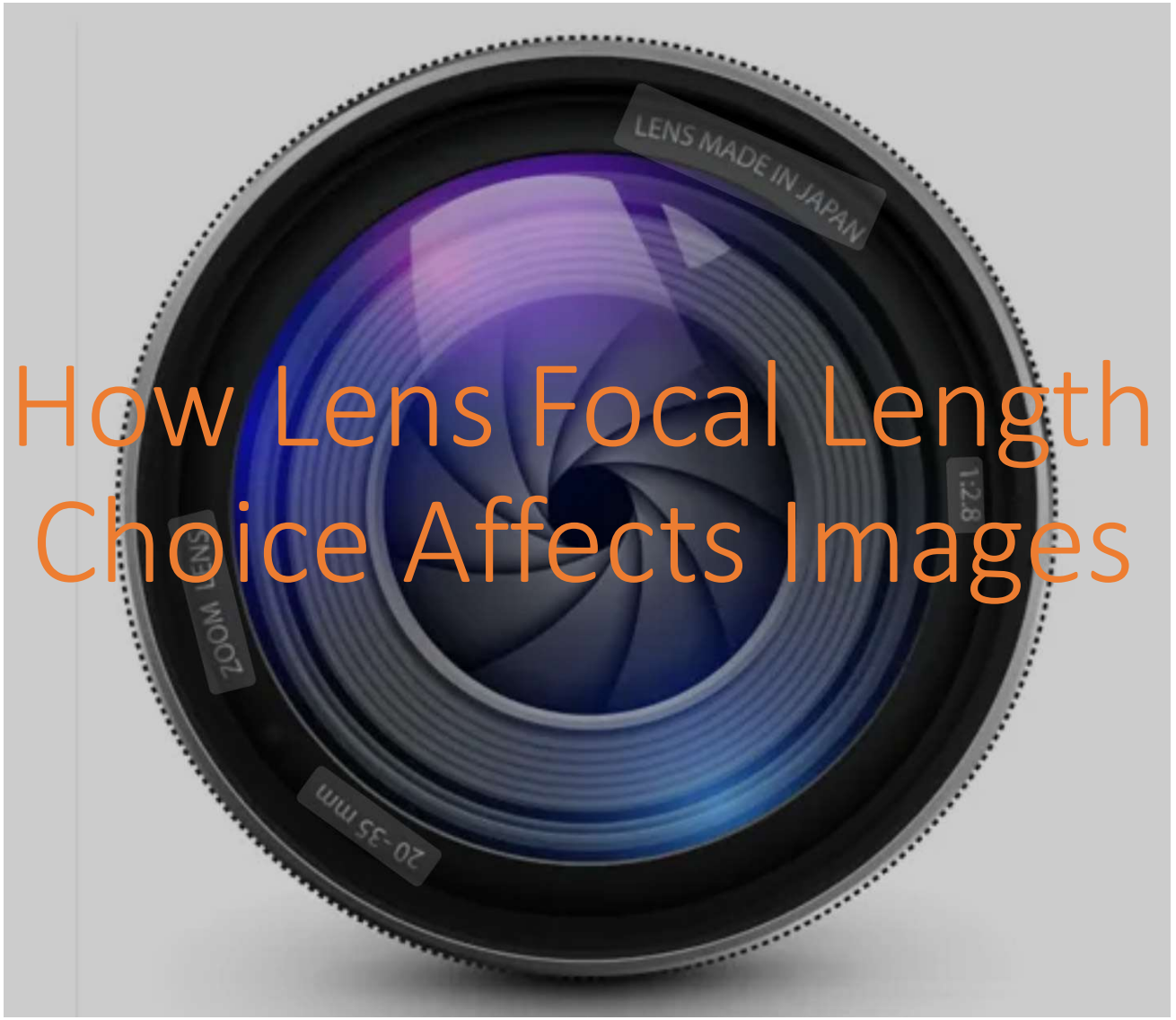
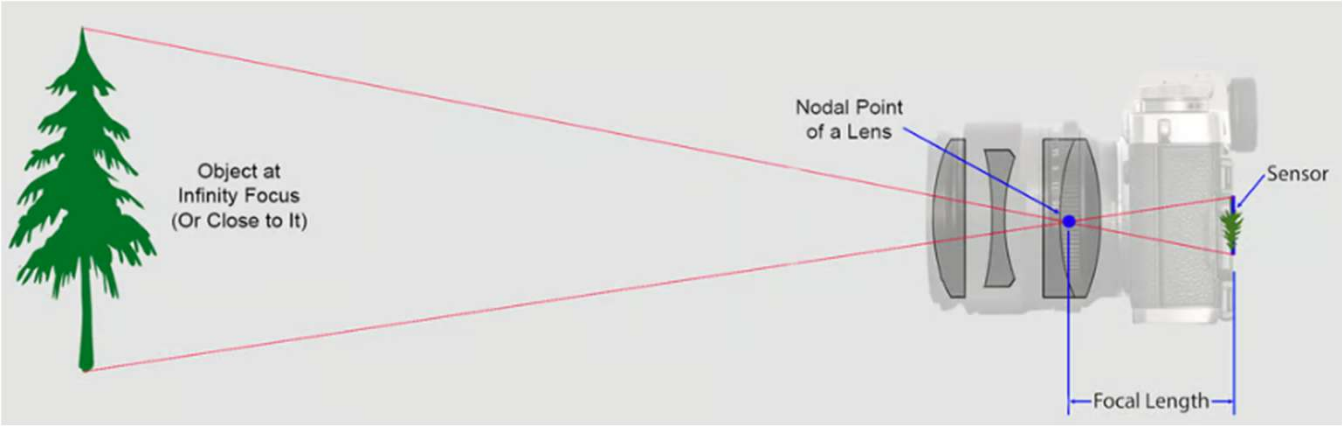


How Lens Focal Length Choice Affects Images

What is the focal length of a lens?

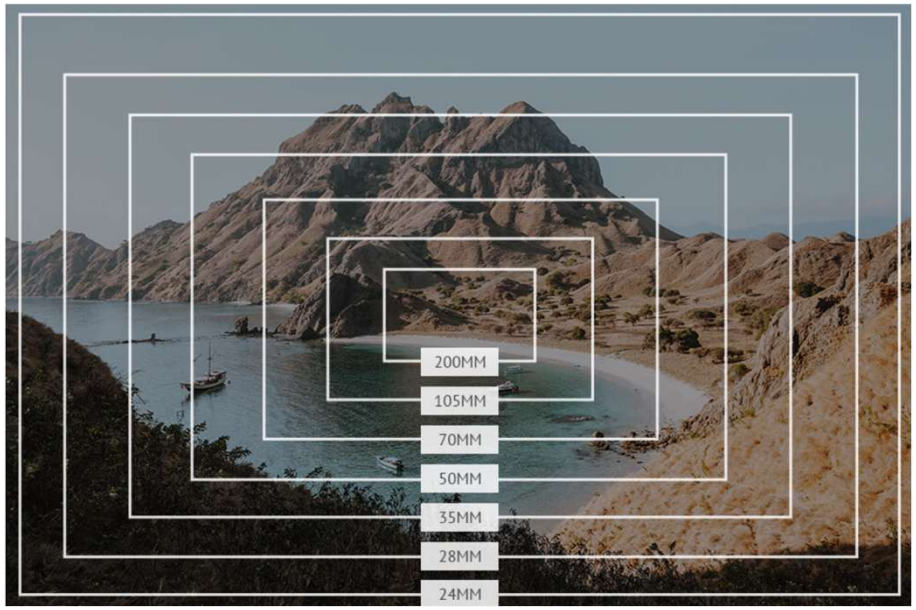
- Focal length measures the distance, in millimetres, between the “nodal point” of the lens and the camera’s sensor



Lens Focal Length – Field of view

- The main effect of increasing focal length is magnification i.e. narrowing the field of view that is captured

- A similar result is achieved by cropping to achieve the same field of view as by optical zooming (but at the expense of reduced resolution i.e. fewer remaining pixels)



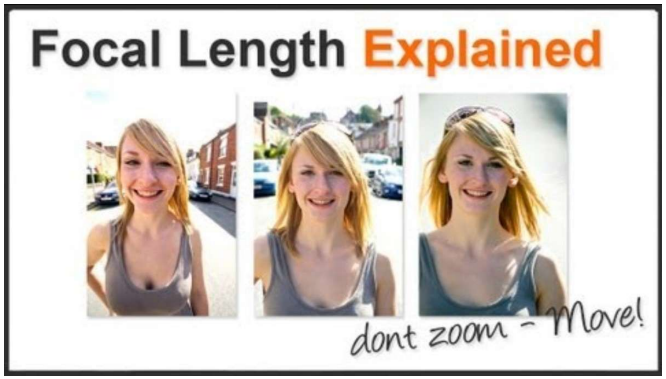
Lens Focal Length Choice

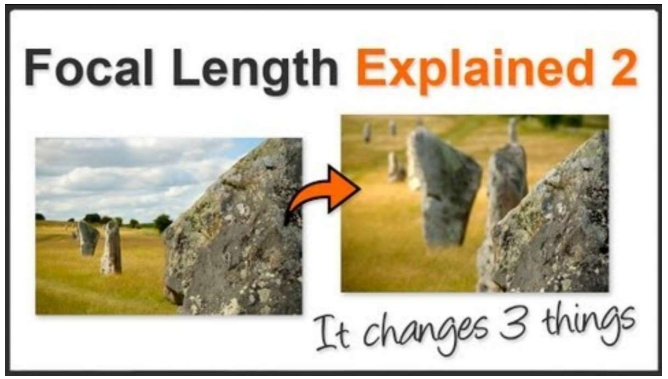
- Two different looking images taken from the same spot just by zooming and recomposing to a different focal length

Lens Focal Length Choice

- Field of View, Perspective, Depth of Field

- Although the primary effect of focal length choice is to alter the **field of view** (magnification), it can also affect the **perspective** between objects in the frame (compression), and the **depth of field** (region of 'acceptable' focus)
- To explain this better here are a couple tutorial videos:

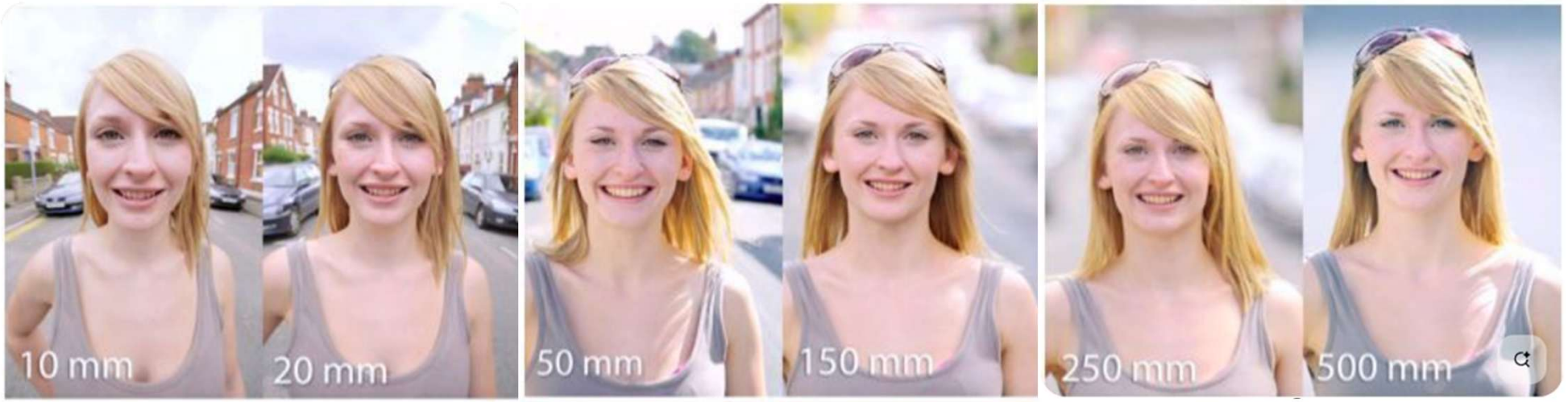




Videos from Mike Browne Photography https://www.photographycourses.biz/videos

Focal Length Effects: Summary

- As the focal length of the lens increases, moving yourself to keep the subject the same size dramatically changes the image field of view, perspective, and depth of field



Wide Angle Lenses: Examples

- Wide angle of view: can cram lots in
- Stretches objects apart
- Large depth of field
- Very intimate close up
- Watch for unwanted distortion (see next slide), or use it creatively

Wide Angle Lenses: Distortion

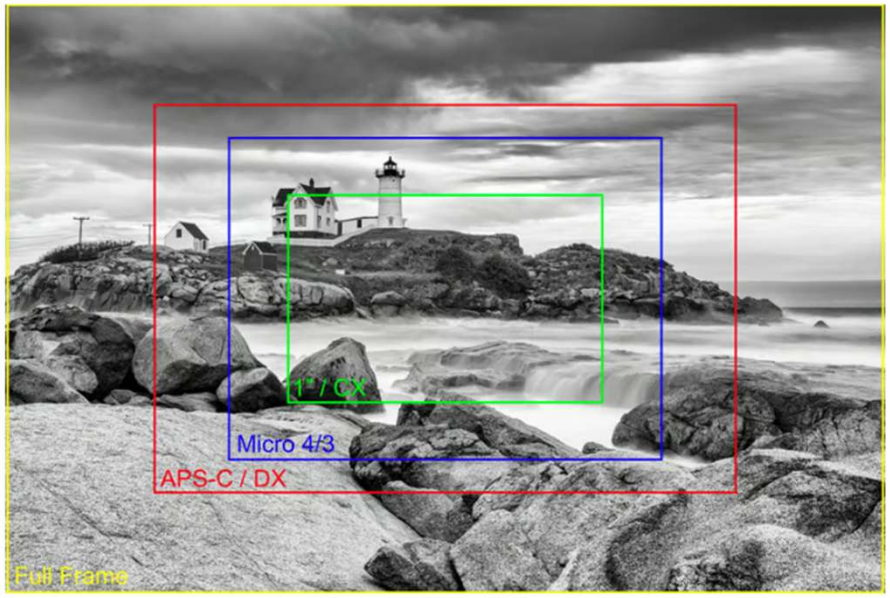
Normal/ Standard Lenses: Examples

- Similar perspective to our own eyes so images look very ‘natural’
- The “nifty fifty“ 50mm prime lens is relatively affordable, typically with a f1.8 or wider aperture making it good for low-light situations, and allowing for creative shallow depth of field. Compact size is ideal for travel and street photography.
- Harder for a photographer to create images that catch the viewer's eye because the perspective is so familiar to our own eyes?

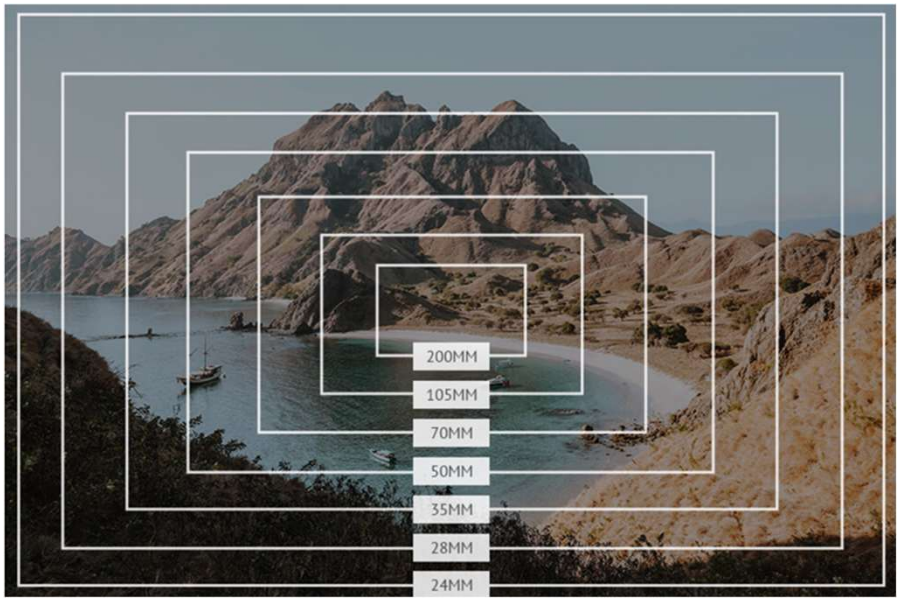
Telephoto Lenses: Examples

- Common usages include wildlife, sports, press photography etc.
- Compresses objects together
- Shallow depth of field
- Relatively big, heavy and expensive

Camera Sensor Size



Nikon D800 + Nikon 24-70mm f/2.8 @ 44mm



- Full Frame is a standard roughly equivalent to the commonly used 35mm size standard of film cameras
- Smaller sensors ‘crop’ the captured image relative to a full frame image
- The result is similar to using a longer focal length lens with a larger sensor, or cropping the image captured by a larger sensor
- Crop Factor is defined as the ratio of the diagonal length of a full frame sensor to the diagonal length of the crop sensor

Sensor size
- Effective Focal Length & Effective F-number

- The effective focal length impacts the field of view and perspective
- The effective F-number impacts the depth of field

Sensor size
- Effective Focal Length & Effective F-number Examples

- For two different sensor size cameras to take identical photos of the same scene (in terms of field of view, perspective and depth of field), there are three important requirements:

1. The two cameras need to be the same physical position relative to the subject you're photographing.
2. The focal lengths of the camera lenses need to be set so that the fields of view seen by the cameras are similar i.e. effective focal lengths should be similar
3. The lenses' entrance pupils (the aperture size you see when you look into each lens) must be physically the same i.e. effective F-numbers must be identical

So comparing between a Full Frame and a Micro Four Thirds camera:

- **A 100mm lens set to f/2.8 on a full frame** (crop factor of 1) camera gives you the same field of view and depth of field as a **50mm lens set to f/1.4 on a micro four thirds** (crop factor of 2) camera
- (50mm focal length x 2 = 100mm effective focal length; f/1.4 x 2 = f/2.8 effective f-number)

Similarly comparing between a Full Frame and an iPhone 6 camera:

- The **iPhone 6 has a focal length of 4.15mm and a f/2.2 aperture*** (crop factor of 7.21)
- This iPhone gives you a similar field of view and depth of field as a **full-frame camera with a 30mm lens set to f/16**
- (4.15mm focal length x 7.21 = 30mm effective focal length; f/2.2 x 7.21 = f/16 effective f- number)

* *The aperture is fixed in most mobile phone cameras. The phone camera achieves correct exposure by automatically adjusting shutter speed and ISO*

Further Reading

What is focal length in photography?

https://photographylife.com/what-is-focal-length-in-photography

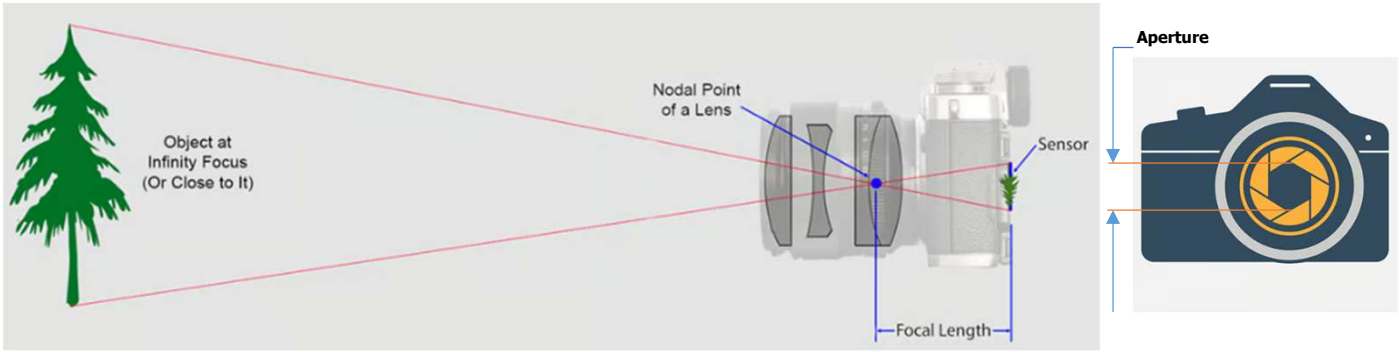
Sensor size, perspective and depth of field

https://photographylife.com/sensor-size-perspective-and-depth-of-field

Backup Slide

Focal length, Aperture & F number (f/ number)

- Focal length measures the distance, in millimetres, between the “nodal point” of the lens and the camera’s sensor
- An F-number is defined as the ratio of the focal length of a lens to the diameter of it’s aperture



- You can think of an aperture of f/16 as the fraction 1/16 (one sixteenth). An aperture of f/8 is equivalent to 1/8 (one eighth). An aperture of f/4 is 1/4 (one quarter) etc.
- So an 80mm focal length at f/4 has an aperture diameter of 80mm divided by 4 (80/4) = 20mm