Announcements

- **MP4** is out. Due on Nov 6 @ 11:59pm.

Final project upcoming deadlines:

- **Oct 27**, submit two .jpg files as the answer to my piazza post:

  1. Image for abstract/title. These will be posted on the class webpage: https://courses.engr.illinois.edu/cs498sl/gallery.php

  2. Snapshot of your first scene for the final project in Unity

- **Nov 3**, a short video of your progress.

Depth Perception: Depth Cues

Monocular

- Retinal image size
- Height in visual field
- Texture gradient
- Image blur
- Atmospheric perspective
- Accommodation
- Motion parallax
- Shadows/ shading
- Interposition

Binocular

- Vergence angle
- Binocular disparity
- Diplopia

Combination of depth cues:

- Decision theory; machine learning
- Bayesian/probabilistic

Scale Perception (vs. Depth Perception)

How large the object that I see is?

You perception of scale and depth are affected by your IPD (inter pupillary distance) in the virtual world.

https://www.youtube.com/watch?v=HEBEQhwG-rU

Developer Advice

- Design your world in meters.

- Do not place objects closer than 1 meter away.

- Match IPD in _____ and _____ to your physical IPD.

Motion Perception: Purposes

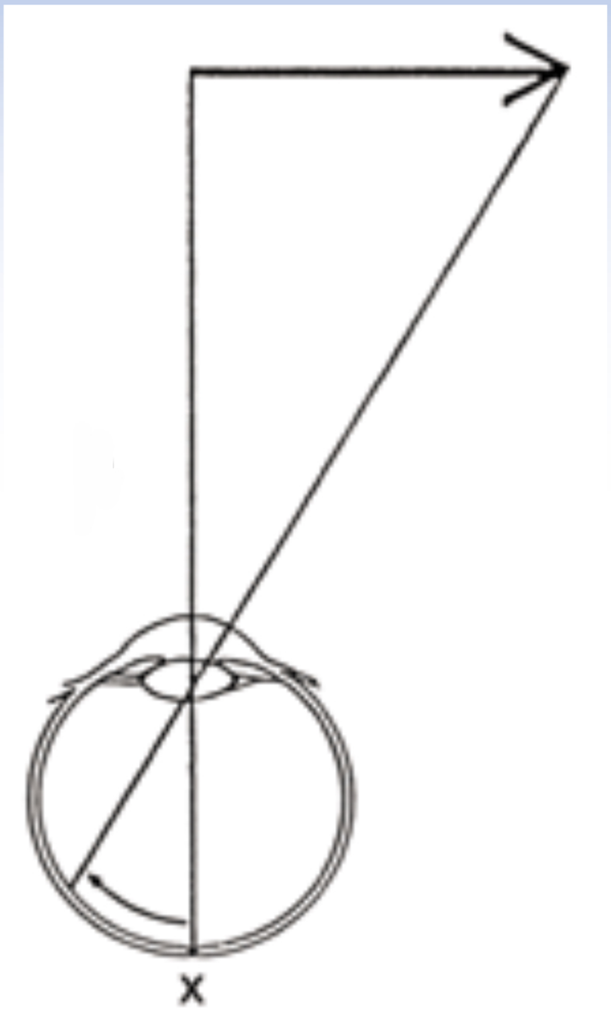
Purposes:

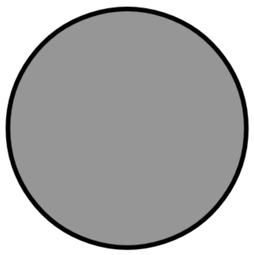
1) Segmentation/Segregation via quick eye fixation on moving objects.

2) Extract 3D structure of an object (spin chair around).

3) Visual guidance for action:
   - manipulation - grab a cup
   - hand-eye coordination
   - self motion information.

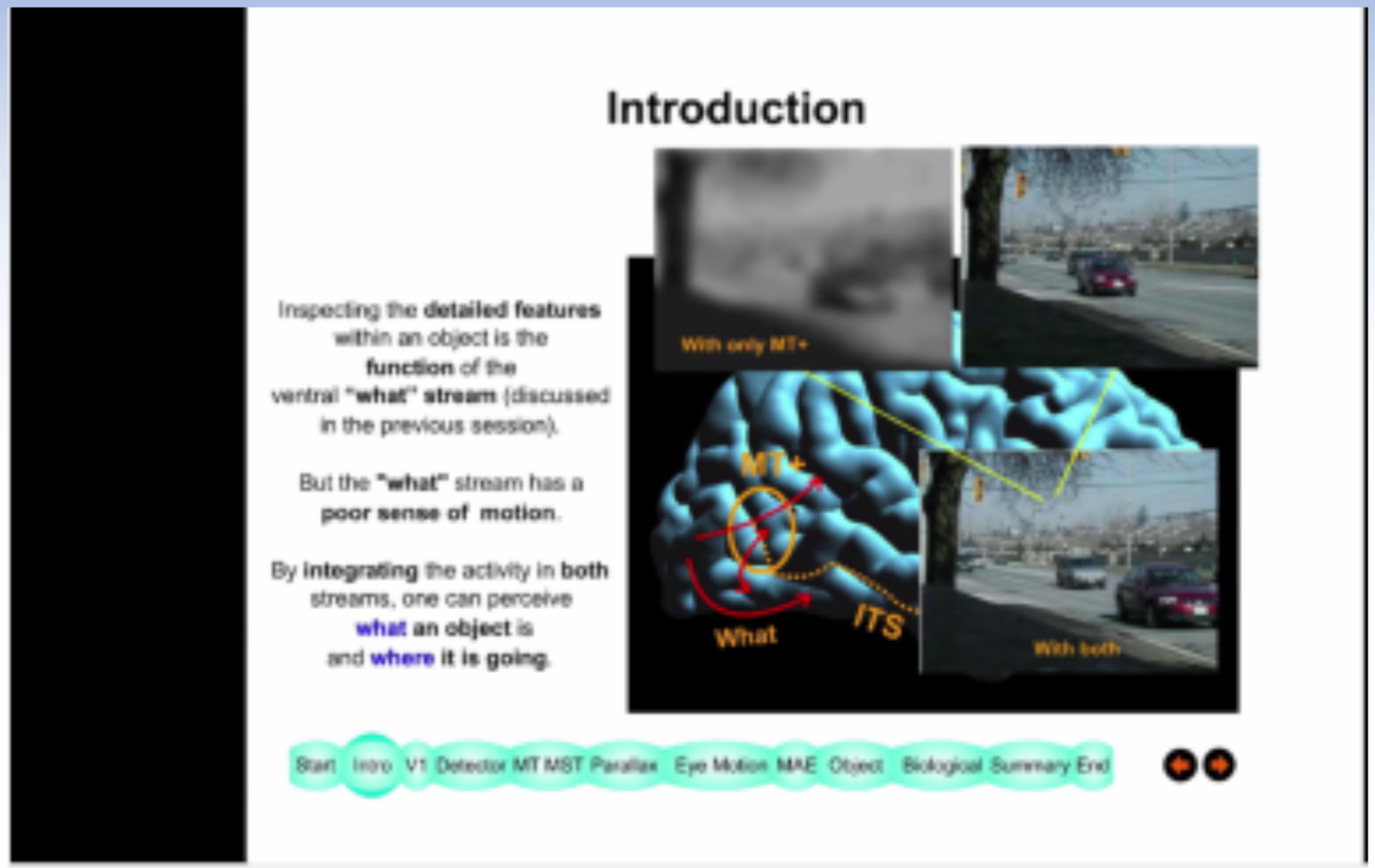
Neural Circuitry for Motion





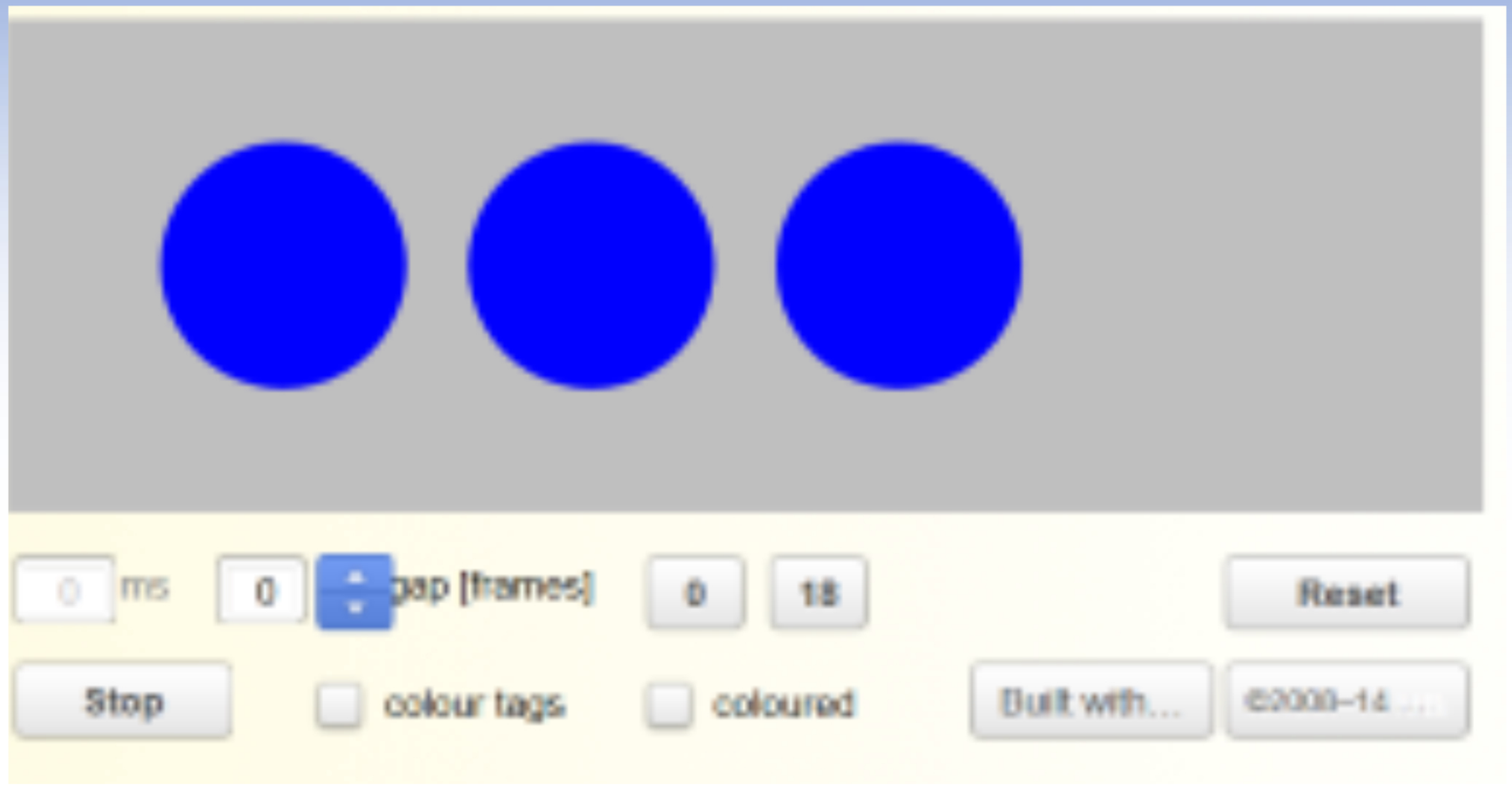
http://www.psypress.co.uk/mather/resources/swf/Demo11_1.swf

Neural Circuitry for Motion



https://www.youtube.com/watch?v=PhWUf9D52RQ

Fundamental Principles: Occlusions and Shutter

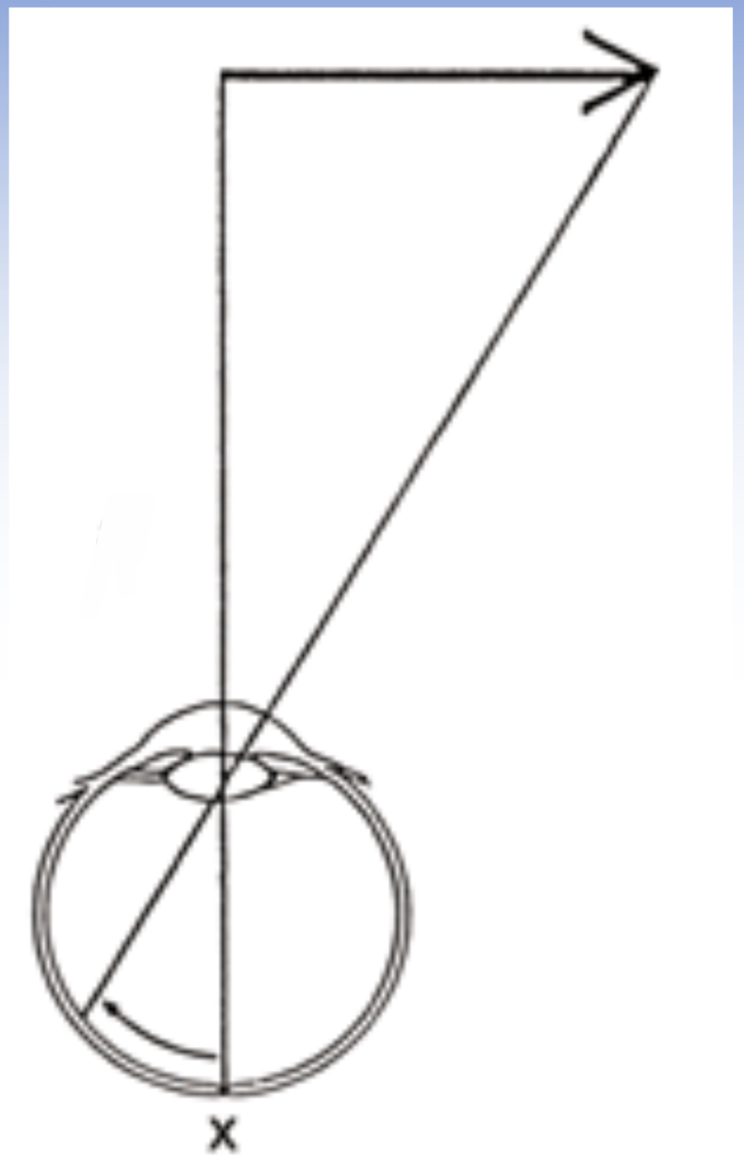


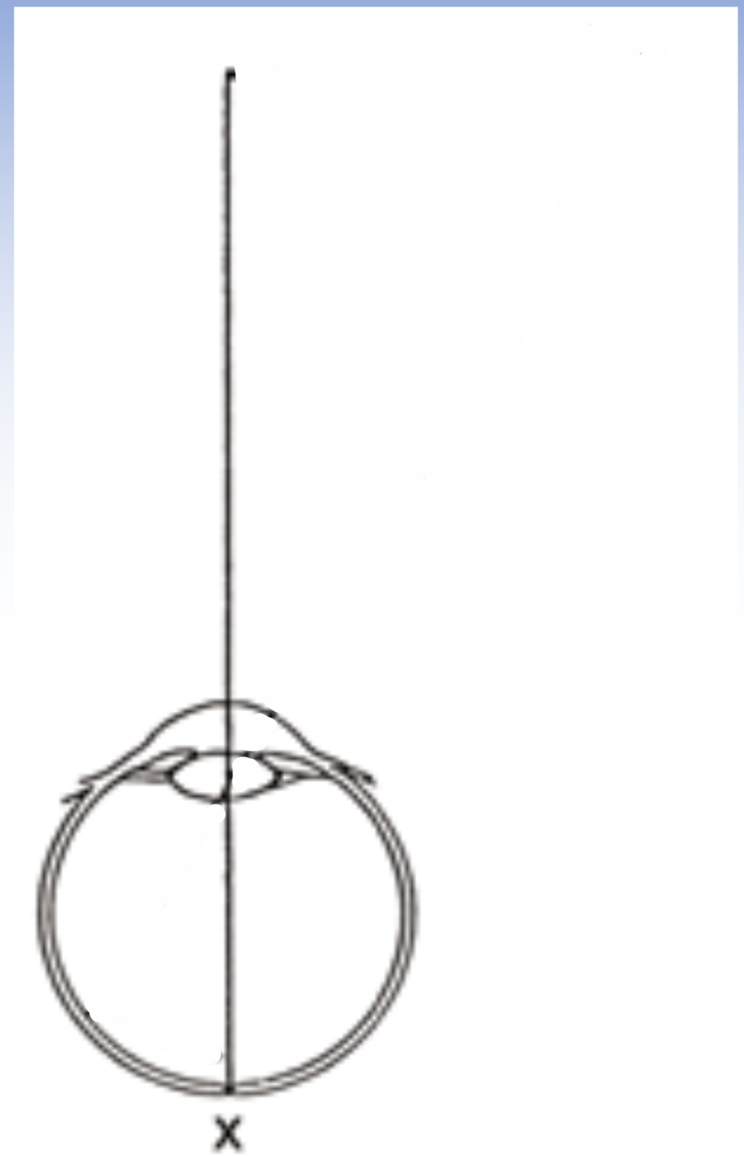
http://www.michaelbach.de/ot/mot-motionBinding/index.html

http://www.michaelbach.de/ot/mot-breathingSquare/index.html

http://www.michaelbach.de/ot/mot-Ternus/index.html

Object Motion vs Observer Motion





Object moves:

Eye moves:

Suppressed
eye motion:

Motion Detection Circuitry

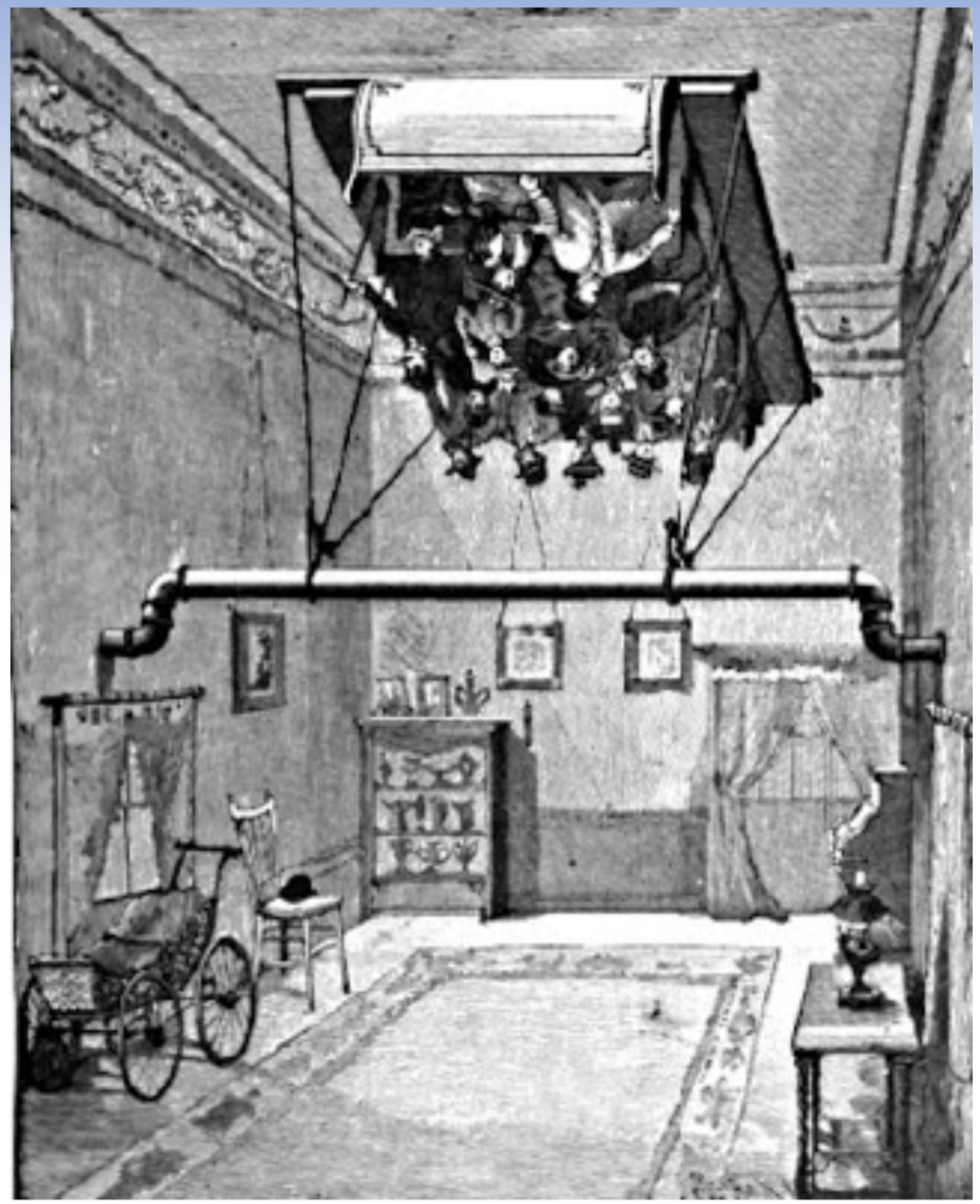
The brain uses more information to distinguish self motion from object motion:

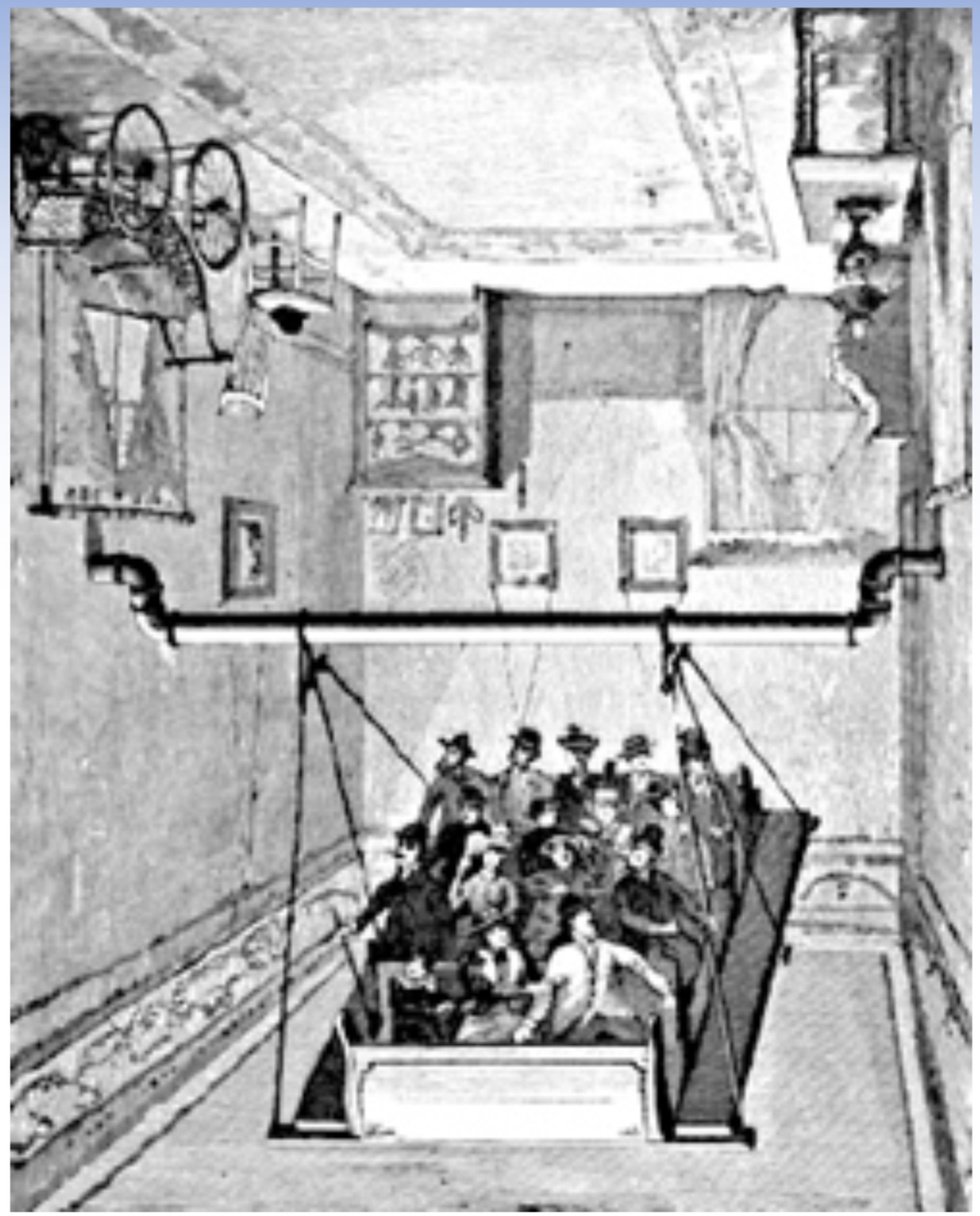
1) Saccadic masking/suppression - suppresses motion detectors

2) Eye movement commands (efference copies) (but also vestibular input, other efference copies from muscles and skin throughout the body).

3) Large scale motions - if eye moves the whole scene must move

Motion Detection Circuitry





https://www.youtube.com/watch?v=vAY50UqY-_Q

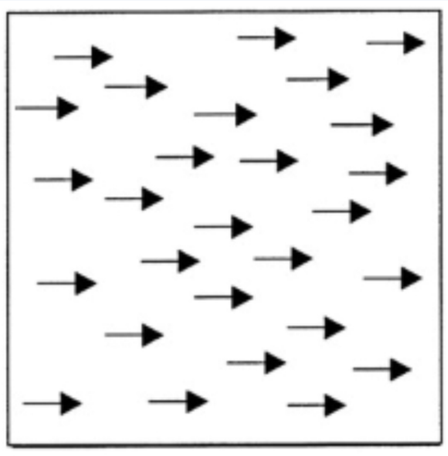
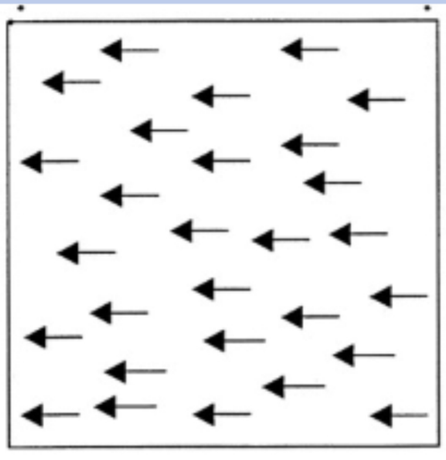
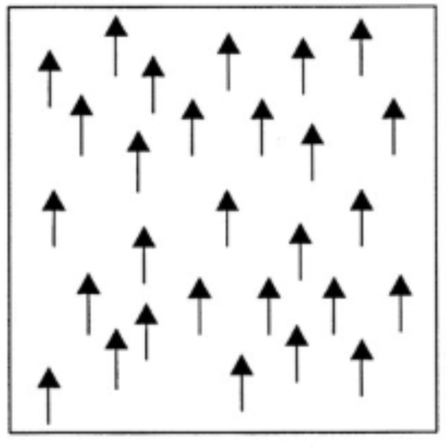
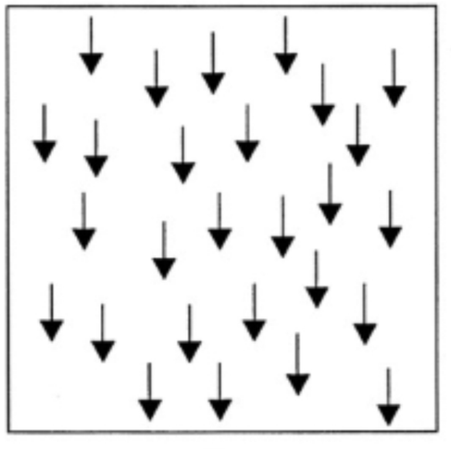
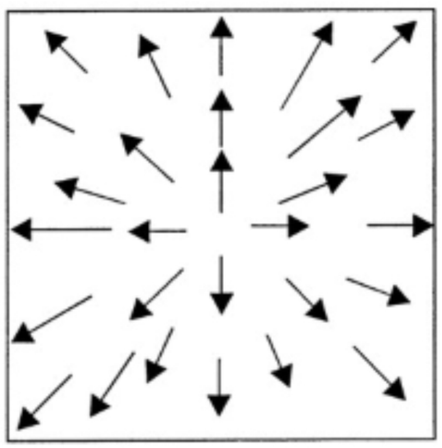
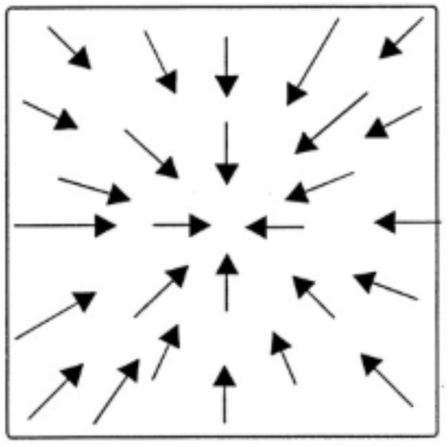
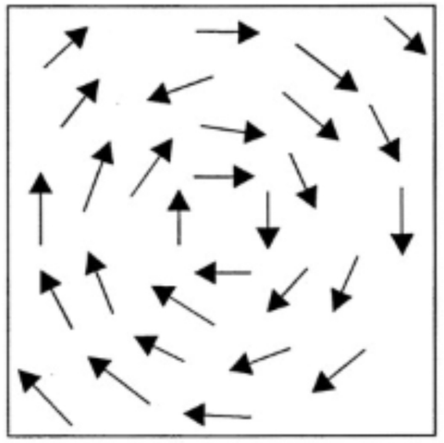
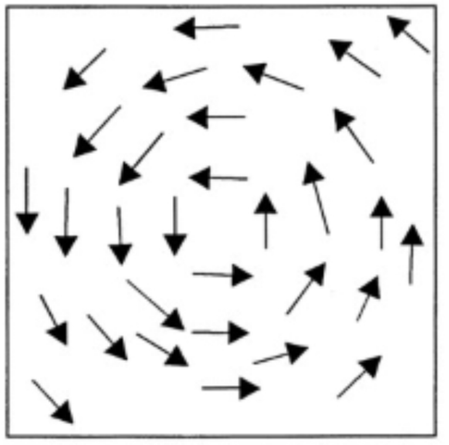
Optical Flow

1) Crucial for understanding simulation sickness (not motion sickness)

2) Tracking movement of features on retina

3) A vector field (or velocities field) on the retina (image plane, sphere)

Optical Flow vs Self Motion

Big Problem in VR