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
- focus distance
- field of view
- depth of field
- aperture
- sensor size
- lens
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: \( \text{diameter} = \frac{f}{\text{<f number>}} \)
  - \( f/2.0, f/2.8, f/4.0, f/5.6, f/8.0, f/11, f/16 \) (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