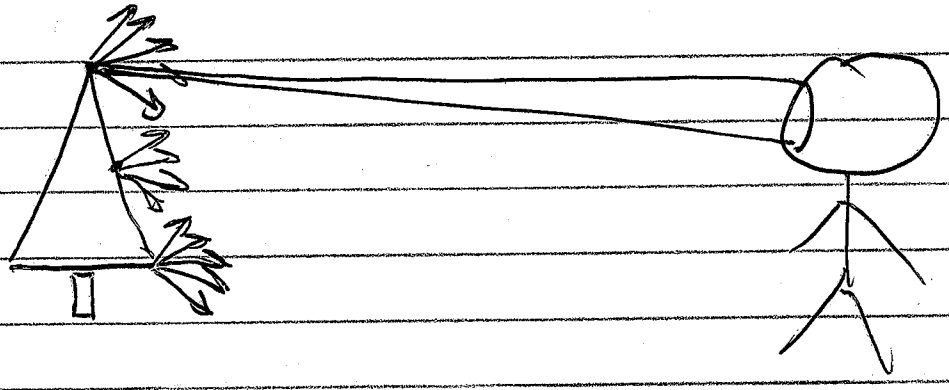
Phys 2426 2017-11-21 Lec 23

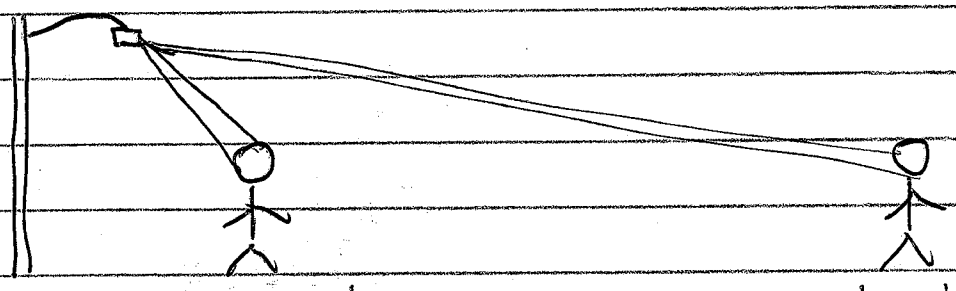
What do we directly see?

- Rays of light that hit the retina.
- If focused, this is a "real image" on the retina
  The rays intersect at the retina.

What was the light doing when it reached us?



- Diverging rays that come from a common point.



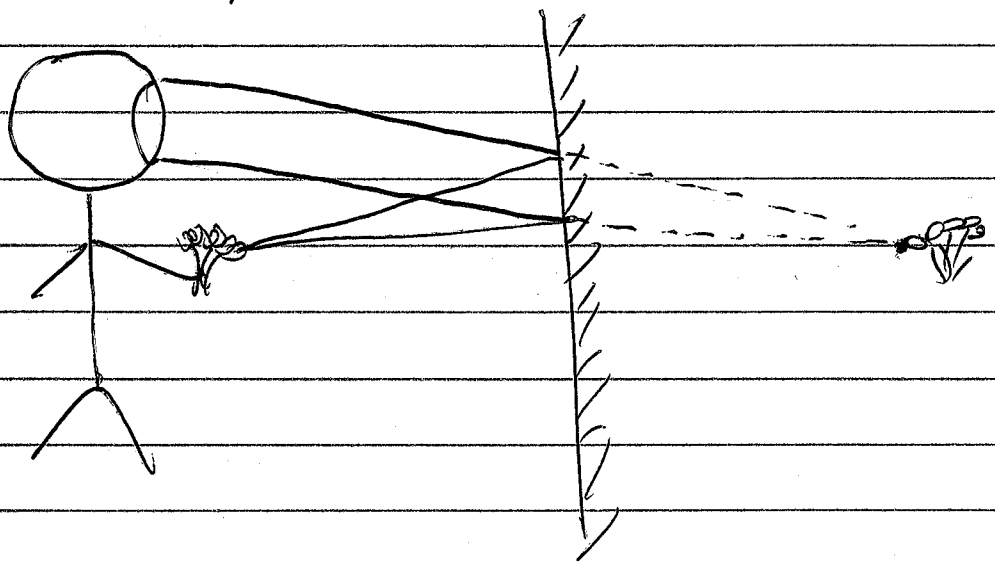
Object is nearby
More Diverging Rays

Object is far
Less Diverging Rays

Extreme case: Parallel Rays
From infinitely far object.

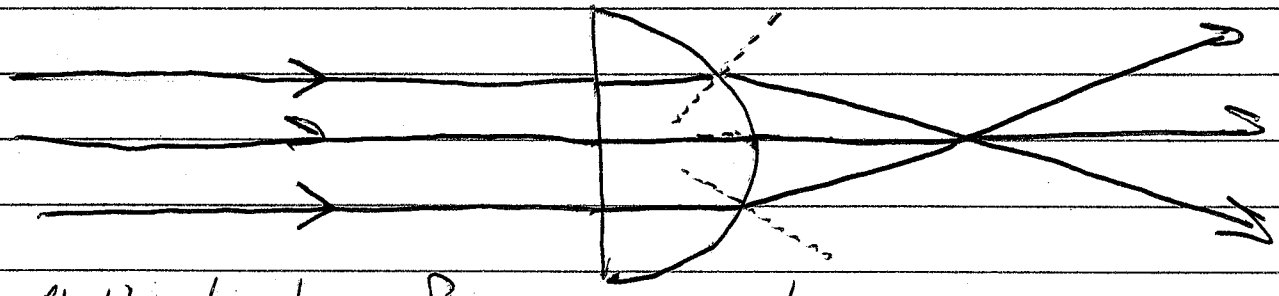
(2)

Our visual processor can be fooled.



The observed rays come from the image. When they never cross, the image is virtual.

What does a lens do?



At the back surface: n_1 = glass = 1.5

n_2 = air = 1.0

- Converging lens - makes parallel rays converge. The crossing point is the focal point
- Generally, the converging lens pushes the rays toward each other.

Thin Lens Equations

$$\frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f}$$

$d_o = p$ = object dist from lens
$d_i = q$ = image dist from lens
f = focal length of lens

d_o	f	d_i
8 cm	3 cm	4.8 cm
5 cm	3 cm	7.5 cm
4 cm	3 cm	12 cm
3 cm	3 cm	∞
2 cm	3 cm	-6 cm

$$\frac{1}{8} + \frac{1}{d_i} = \frac{1}{3}$$

$$d_i = 4.8 \text{ cm}$$

$$\left(\frac{1}{3} - \frac{1}{5}\right)^{-1} = 7.5 \text{ cm}$$

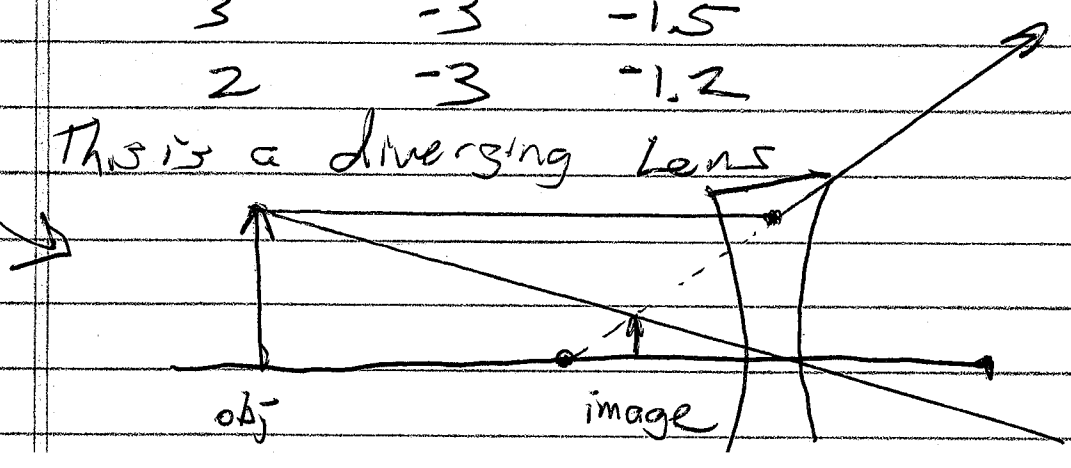
$$\frac{1}{3} + \frac{1}{d_i} = \frac{1}{3}$$

Negative Focal Length

8	-3	-2.2
6	-3	-2
4	-3	-1.7
3	-3	-1.5
2	-3	-1.2

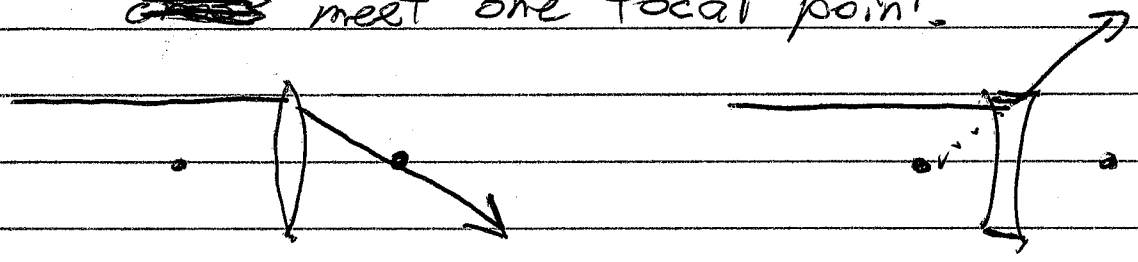
$$d_i = \left(\frac{1}{F} - \frac{1}{d_o}\right)^{-1}$$

This is a diverging Lens



Principle Rays

- Parallel Ray – Bends in or out to meet one focal point.



- Central Ray – goes straight
- Focal Ray – ~~bends to hit other focal point~~ bends to be parallel to axis (horizontal)