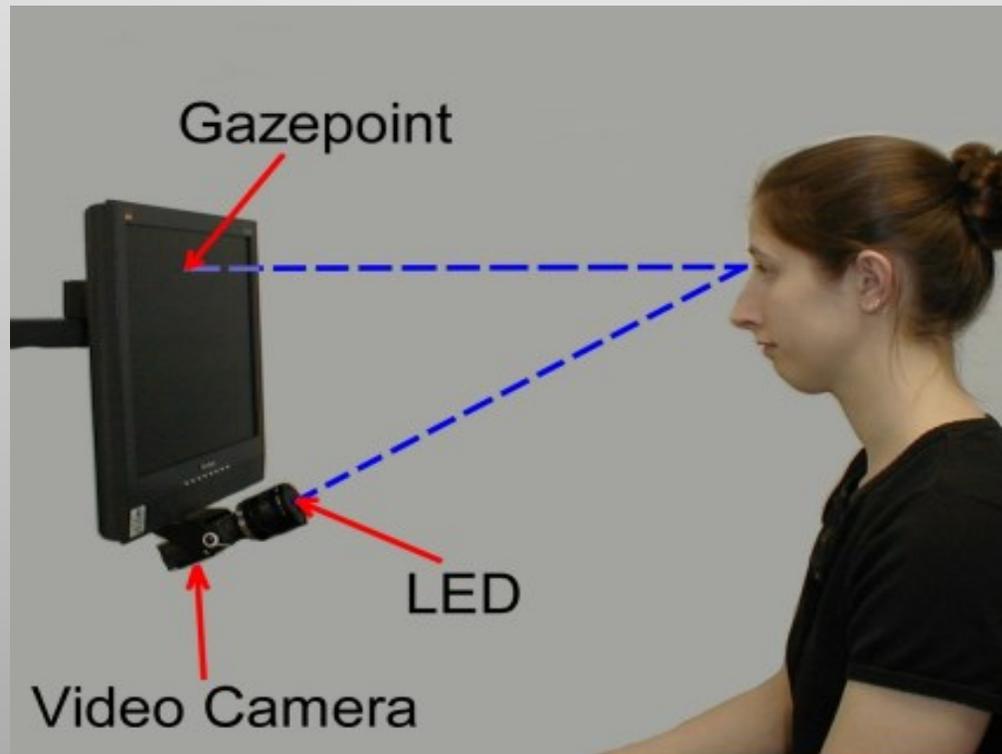




**Eye Tracking Technology:  
How Does it Work?  
What is its future in 21<sup>st</sup> Century  
Health Care?**

**Nancy Cleveland, RN, BSN**

Eye tracking systems track eye movements by processing images of the eyes

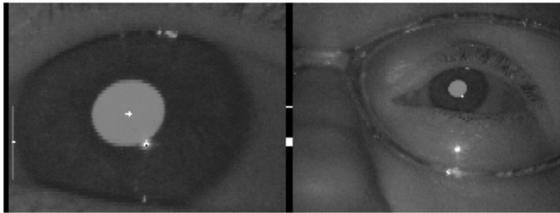


*Camera and monitor configuration for remote eye tracking*

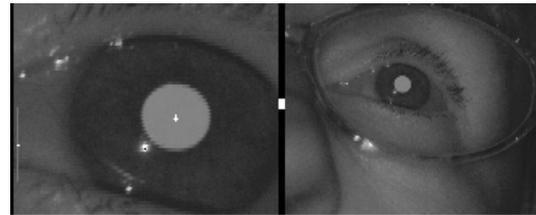
All eye tracking systems require some sort of user calibration in order to be able to determine where the user is looking.

All eye tracking systems use the pupil-center/corneal-reflection method of eye tracking.

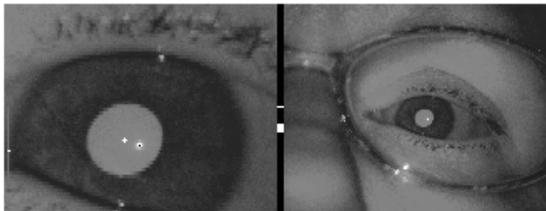
# Pupil-Center/Corneal-Reflection Method



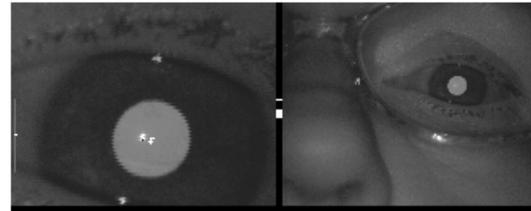
Gaze up to left



Gaze up to right



Gaze to bottom left



Gaze on camera

# Applications of Eye Tracking Technology in Medicine and Healthcare



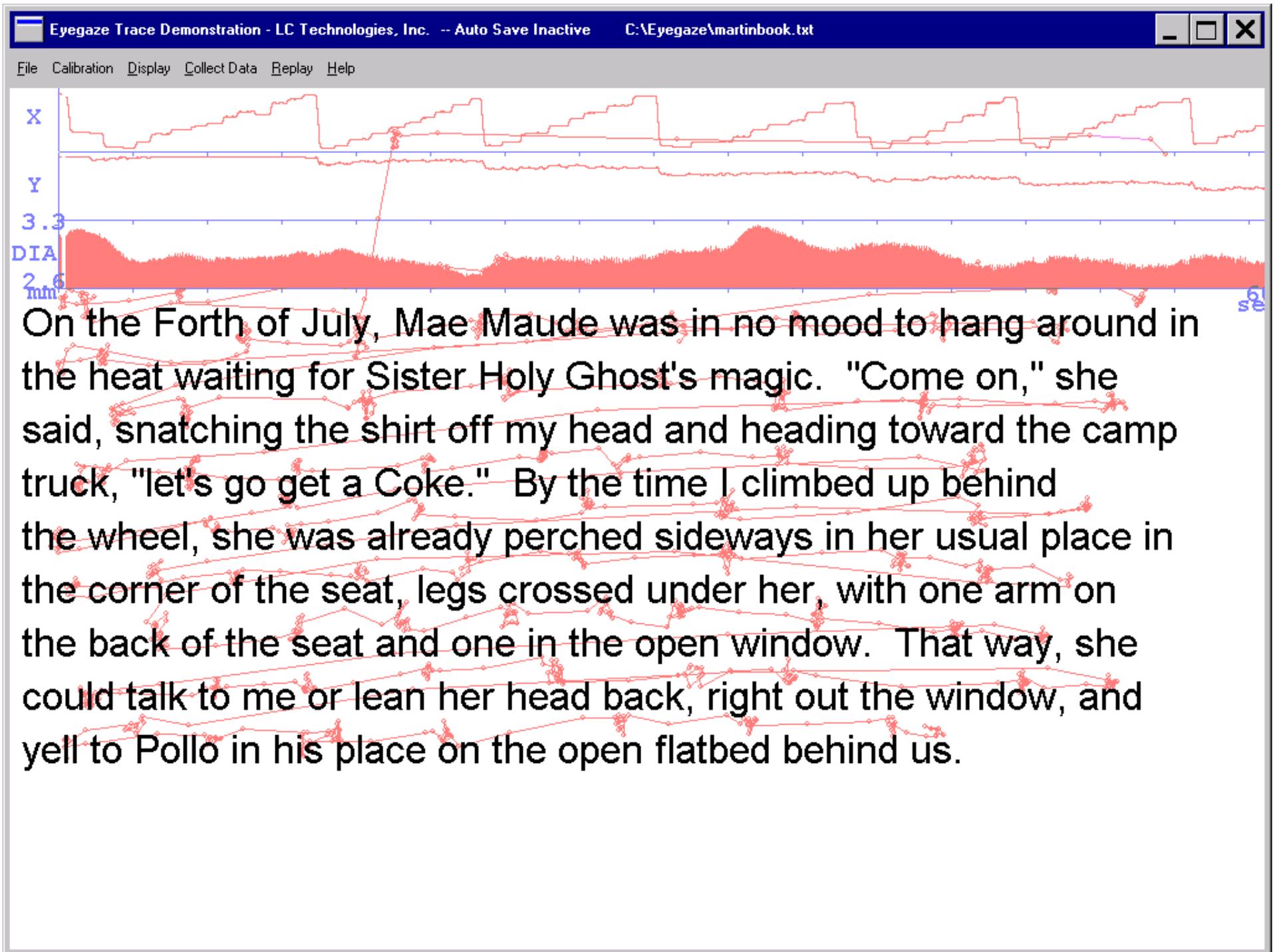
Eye tracking pre-term infants in the NICU at  
Brigham & Women's Hospital



Eye tracking in Autism research



Reading research





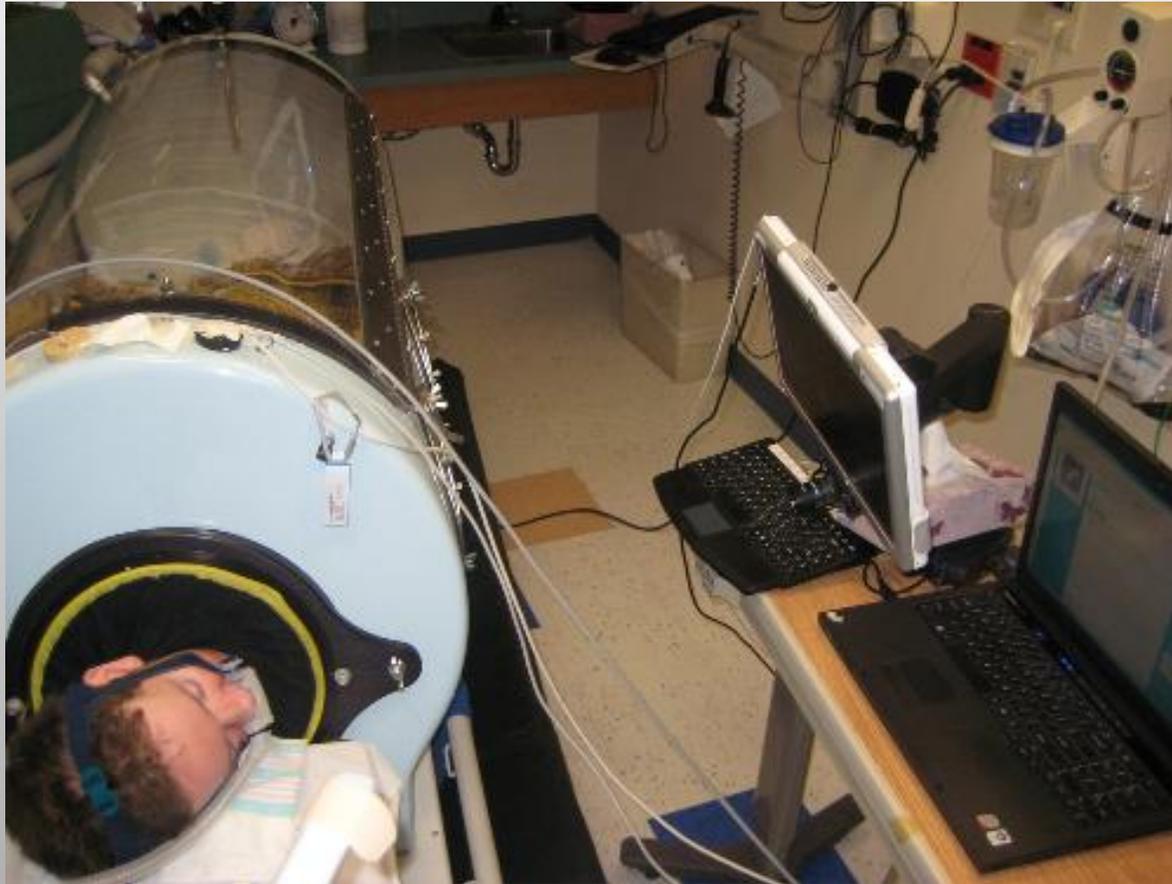
fMRI with eye tracking



Using eye tracking to test auditory comprehension  
in stroke patients with aphasia



**Eyegaze communication systems are used by locked-in patients in long-term care facilities**



Using an Eyegaze communication system  
in the ICU

# Who are Eyegaze Users?

People with:

- ALS
- Brain injuries
- Cerebral palsy
- Multiple sclerosis
- Muscular dystrophy, Spinal Muscular Atrophy, Werdnig-Hoffman syndrome
- Spinal cord injuries
- Strokes

How do you evaluate  
someone for potential  
Eyegaze use?

The ability to follow a moving target, e.g. your finger, is called visual pursuit.

Visual pursuit does not indicate the presence of volitional eye control!



Test for volitional eye control by asking client to look up,  
down, left and right



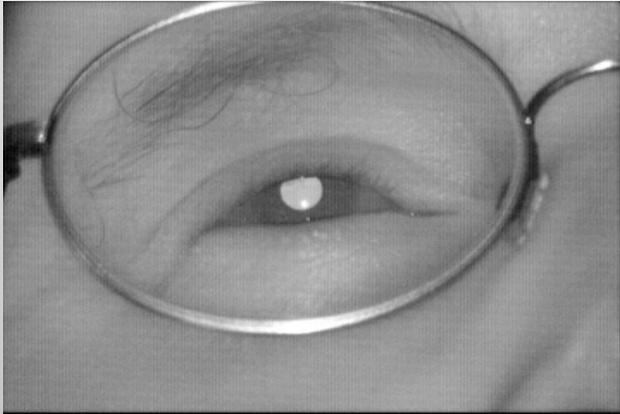
Then look at the camera



If the intended user's eyes don't track together, (strabismus) try using a nasal-side eye patch. This may also help with double vision.



# Physiology Affecting Eye tracking



1. Ptosis of the eyelid: a common problem for people with ALS, strokes.

2. Asymmetric pupil shape: the pupil does not remain round as it constricts and dilates. Can occur in people with ALS, strokes.

3. Nystagmus: if the “bounce” rate is no more frequent than 3 times per second the some Eyegaze systems can accommodate.

What the heck is midriasis and why does it matter?



Midriasis: an abnormally dilated pupil,  
a common side-effect of Baclofen.

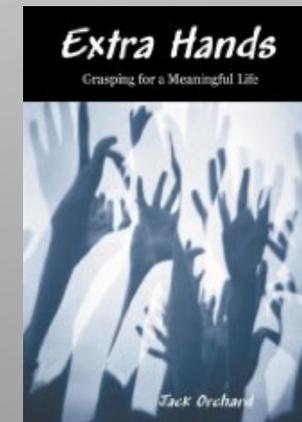
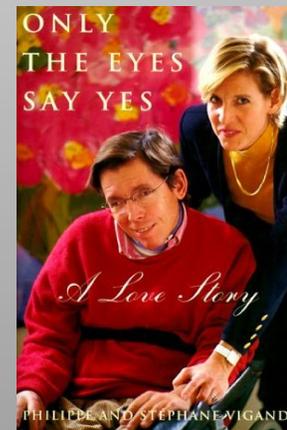
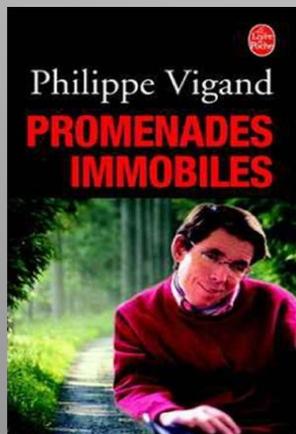
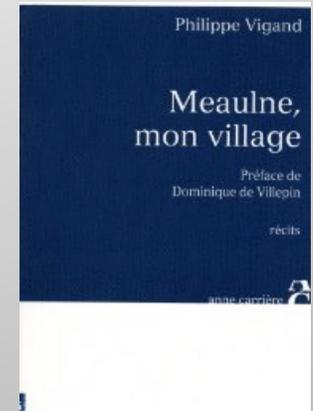
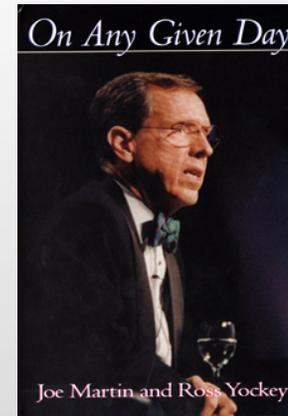
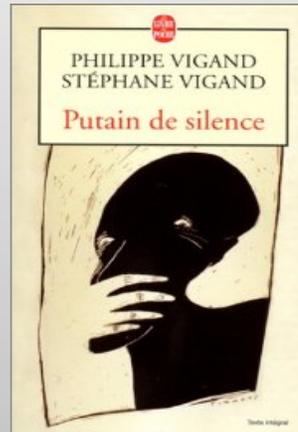
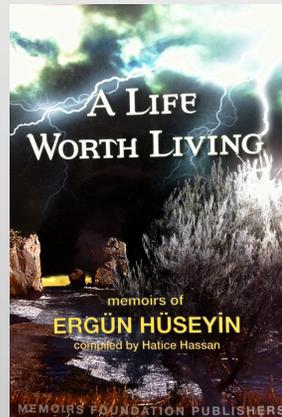
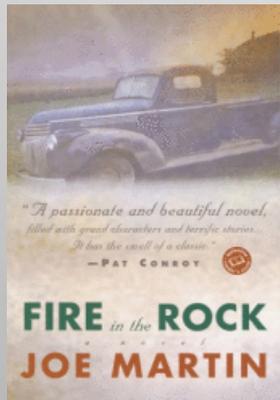


Eye gaze communication users are as young as 2 years old.



Jim, has ALS and works full-time as a Mac programmer at MIT

## Books Written with Eyegaze systems



What's next?



Robotic surgery



Controlling computers in the OR



Early diagnosis of amblyopia