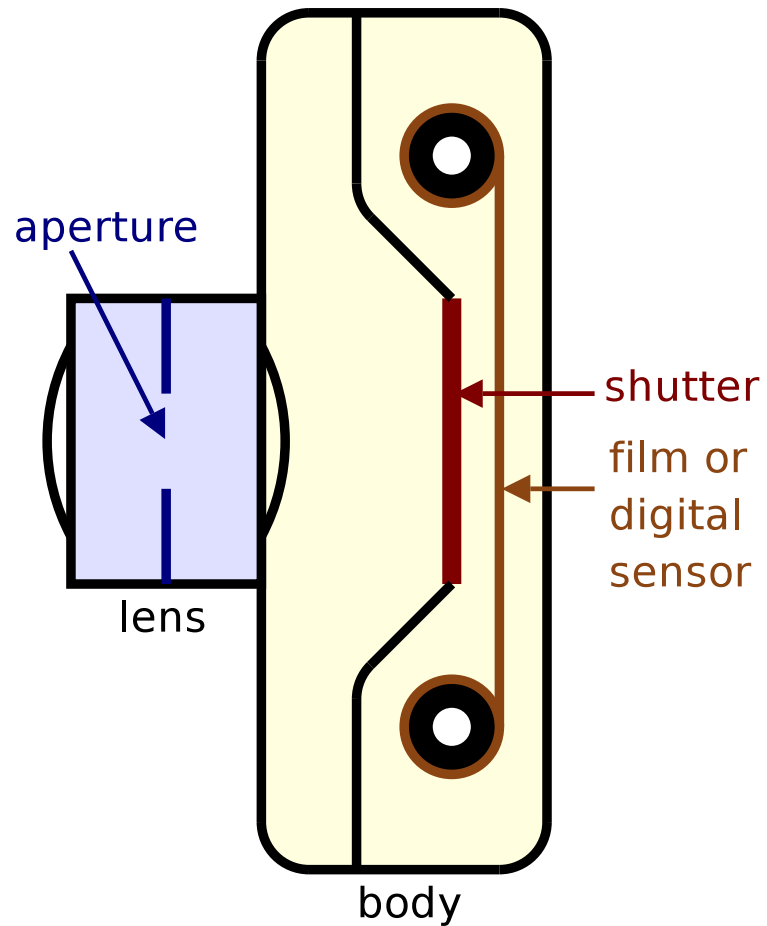
How can the photographer tell what the camera sees?

- **Twin-lens cameras** (includes most compact cameras)
Photographer looks through a second lens, which approximates the camera's field of view
- **Single-lens reflex (SLR) cameras**
Magic with mirrors!



- **Electronic viewfinder (EVF)/Live preview**
Digital sensor constantly takes preview pictures

BASIC CAMERA SETTINGS



- Focal length
- Focus distance
- ISO speed (sensitivity)
- Shutter speed
- Aperture

FOCAL LENGTH

Focal length: Controls field of view (“zoom” to a layperson)

In terms of 35mm film:

- Around 50mm focal length is called **normal** (similar to field of view of eye)
- Shorter focal lengths are called **wide angle**
- Longer focal lengths are called **telephoto**

Actual numbers may be different for other cameras, but it is common to refer to 35mm equivalent focal length.

Prime lenses have a fixed focal length (e.g. 50mm)

Zoom lenses can be set to a range of focal lengths (e.g. 16-35mm, 80-200mm). Some consumer cameras specify a multiplication factor instead (e.g. 4x zoom).

FOCAL LENGTH

Also affects perspective!

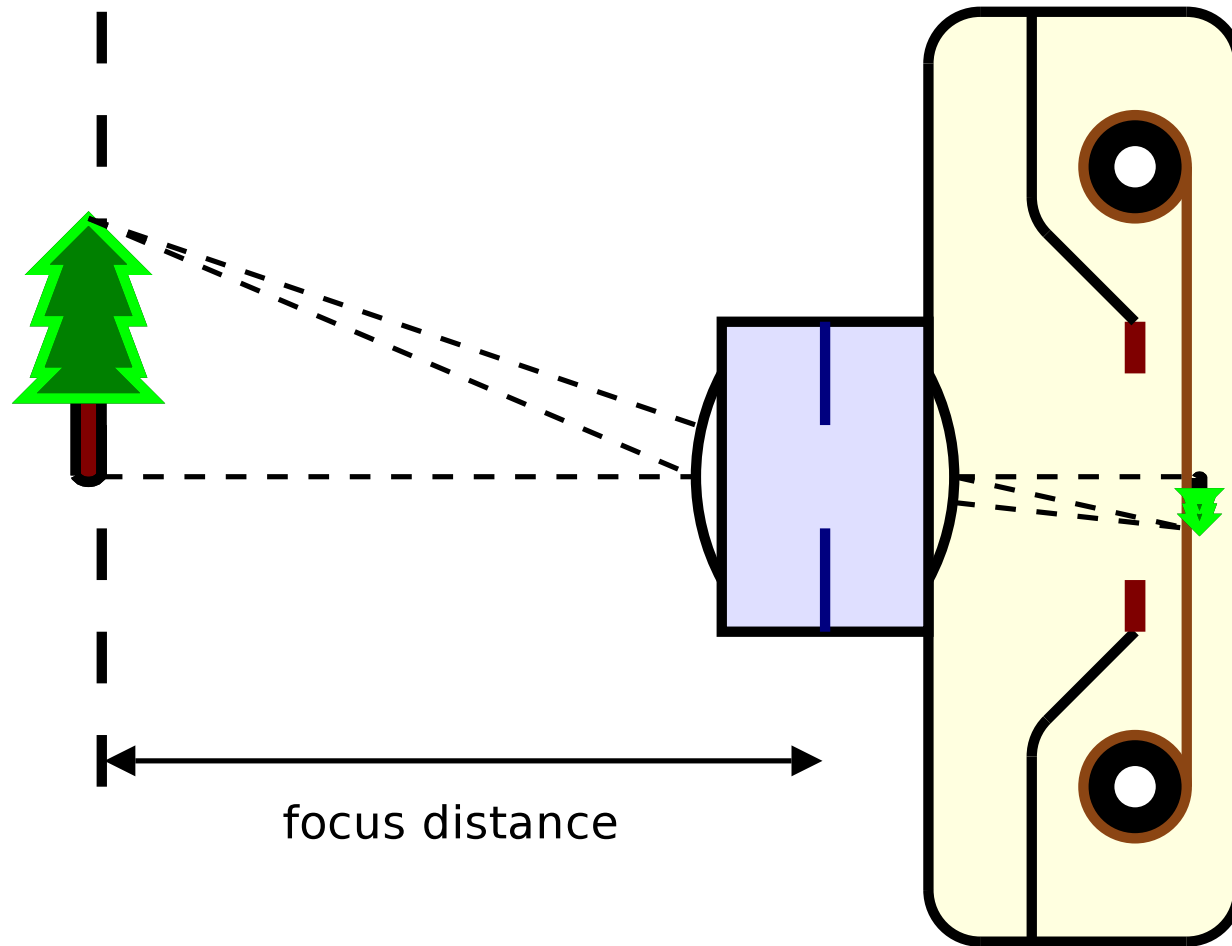


telephoto (300mm)

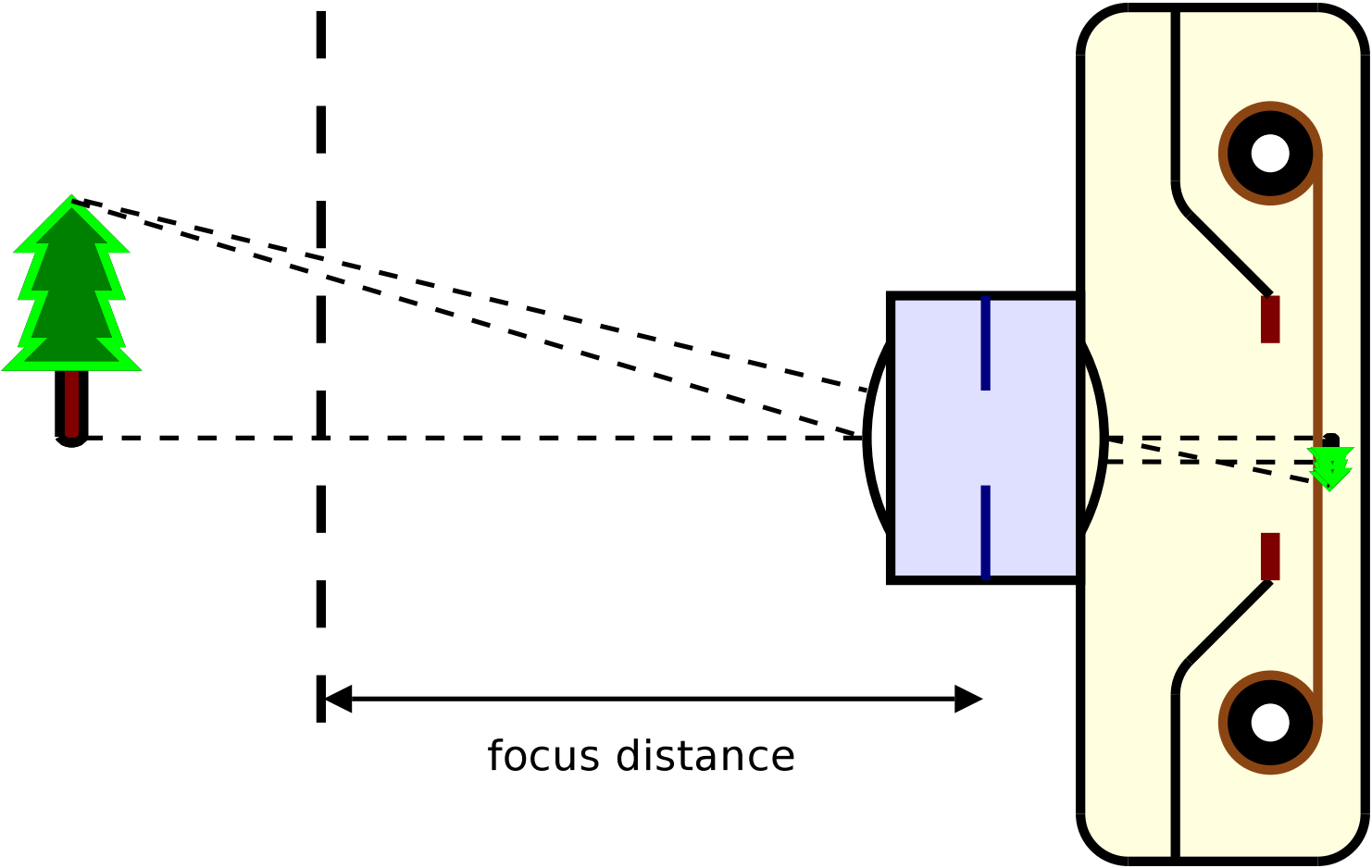


wide angle (28mm)

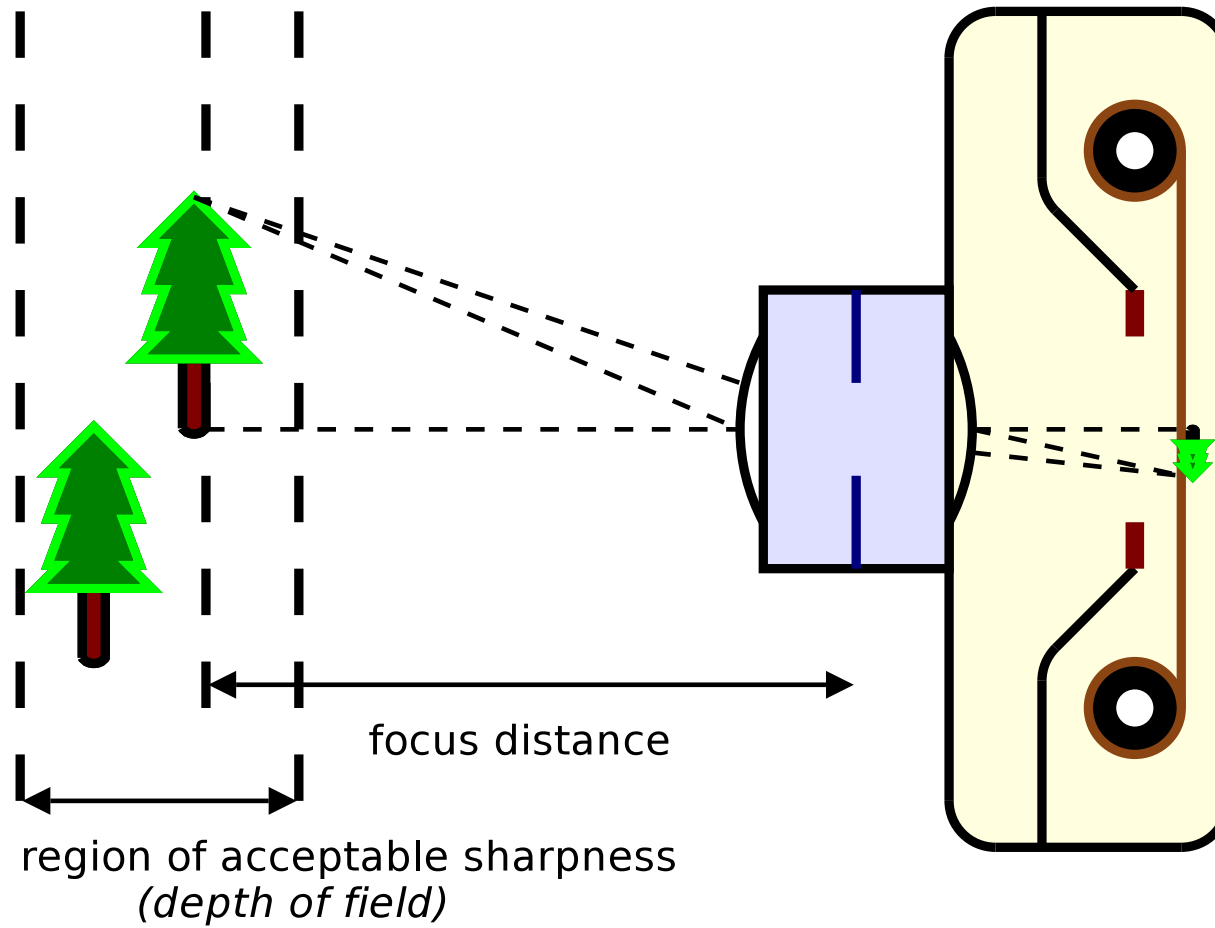
FOCUS DISTANCE



OUT OF FOCUS



DEPTH OF FIELD



ISO SPEED (SENSITIVITY)

ISO Speed: Sensitivity of recording medium

- Film: Property of the film used
- Digital: Camera setting (gain of digital sensor)

Darker environments and fast motion may require higher ISO speeds, at the expense of more noise/grain.

SHUTTER SPEED

Shutter speed: Amount of time shutter is open

Beware of camera shake when handholding!

Rule of thumb (1/f rule):

When handholding the camera, at a focal length of N mm, use shutter speed of at least $1/N$ s.

e.g. for 50mm lens, use at least 1/50s.

SHUTTER SPEED

Can be used for creative control



1/50s



1.3s

APERTURE

Aperture: Diameter of light-admitting hole in lens

Usually described as a ratio of focal length (e.g. f/4)

Smaller number means larger aperture!!!

Stops: 1, 1.4 ($\sqrt{2}$), 2 ($\sqrt{4}$), 2.8 ($\sqrt{8}$), 4 ($\sqrt{16}$), 5.6 ($\sqrt{32}$), 8 ($\sqrt{64}$),
11 ($\sqrt{128}$), 16 ($\sqrt{256}$), 22 ($\sqrt{512}$), 32 ($\sqrt{1024}$)

Maximum aperture determined by lens.

Each stop halves the amount of light.

Most cameras allow setting in half-stop or one-third-stop increments.

APERTURE

Affects depth of field



f/2.8 (large aperture)



f/8 (smaller aperture)

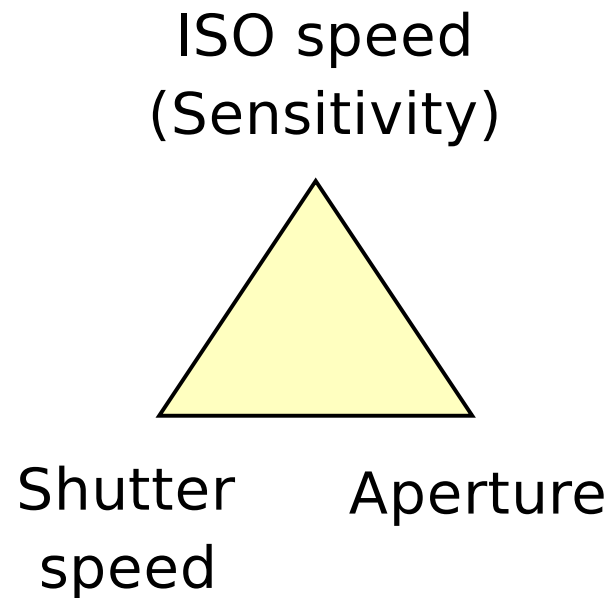
OTHER FACTORS AFFECTING DEPTH OF FIELD

- **Focal length** (at given subject distance)
Longer focal length reduces DoF
- **Subject distance** (at given focal length)
Closer subject distance reduces DoF
- **Size of output image**
Larger print reduces DoF

THE EXPOSURE TRIANGLE

- Shutter speed and aperture both affect the amount of light reaching the recording medium.
- ISO speed affects the sensitivity of the recording medium.

These settings need to be balanced to create the right exposure!



UNDEREXPOSURE



OVEREXPOSURE



EXPOSURE EXAMPLES



ISO 100 f/2.8 1/160s



ISO 100 f/8 1/20s

EXPOSURE EXAMPLES



ISO 100 f/22 1.3s



ISO 400 f/5.6 1/50s

METERING

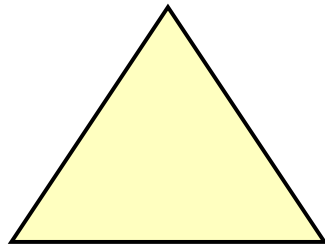
Luckily, modern cameras have built-in metering to help you

- Measures the amount of light reaching the camera
- Camera can guess some or all exposure settings
- More detailed information in Part II !

FULLY AUTOMATIC (□) MODE

All three parameters (and more) are chosen automatically.

ISO speed
(Sensitivity)



Shutter
speed

Aperture

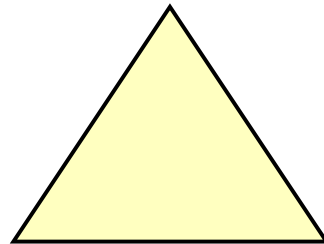
— AUTOMATIC

— MANUAL

PROGRAM (P) MODE

The camera chooses the shutter speed and aperture.

ISO speed
(Sensitivity)



Shutter
speed

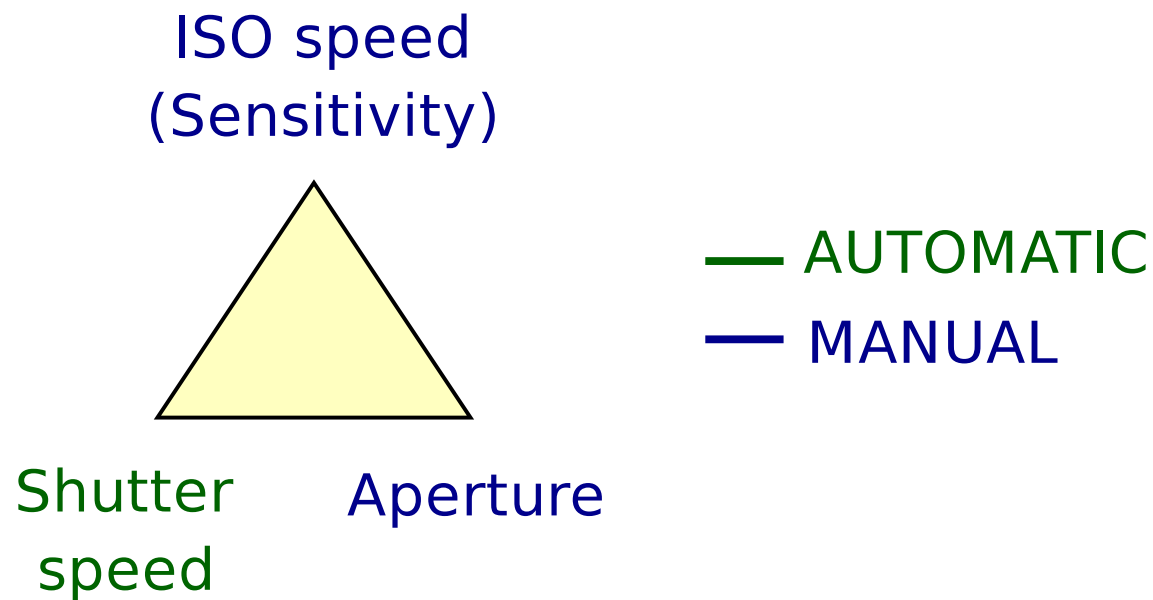
Aperture

— AUTOMATIC

— MANUAL

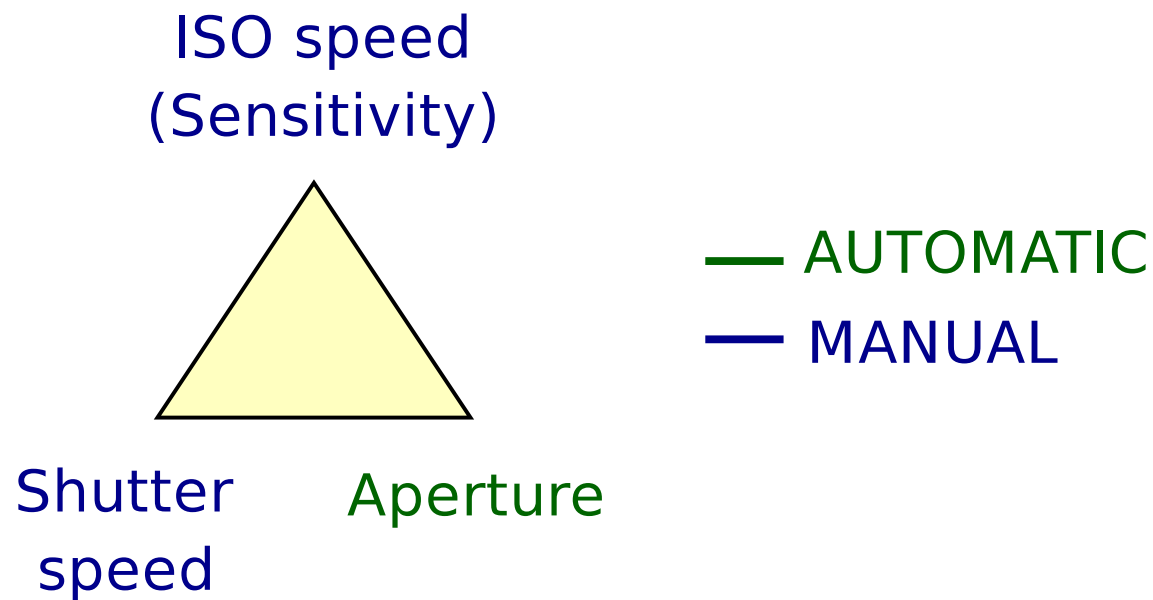
APERTURE-PRIORITY (Av) MODE

You choose aperture, the camera chooses shutter speed.



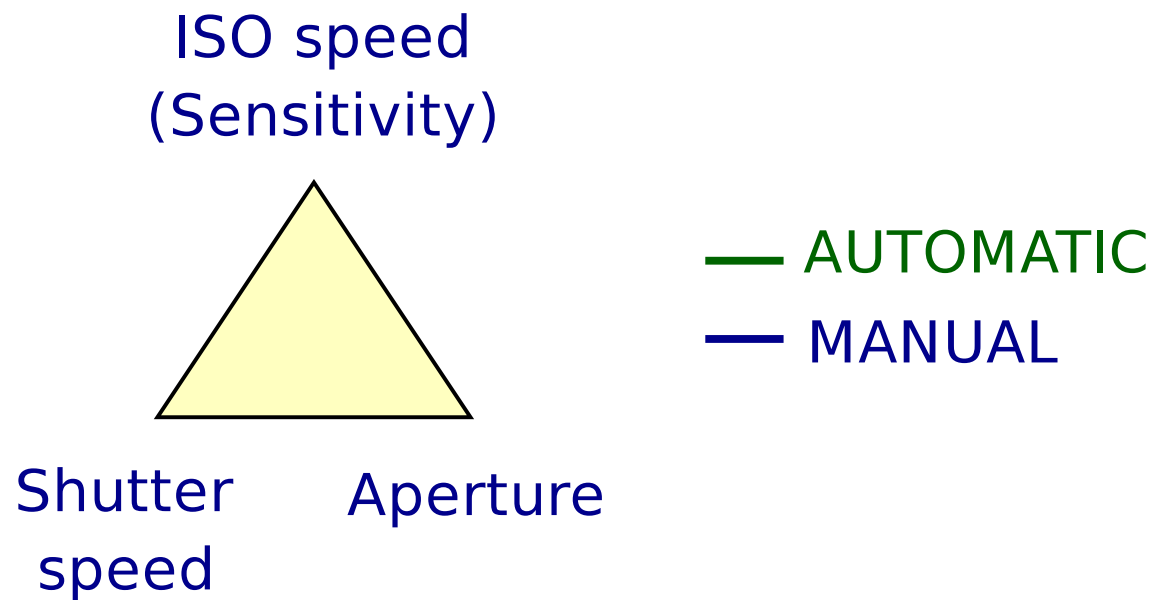
SHUTTER-PRIORITY (Tv) MODE

You choose the shutter speed, the camera chooses aperture.



MANUAL (M) MODE

Parameters manually set. Camera just gives you an opinion.



REVIEW

Exposure parameters

- ISO speed
- Shutter speed
- Aperture

Choose shooting mode depending on which of these parameters you want manual control over.

Other parameters discussed

- Focal length
- Focus distance

QUESTIONS