

Lecture 3 Graphics 101

Why are things the way they are?

Review

How are we going to learn graphics?

- Class Organization
- Web Programming Basics

Today

Some basic background

The workbook is pretty self-explanatory (a good intro to Canvas programming)

Computer graphics (the field) is the study of

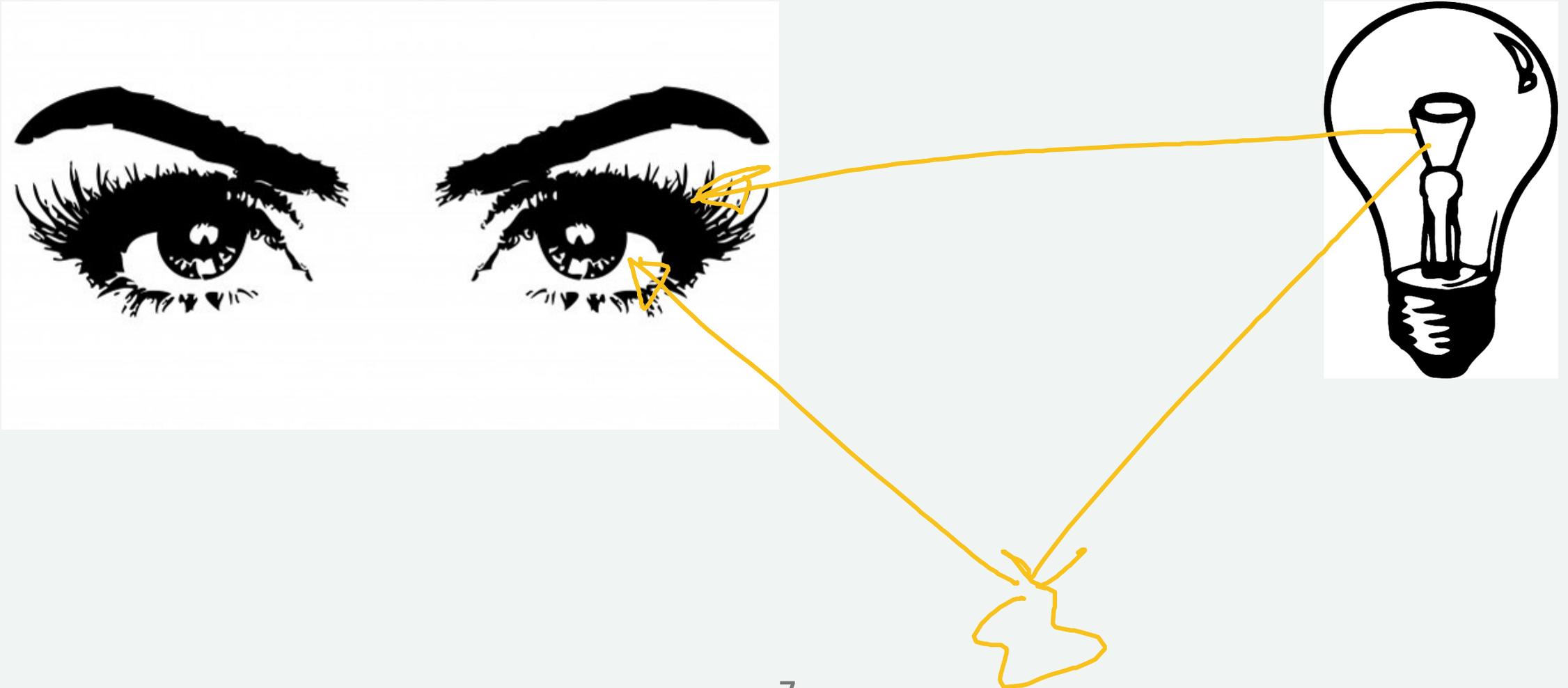
How computers create things we see

How do we see?

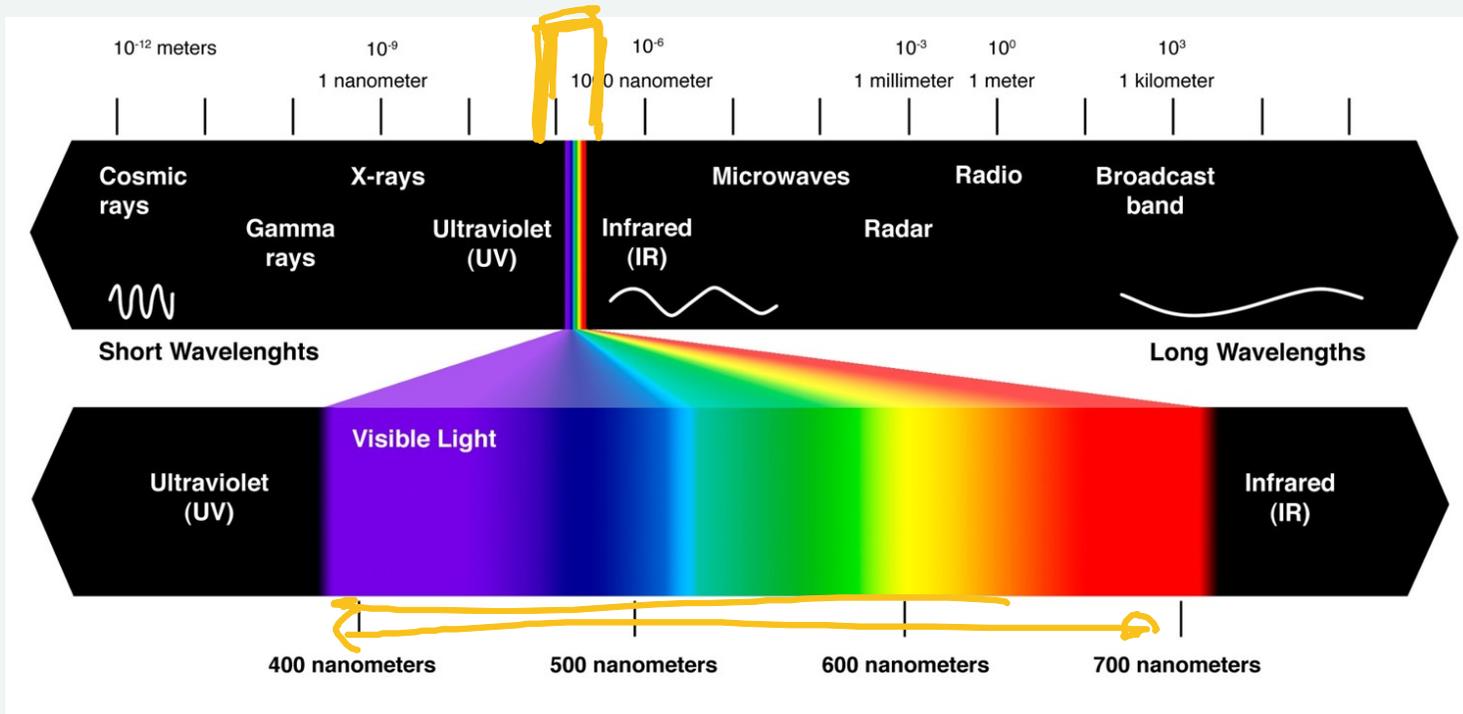
How do we see?



How do we see? (What do we see?)



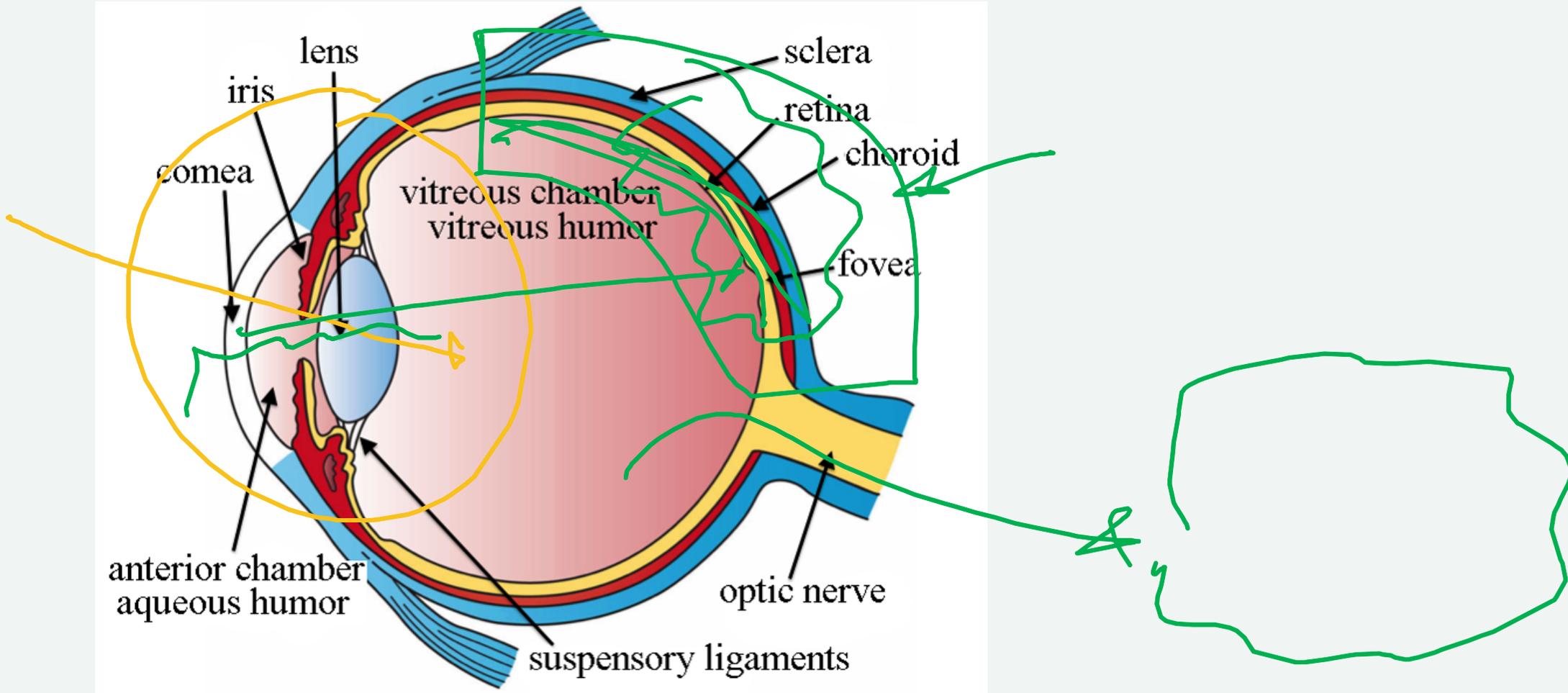
A little about light



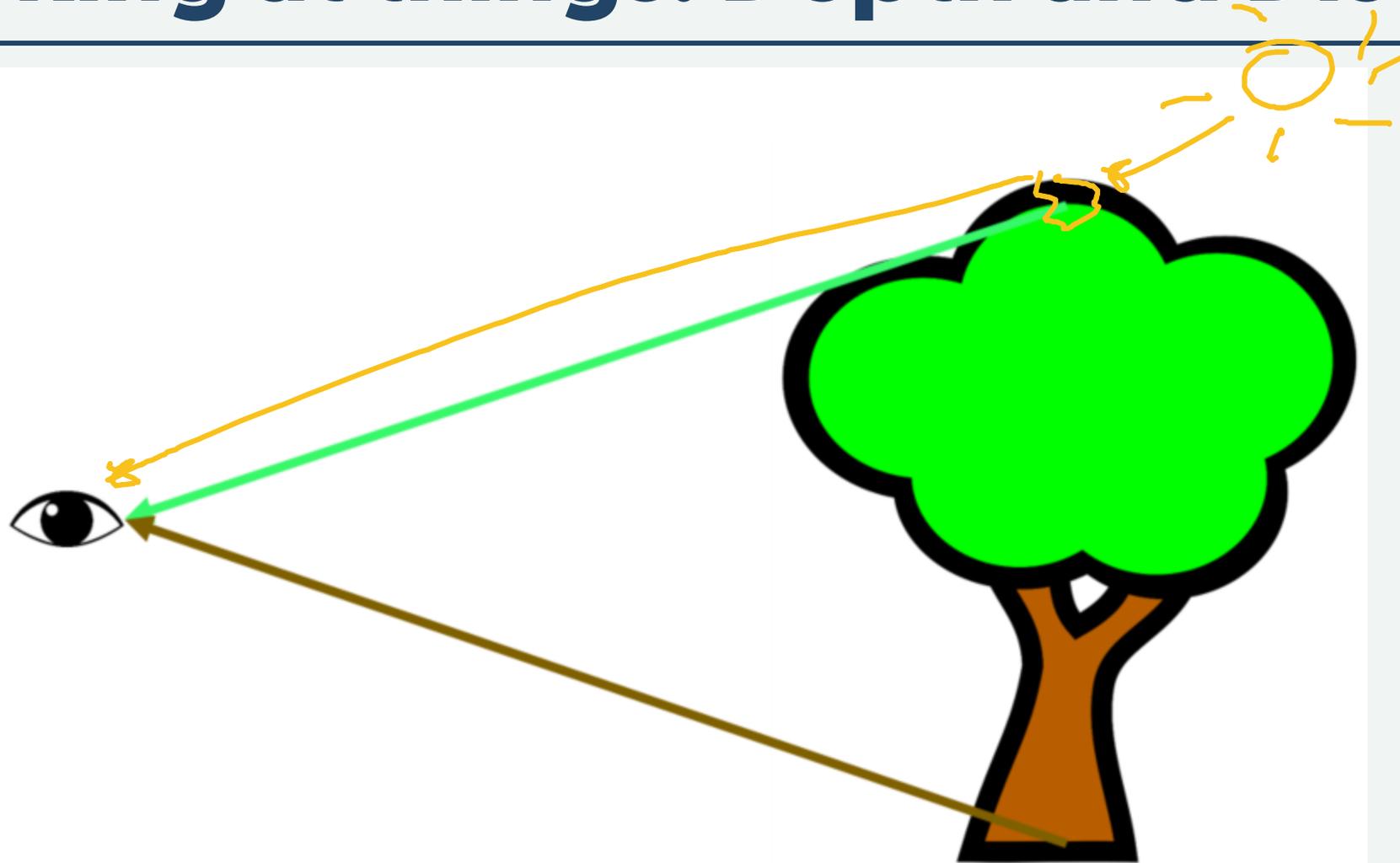
- travels in straight lines
- hits things
 - absorbed
 - bounces
- has color [wavelengths]
 - Why 3 numbers?



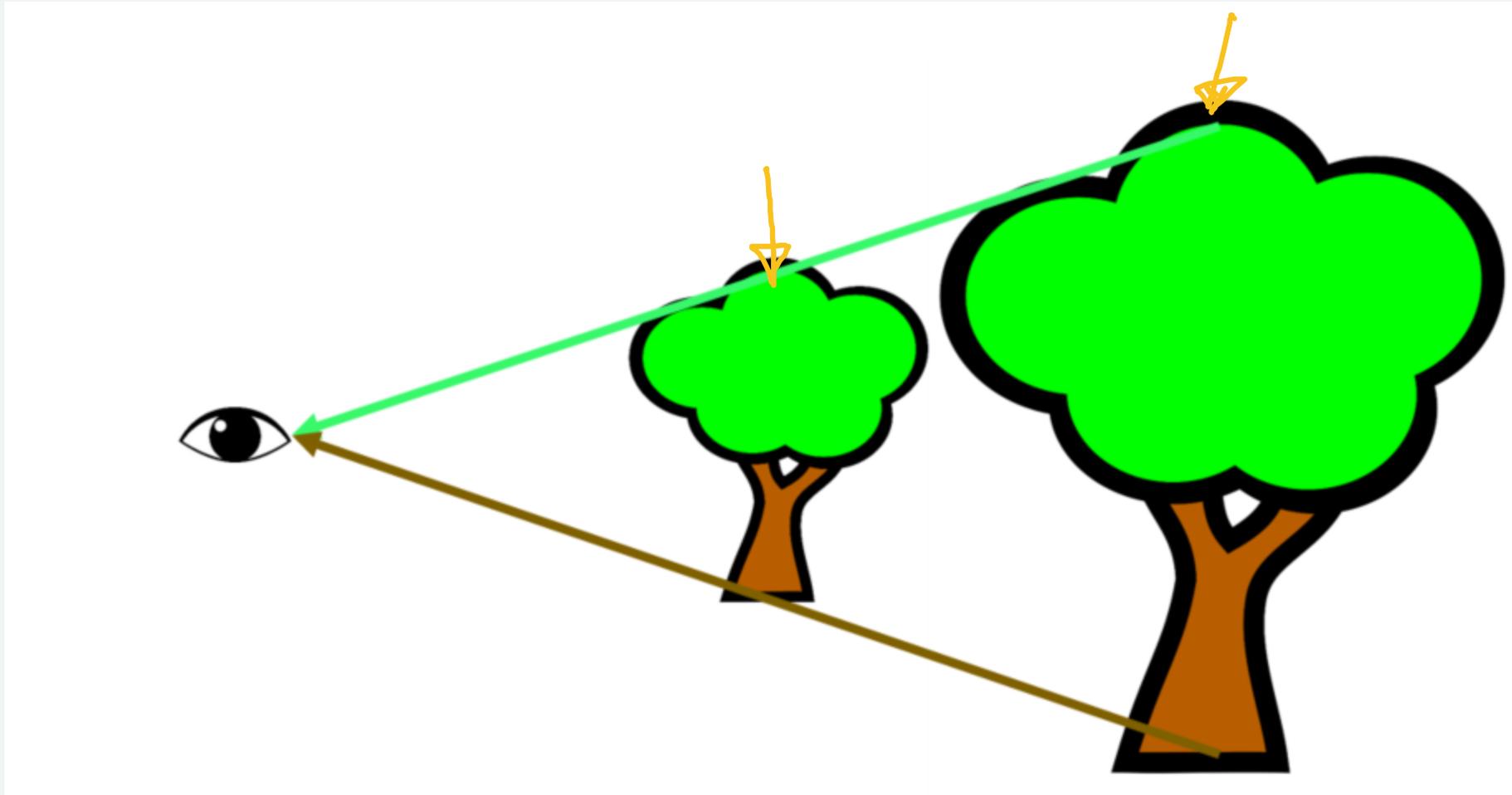
Where (some) light ends up



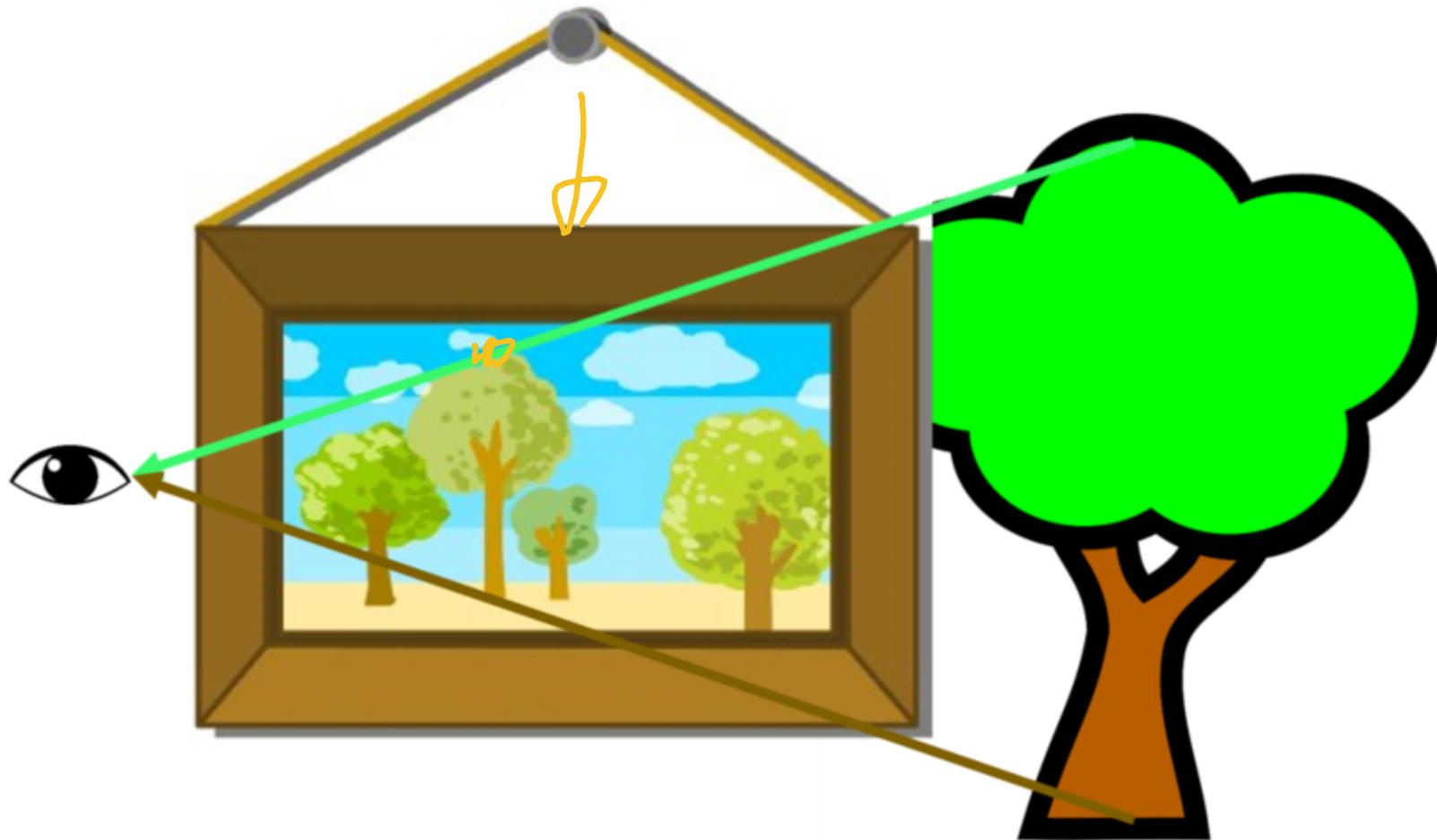
Looking at things: Depth and Distance



Looking at things: Depth and Distance



Looking at things: Depth and Distance



Can a Picture Fake Us Out?

https://www.turneadv.it/wp-content/uploads/2017/10/3D-pedestrian-crossing-island-2-59f03455342f2__880.jpg

















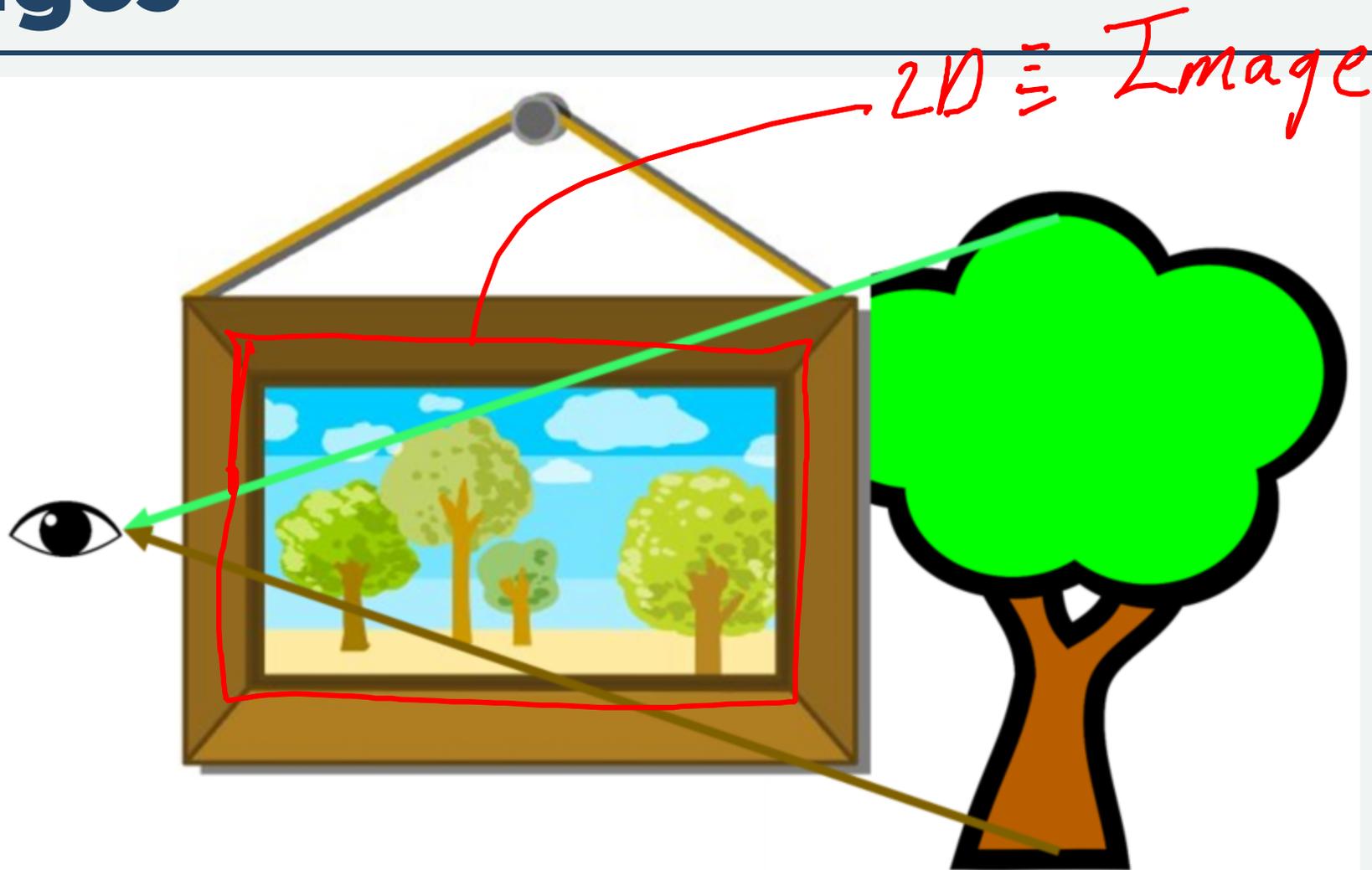
The artist is Julien Beever - you can look him up on the web

We sense 2D

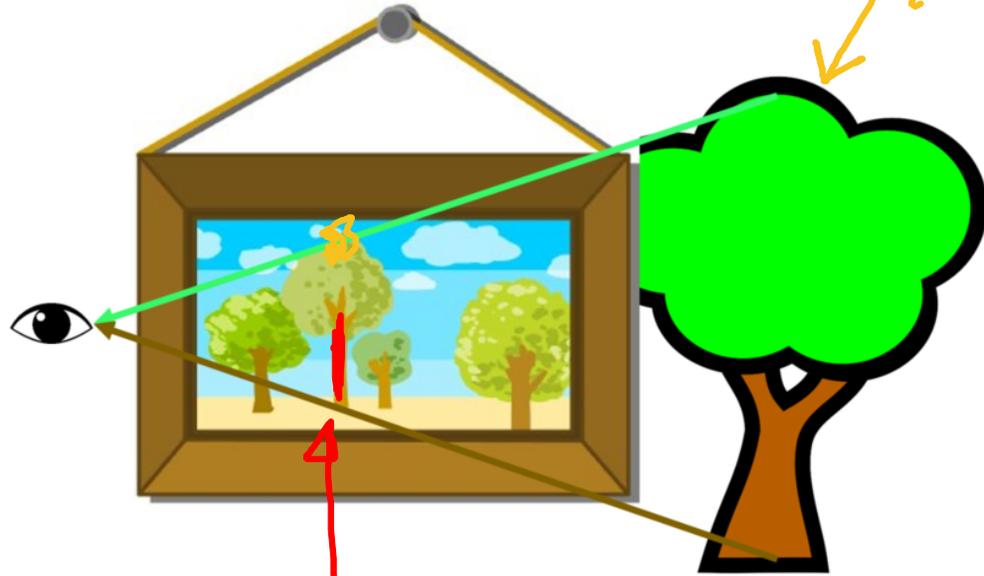
(actually, a little more than that)

We infer 3D

Images



Creating Images



- simulate **photons**

- simulate **painting**

- just draw in 2D

Physically-Based

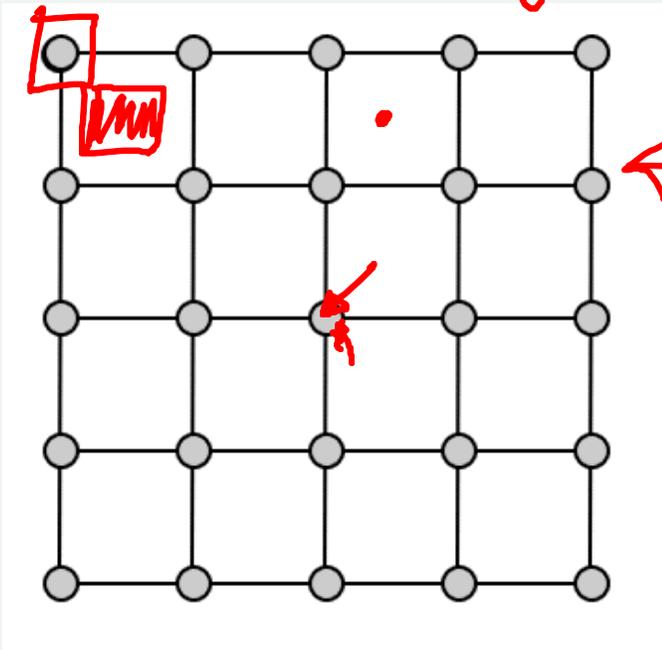
vs.

Primitive-Based

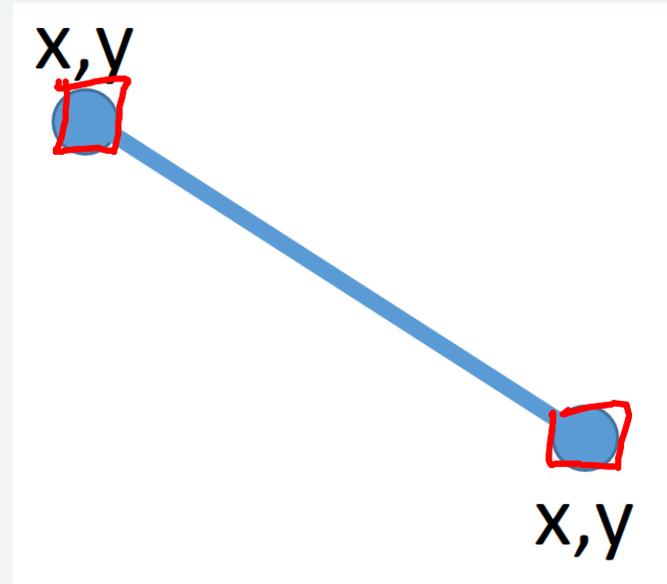
Representing Images

Sampled (Raster)

regular grid



Geometric (Primitives)



Displays

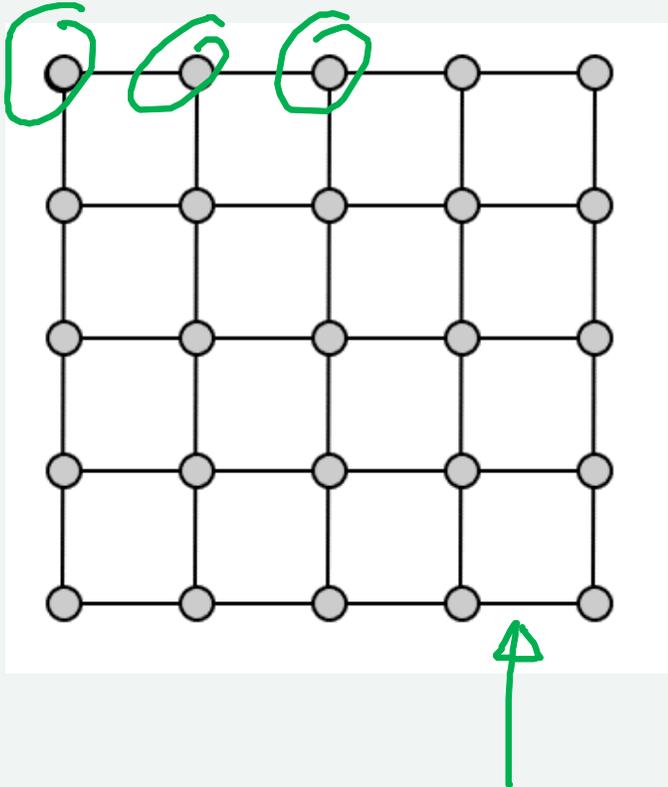
How we **show** images

Sometimes the output is 3D (e.g. a 3D printer)

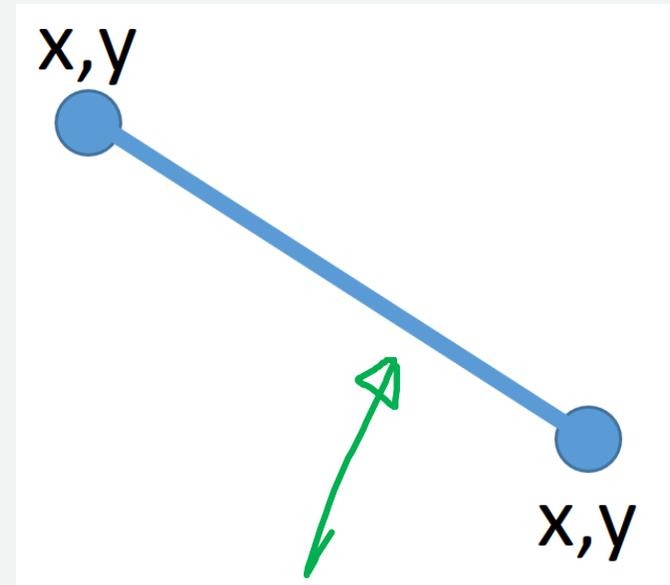
- we need to represent **shapes**
- similar problem to making pictures

Types of Displays

Sampled (Raster)



Geometric (Primitives)



Examples of Displays

Sampled (Raster)

- LCD/LED/CRT
- Laser printer, inkjet printer, ...
- 3D printer (most)
- Projectors
- Film (irregular grid of crystals)

(just about anything you encounter)

Geometric (Primitives)

- Pen plotters
- Laser light shows
- Old fashioned vector displays

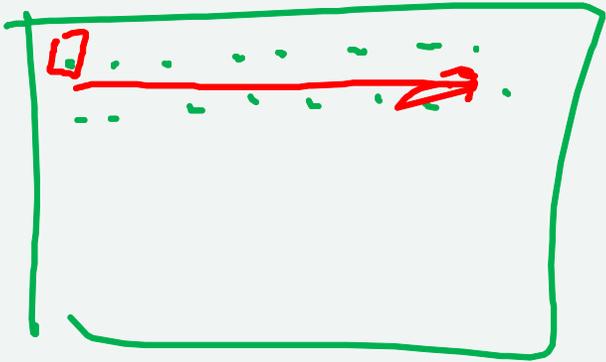
(nothing that is common today)



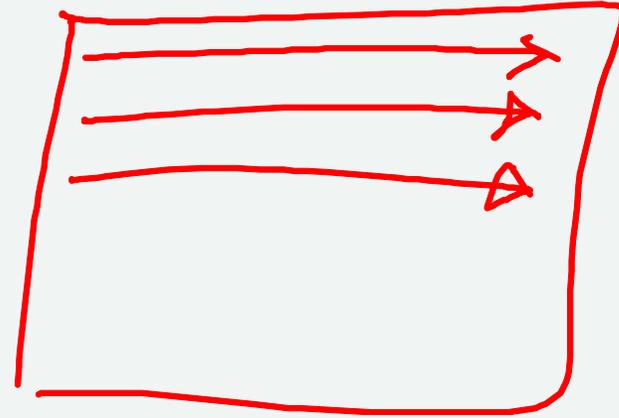
Buffers

block of memory

Frame Buffer / Color Buffer
(and many more to come)



chunk of memory



Another Important Distinction in Displays

Continuous vs. Flicker/Strobe

Appearing Continuous

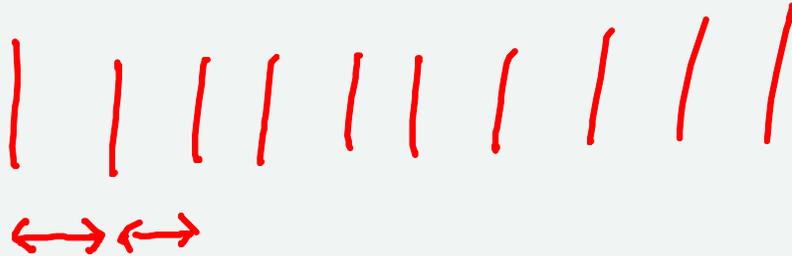
Flicker Fusion ←

*flashing things
seem continuous*

not persistence of vision

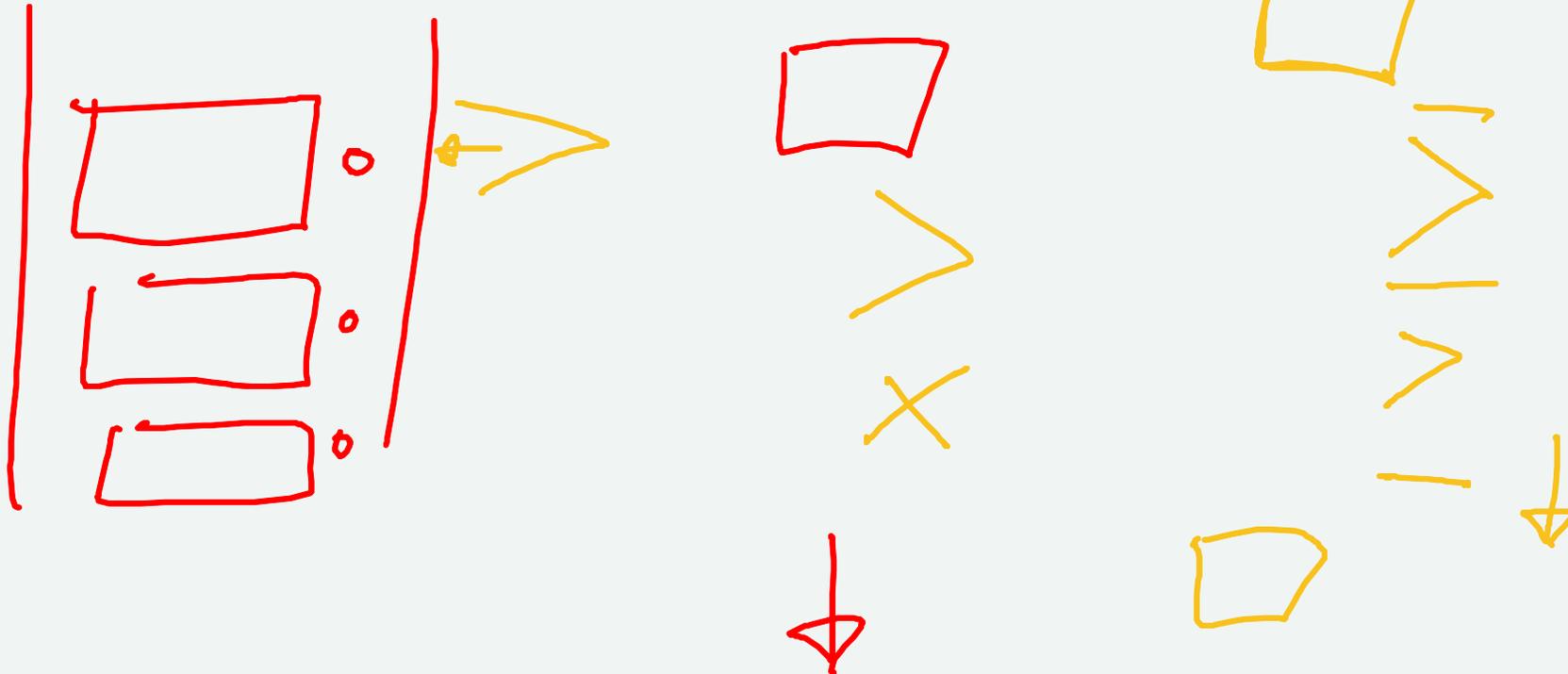
Important Issues in Flicker Fusion

Frame Rate — ambient light
Consistency person



How a movie projector works

Lumiere brothers, 1894 (not Edison!)



Most computer displays are Flicker-Based

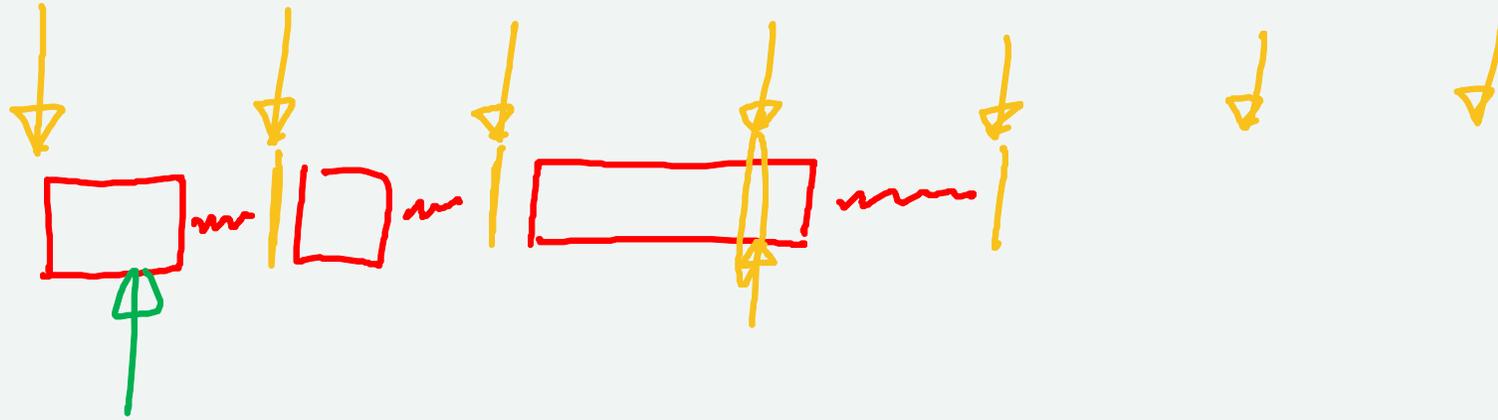


Animation and Redraw

Erase and start over



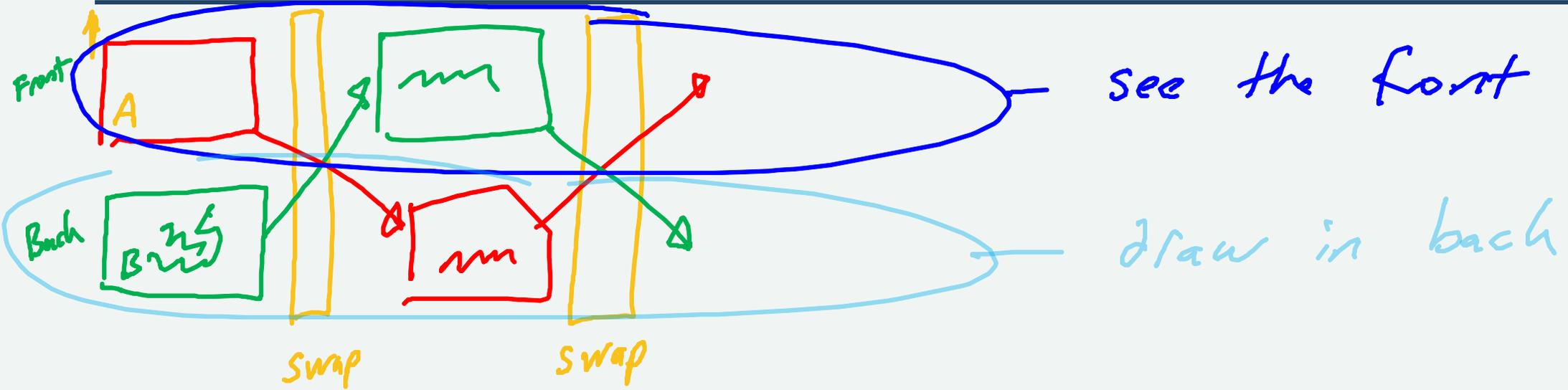
Display Synchronization (Buffering)



Buffering

What if you draw too slowly? or too fast?

Double Buffering



Why double buffer?

- only show finished images
- frame rate constancy

Buffering and Web Graphics?

The web browser takes care of this
(we lose control)

`window.requestAnimationFrame` waits until after a buffer swap
(in simplified theory)

