3A-L1 Cameras and images

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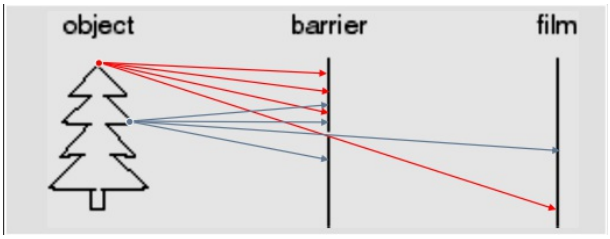
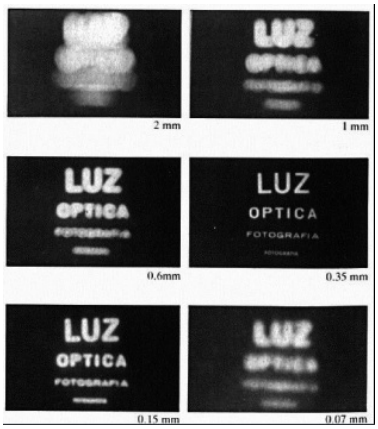
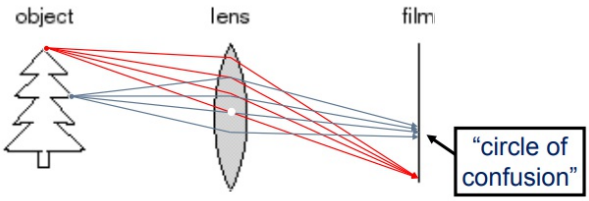
1. Intro
    a. What is an image?
        i. Up until now: a function - a 2D pattern of intensity values
        ii. Today: **a 2D projection of 3D points**
2. Imaging System
    a. simple definition
        i. it's some device that allows **the projection of light from three dimensions to some medium** that will record the light pattern.
        ii. That medium can be film or it can be a sensor, etc.
    b. key word is projection
        i. when you do projection somehow you're lossing the info. in the third dimension
3. Image Formation
    a. each point in one object gives out light in all directions so that to get a clear projection of some obj, we have to only allow one point gives one light to the film. i.e. Pinhole camera
        i. the projection is inverted



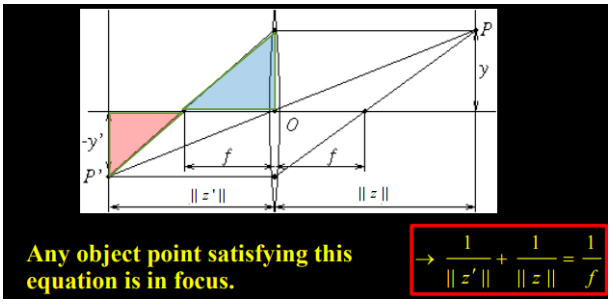
4. Aperture
    a. when the aperture is big, too much light get overlapped; while, when it's too small, the light gets diffraction(衍射)



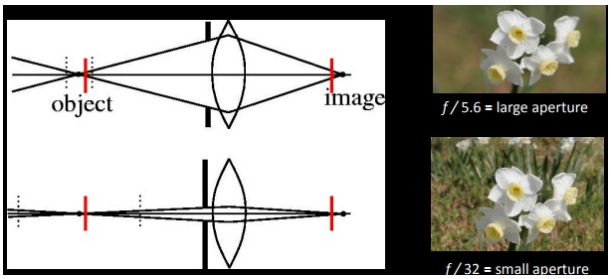
5. Lenses
    a. Now we use lens instead of hole



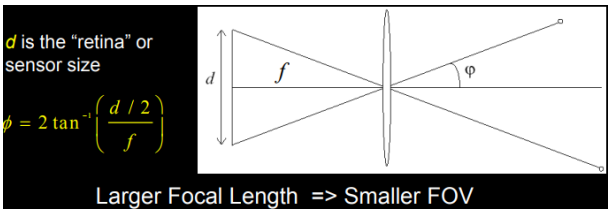
6. Thin Lens



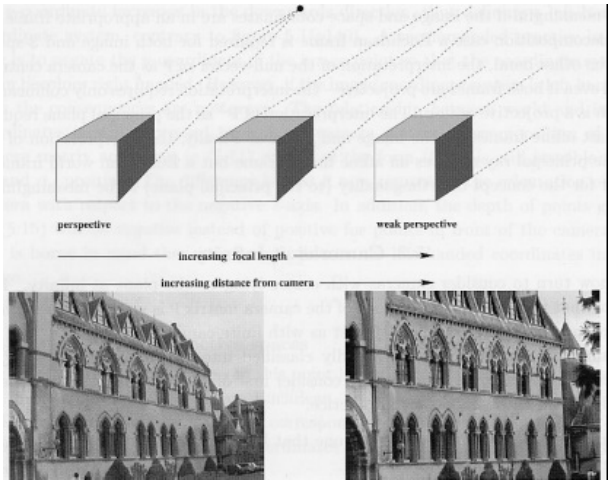
7. Varying Focus
    a. pull effect for video
8. Depth of Field
    a. controlled by the aperture, the smaller the aperture, the better depth of field



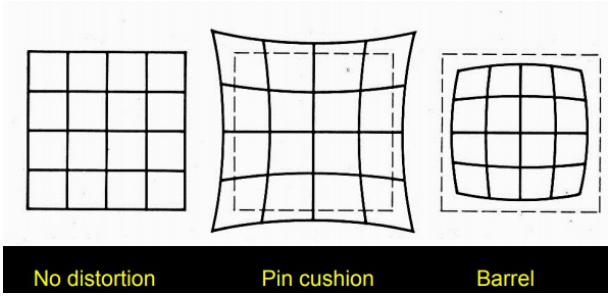
9. Field of View



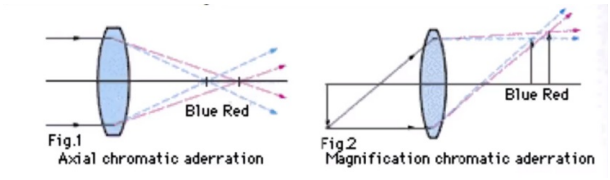
10. Zooming and Moving are not the Same
    a. perspective of distortion,
        i. happened when stay too close to the obj



11. Dolly Zoom
    a. Basically, if you move closer and closer to something, but you widen out the lens at the same time, you'll cause the object and subject in the middle to stay about the same size and to be stationary. but the all the stuff from the outside is going to look like it grows.
12. Lenses Are Not Perfect
    a. Geometric Distortion
        i. Pin cushion
        ii. Barrel



    b. Chromatic aberration
        i. differernt color rays have different diffraction rate



    c. Vignetting

13. Lens Systems
    a. to solve the problems above, you have to pay money to buy good lens systems.
14. End
    a. So, when we do the mathematics of how images relate to the geometry of the world, we'll use the pinhole model.
        i. the mathematics of a pinhole camera are very well understood and are very clean.
    b. But everything that I've showed you here is how we build lenses that give us this illusion of having a very powerful pinhole imaging system.
    c.