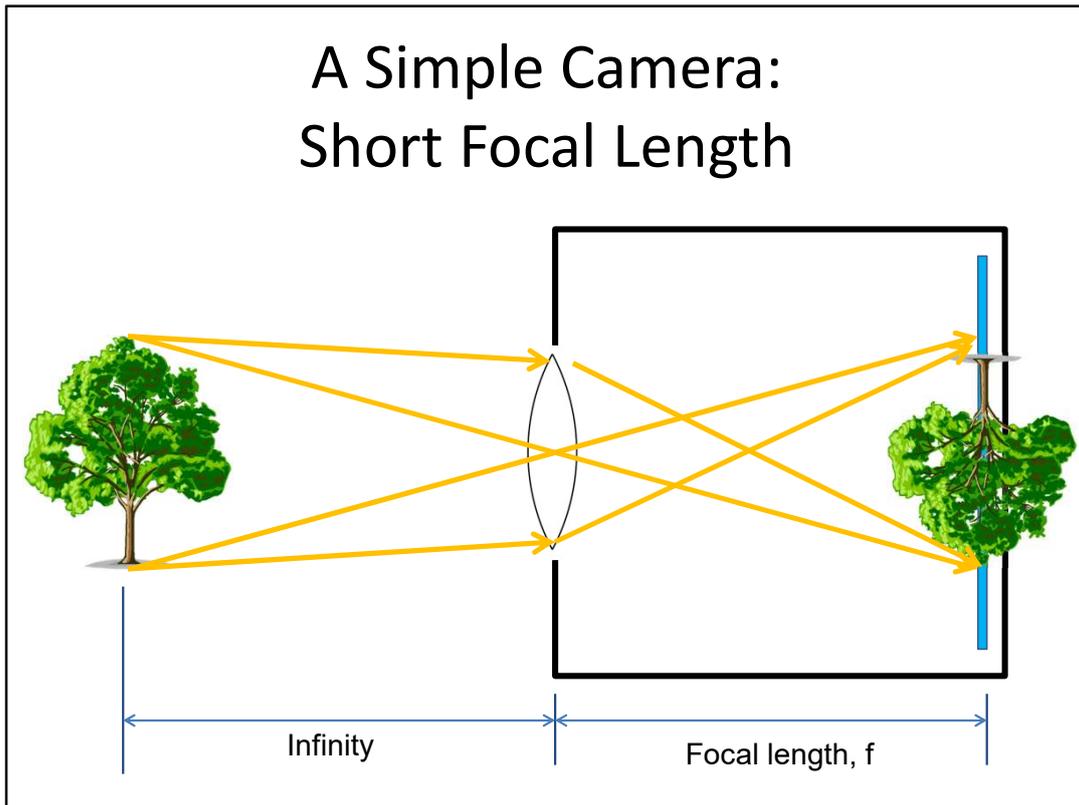




Part 1: How Does A Camera Work?

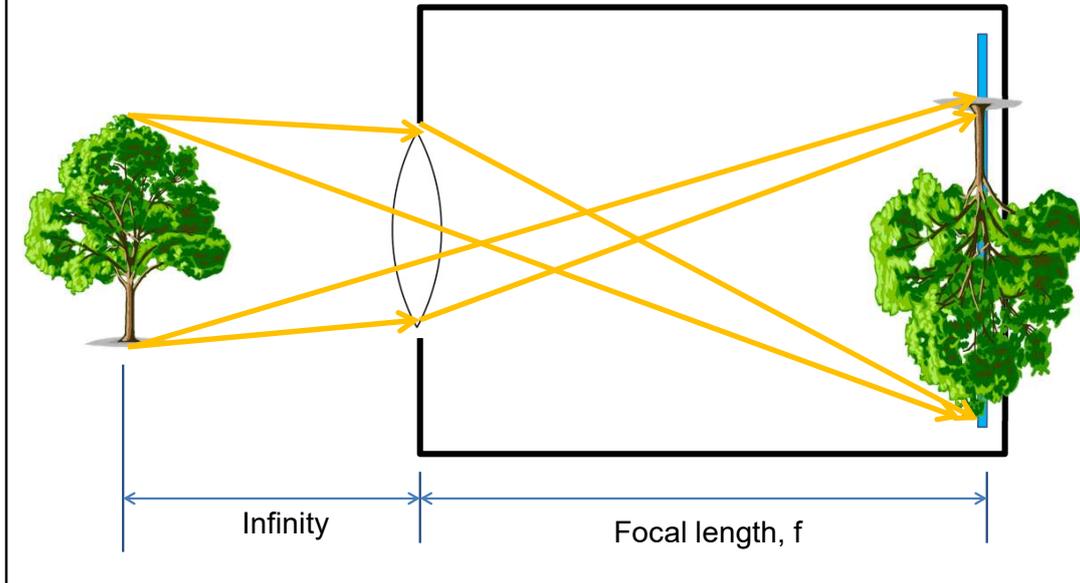
Steven Beard
Musselburgh Camera Club

A Simple Camera: Short Focal Length



The simplest camera consists of a light-tight box with a lens at one end and a light sensitive material at the other end. The focal length of the lens is defined as where an image at infinity is brought to a sharp focus. You can try this out by using a magnifying glass to project an image of a window onto a sheet of paper.

A Simple Camera: Long Focal Length



A lens with a longer focal length needs a longer box to keep the image in focus. Notice how the longer focal length produces a magnified image. This is the basis of a telephoto lens.

Try projecting an image of a window using two different magnifying glasses: a powerful one and a not so powerful one. The most powerful magnifying glass will magnify more when used as a magnifying glass, but the least powerful one (with the longer focal length) will project a larger image of the window.

Choice of Camera

- The important thing is the image, not the camera.
- Images can be captured by Digital (or Film) SLR* s, point-and-shoot cameras, smartphones, tablets, or even digital scanners.
 - You can take a good image with a bad camera and a bad image with a good camera.
 - A better camera will be more tolerant of difficult situations and will give you more control.

* SLR = *Single Lens Reflex*



Smartphone/ Tablet

- Fixed lens.
- Limited situations.
- Noisy.
- Only limited control.



Point-and-shoot

- Mostly fixed lens (with zoom).
- Mostly auto control but some manual overrides.

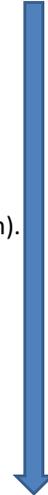


Digital SLR*

- Interchangeable lens.
- Lower noise (especially with “full-frame” sensor).
- Manual control options.
- Fittings for expansion.

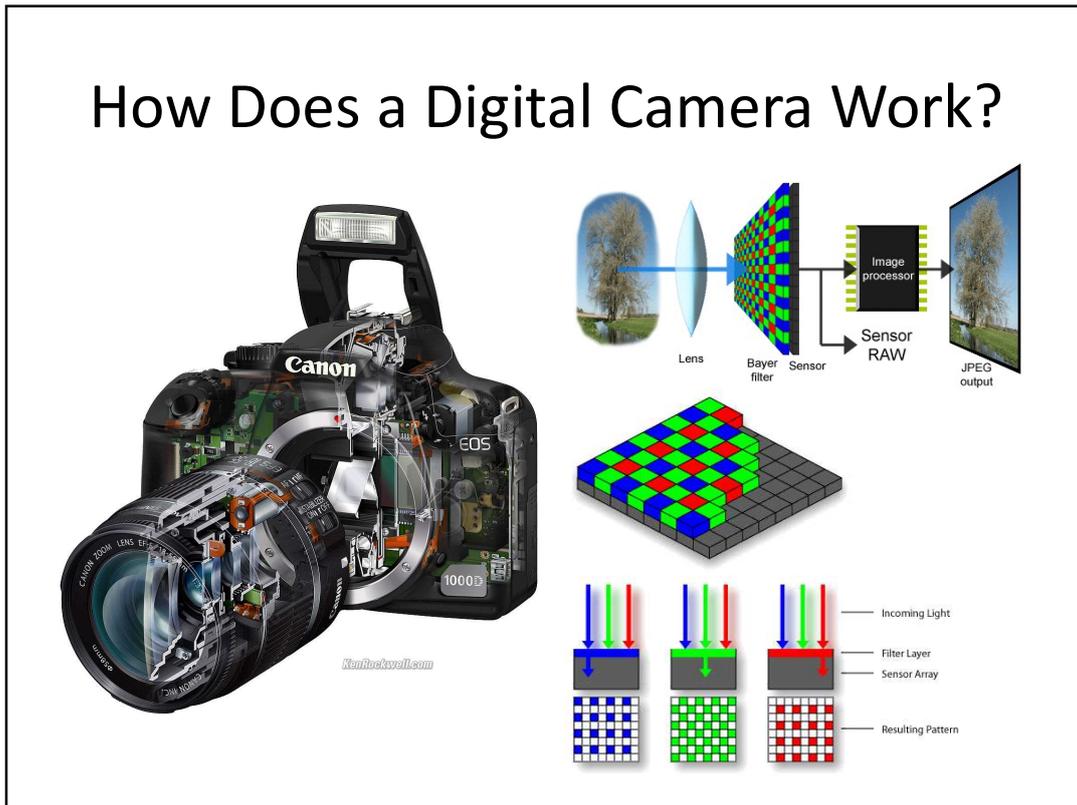
Better Quality

More control



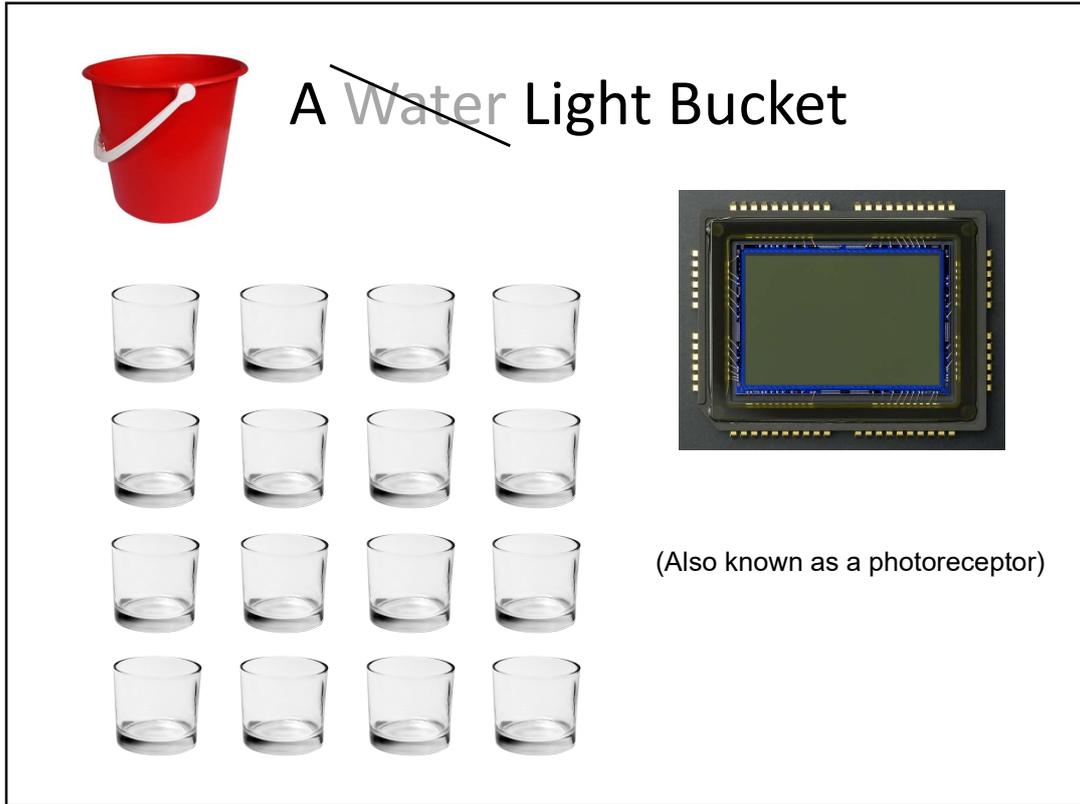
Don't despair if you can't afford an expensive digital camera. Owning expensive equipment might be a good talking point, but it is not the main point of photography. The main point of photography is in creating an interesting image, and you can do this with all kinds of different cameras. Once you are capturing good images, better equipment will help you be more creative and capture images in a wider range of situations, but you can create a good image with any equipment. The secret is to know its limitations.

How Does a Digital Camera Work?



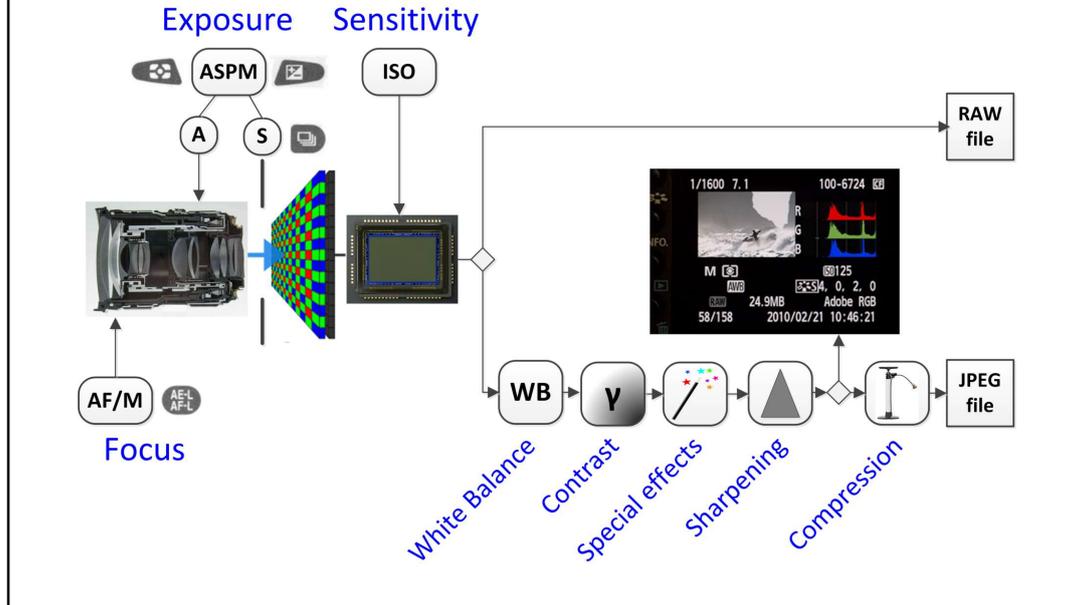
A digital camera contains a detector consisting of an array of light sensitive cells = photo-receptors (c.f. light buckets). Cells can be made sensitive to different wavelengths of light (e.g. visible or IR), but in a detector array all the cells are the same, so they react to colour in the same way. Colour information is recorded by adding a clever device known as a Bayer filter, which directs different coloured light to adjacent photo-receptors. When converted to information, each light sensitive area is known as a picture element, or pixel for short. The information for different colours is separated into channels.

You can imagine the camera's detector as an array of little buckets which collect rain as it falls from the sky. The camera electronics is like an army of people with rulers measuring the depth of the water in the buckets. Some of the water might splash and spill, creating noise. If a bucket overflows it can no longer collect information – your highlights are blown. Better cameras (such as digital SLRs) have larger buckets and are less affected by spills, which means less noise. Raising the ISO setting on a camera is like squeezing the buckets. They become narrower and easier to fill with water, but they become more sensitive to spills and therefore more noisy.



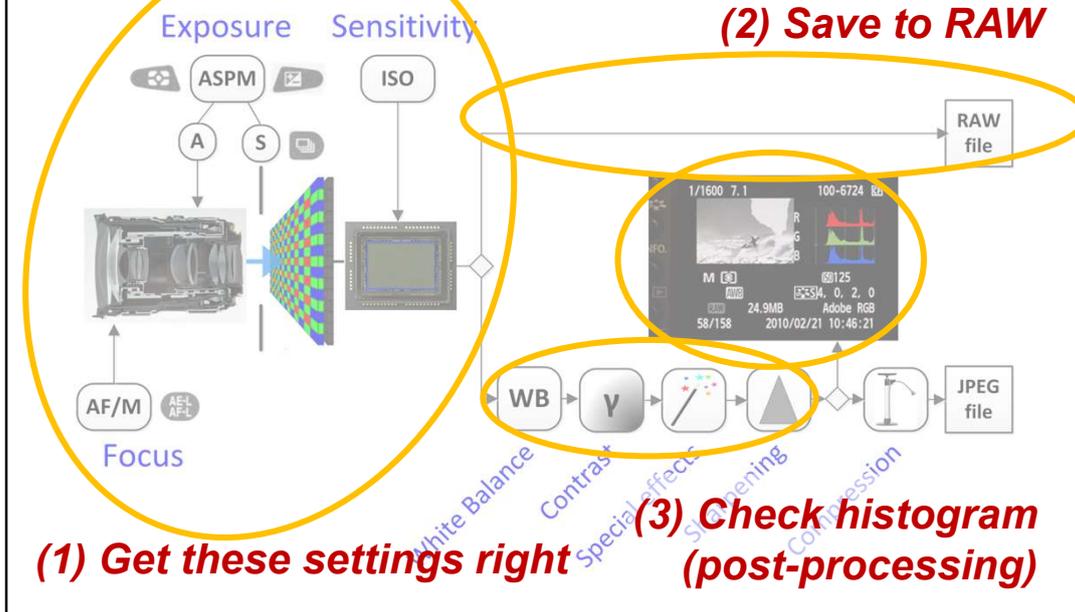
The light sensitive cells in your camera's detector fill with charge like cups or buckets fill with water. Each cell can only contain a limited amount of charge. When it is full, no more light can be registered – the “bucket” has overexposed and your highlights have blown. The size of your camera's “buckets” also determine how noisy they are. Small spills have the largest effect on the small “buckets”.

What Happens to Information Collected by a Digital Camera?



This is the flow of information through a camera. Some settings (the ones on the left) are vital because they cannot be changed once the image is captured. Some camera settings (from white balance onwards) are not as vital because they can be changed later (if you save in RAW). If you intend to process images with Photoshop, always save in RAW. Saving images to JPEG is an option if you don't use Photoshop or if high speed capture is important (sacrificing some image quality). JPEG compression can introduce ugly artefacts, so keep compression to a minimum. TIFF format is better than JPEG but not as good as RAW. Be aware that the histogram you see on the back of a camera is based on the converted JPEG, not the RAW image.

What Happens to Information Collected by a Digital Camera?



These settings are used to control how the camera processes the images. RAW images tend to have a low contrast and need to be gamma-corrected. In this case, the camera is processing the images for you instead of Camera Raw and Photoshop (which is useful if you don't have Photoshop). The histogram displayed by the camera represents the state of your image after these processing steps. The good news is that this histogram tends to be pessimistic. The RAW files have a better dynamic range, so you might be able to recover a small amount of lost highlights or shadows. (To give a better representation in this histogram, try putting the camera into low contrast mode.)