



Eye Gaze 101 Discussion: Challenges, Opportunities, Pre-screening & Evaluation

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EYEGAZE

Disclosure



Eyegaze Inc. Manufactures the Eyegaze Edge[®] SGD

James Brinton, CCC-SLP is a Salaried, Full-time employee, & visual examples used with permission from Eyegaze Edge[®] users.

Learning Objectives

- Understand how an eye gaze SGD interacts with the human eye
- Review Pre-screening
- Discuss Common Challenges



Eye Gaze Challenges - Clinically

Formidable challenges:

- Predict rapid and precise eye movements
- Reliability, training & support
- Maximize people's connection to the world around them
- Accommodating various eye conditions
- Future-proofing the device

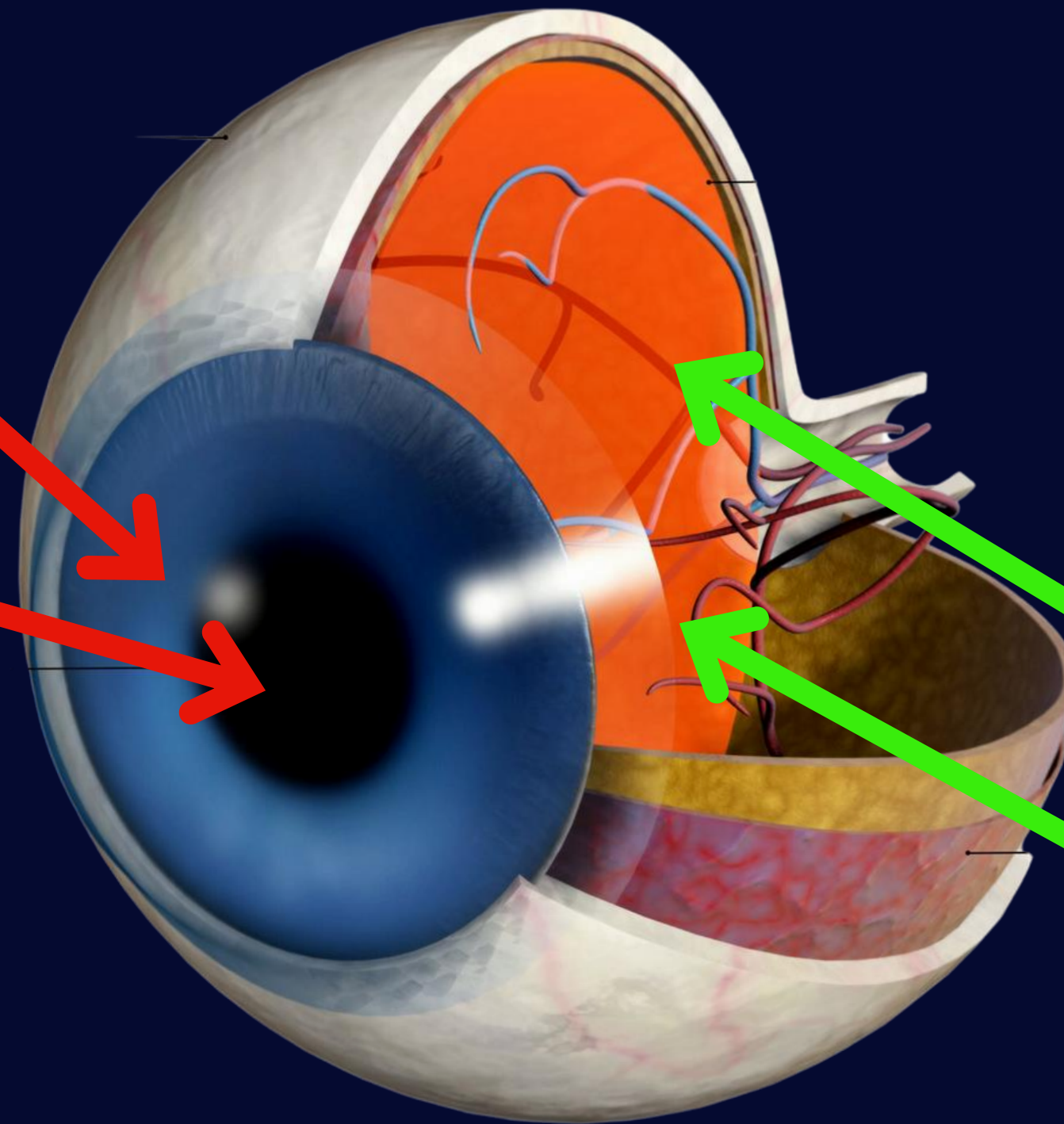
LANDMARKS TO KNOW

Cornea

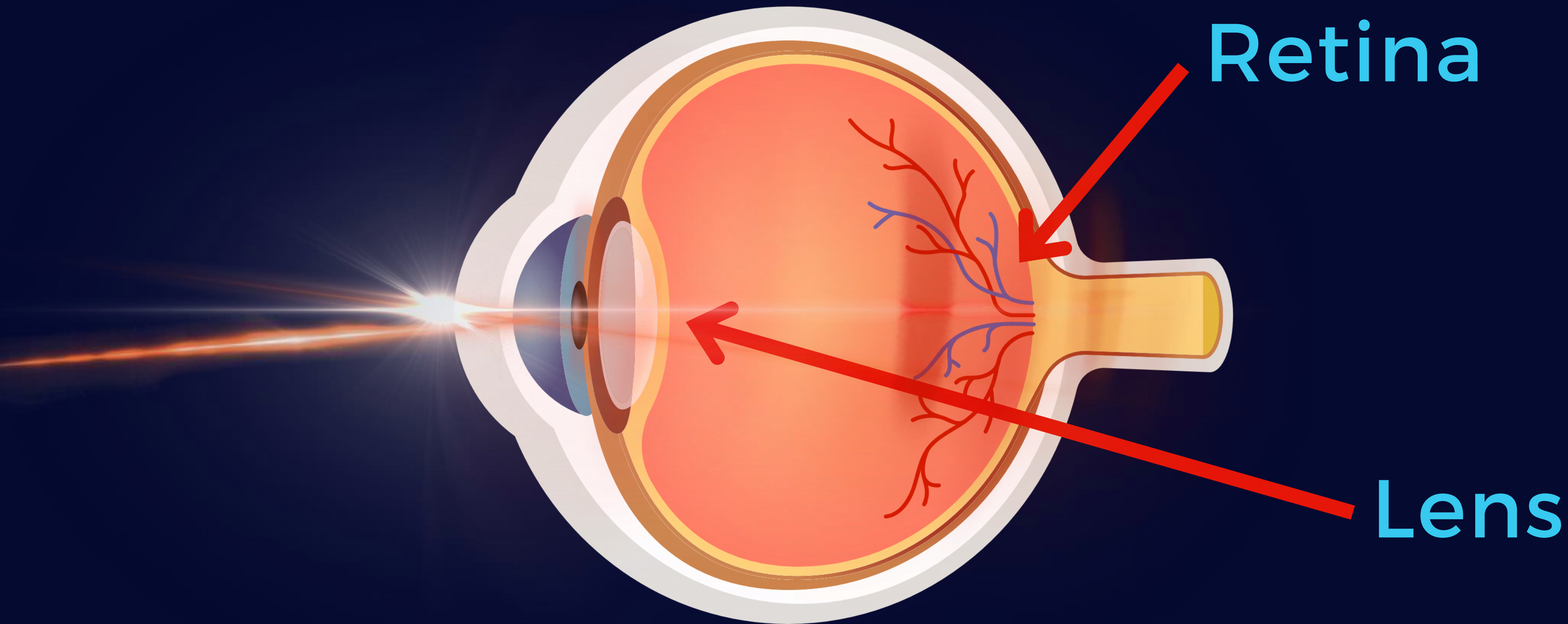
Pupil

Retina

Lens



PATH OF INFRARED LIGHT



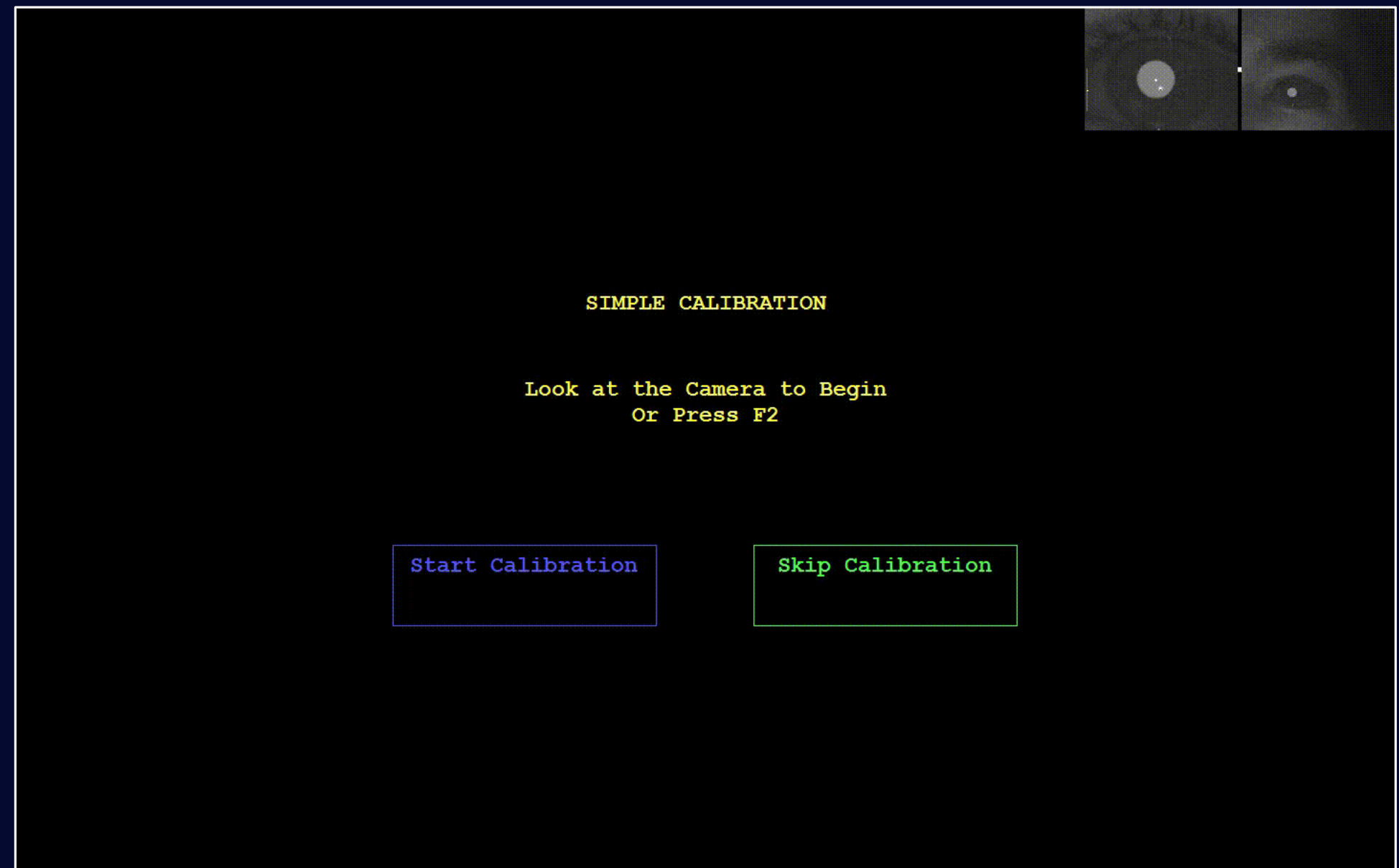
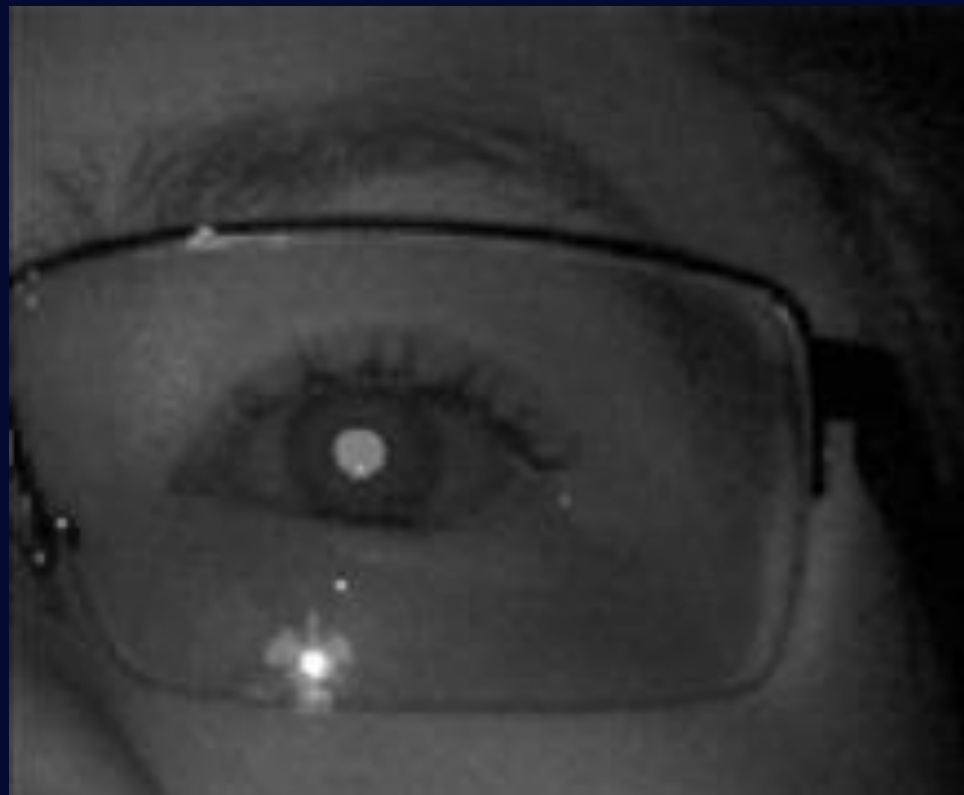
How Does it Work?



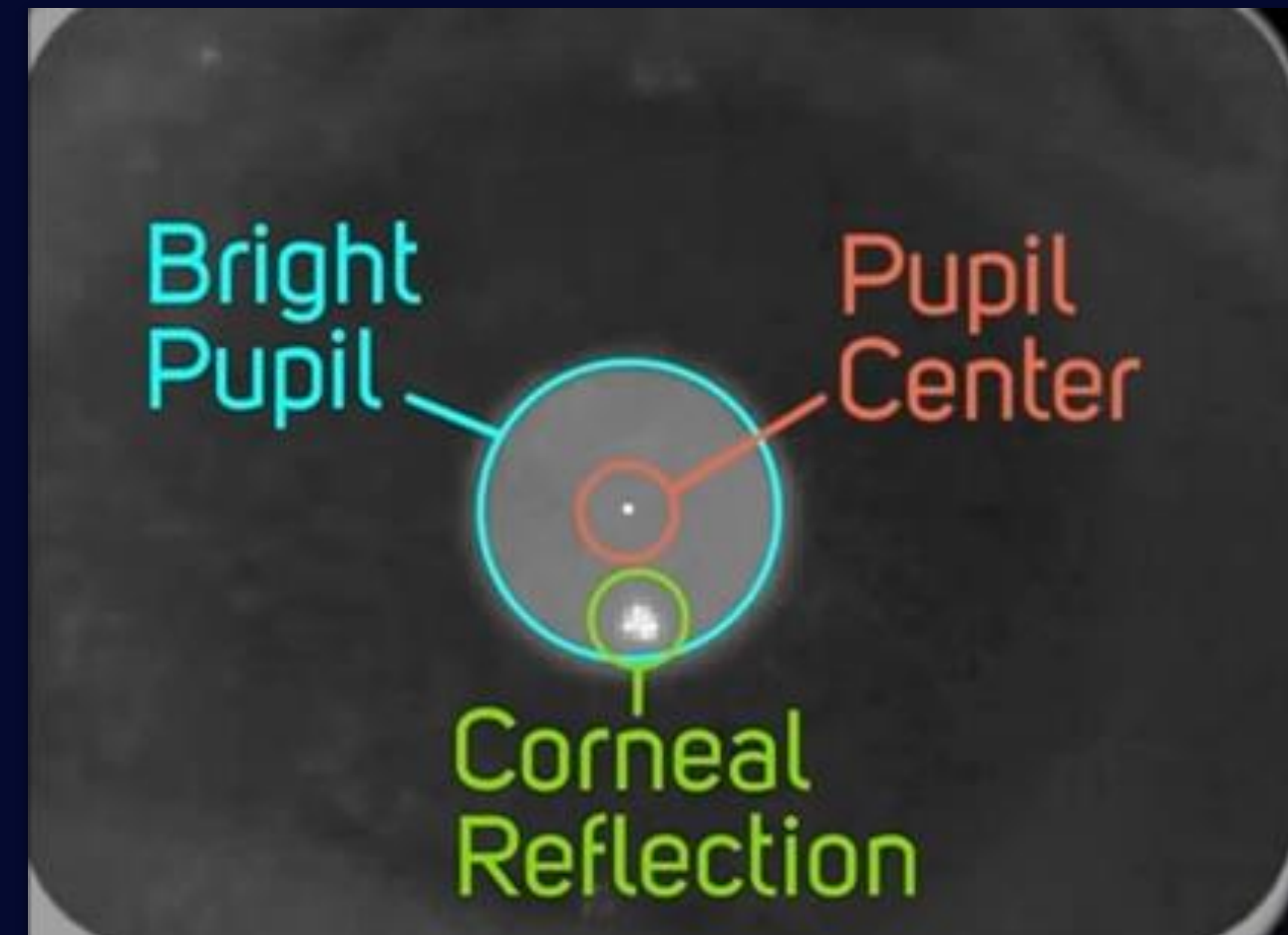
1. The camera
shines Infrared
light on eye

How Does it Work?

2. The Camera captures images 50 times per second!



The eye tracker needs to see and measure the pupil center and corneal reflection from the light to predict your gaze



Pre-screening

It is critical to ask questions before the assessment!

- ◆ How are they currently communicating? yes/no?
- ◆ Can they demonstrate volitional eye movement?
- ◆ Do they wear glasses? Eye conditions?
- ◆ How & where will they be positioned?
- ◆ What have they tried & how was it?

Can they look up, down, left & right?

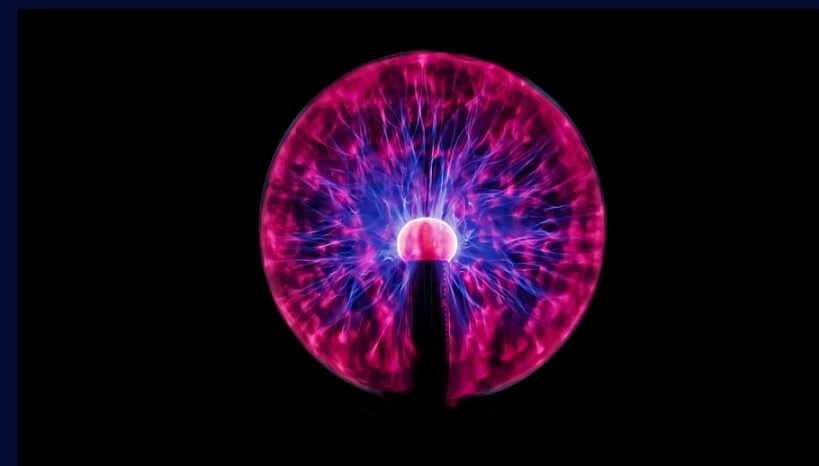


Can they look up, down, left & right?

If a child does not understand left/right directions, try familiar:



- ◆ Items (Look at the balloon!)
- ◆ Characters (Look at Elmo! Look at Lightning McQueen!)
- ◆ Family members (Look at Mom!)



Visual pursuit is following a moving target



Volitional control is critical for intentionality



Positioning

How is the individual most comfortable?

Are they supported and stable?

Adjust the screen to meet them where they are



Realistic Expectations

- ◆ More than one session may be needed
- ◆ Making the device “talk” may not be the first goal
- ◆ Don’t assess every session
- ◆ Developmentally appropriate behavior
- ◆ Not all are ready for symbol representation

Eye Gaze Skills Hierarchy

1	Experimental learning	Tolerate React	Look Respond
2	Making something happen	Produce a desired effect	
3	Mastering skills	Targeting Dwelling	
4	Choosing independently	Playfully Choosing Finding the Right One	
5	Access Functional Activities	Independently navigating	

Eye Gaze Skills Hierarchy

Adapted from "Unlocking Abilities: Developing touchscreen, switch and eye gaze skills for learning and beyond," Indigo Solutions (formerly Independent Living Centre Western Australia), 2016

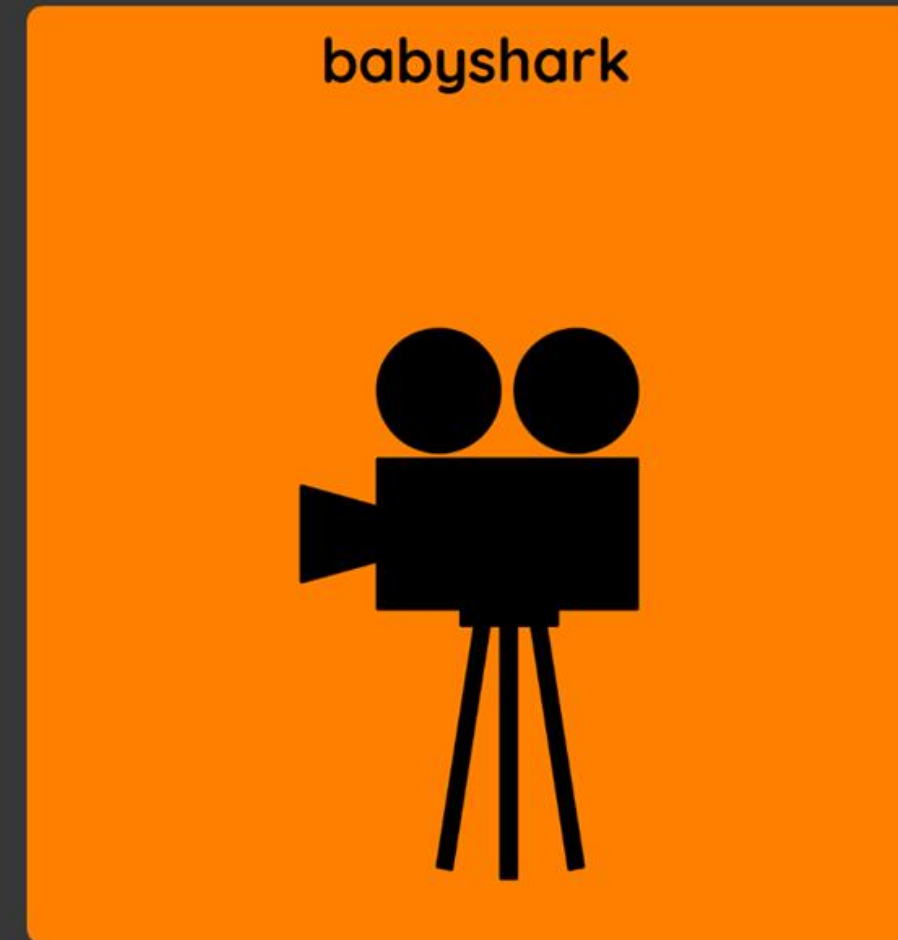
Skill Level 2 Example



Skill Level 2 Example



Skill Level 3: Targeting & Dwelling



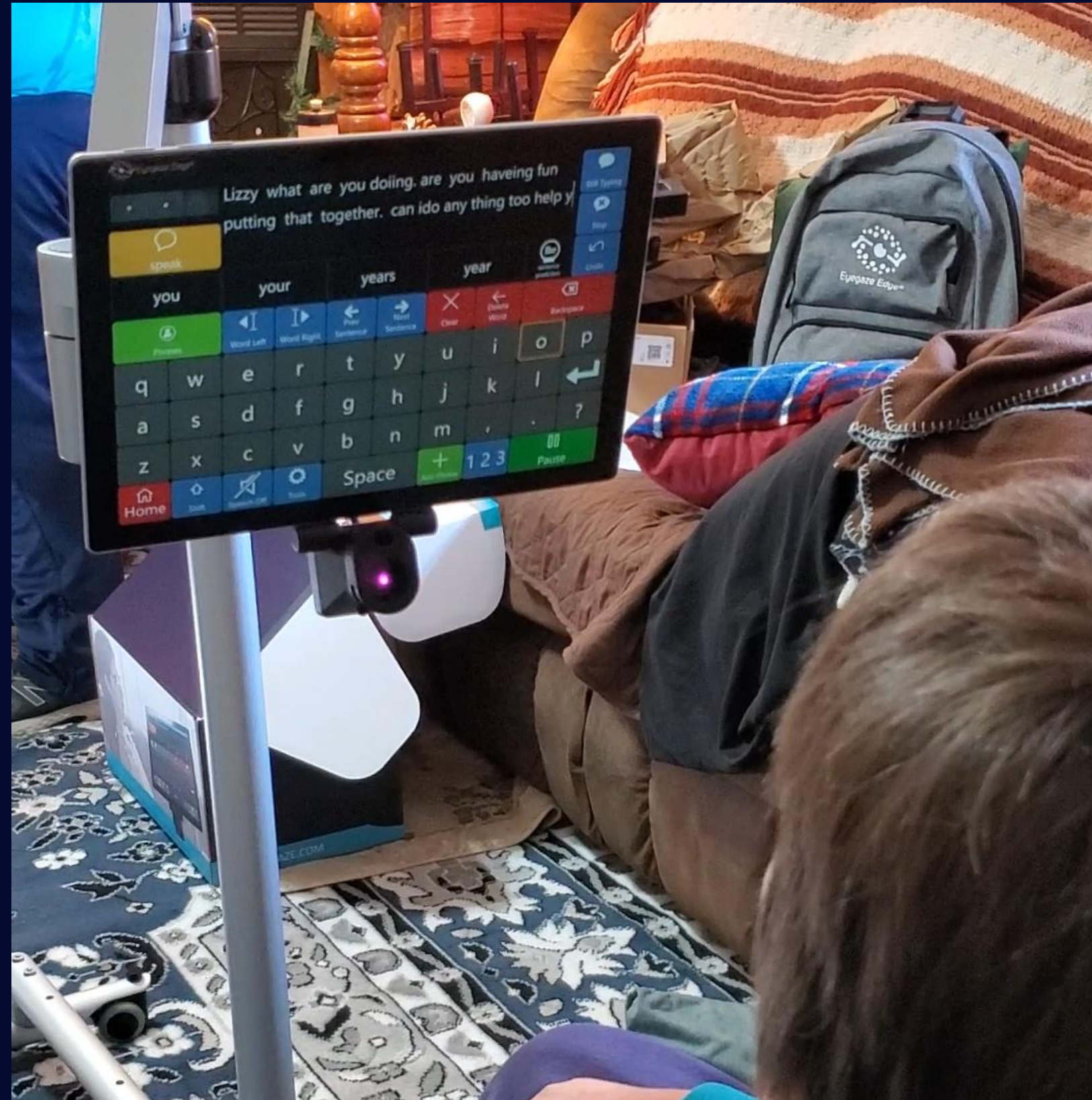
Skill Level 4: Choosing Independently

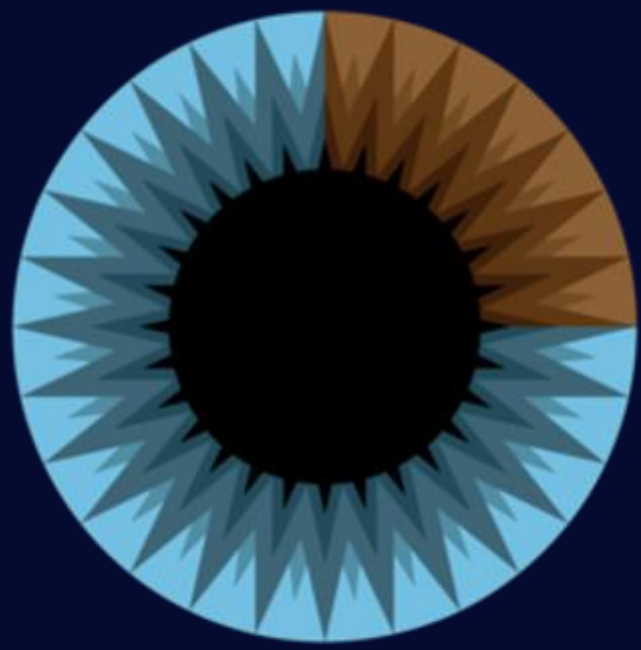
**CHOOSING
BUTTONS
INDEPENDENTLY**

Skill Level 4: Choosing Independently



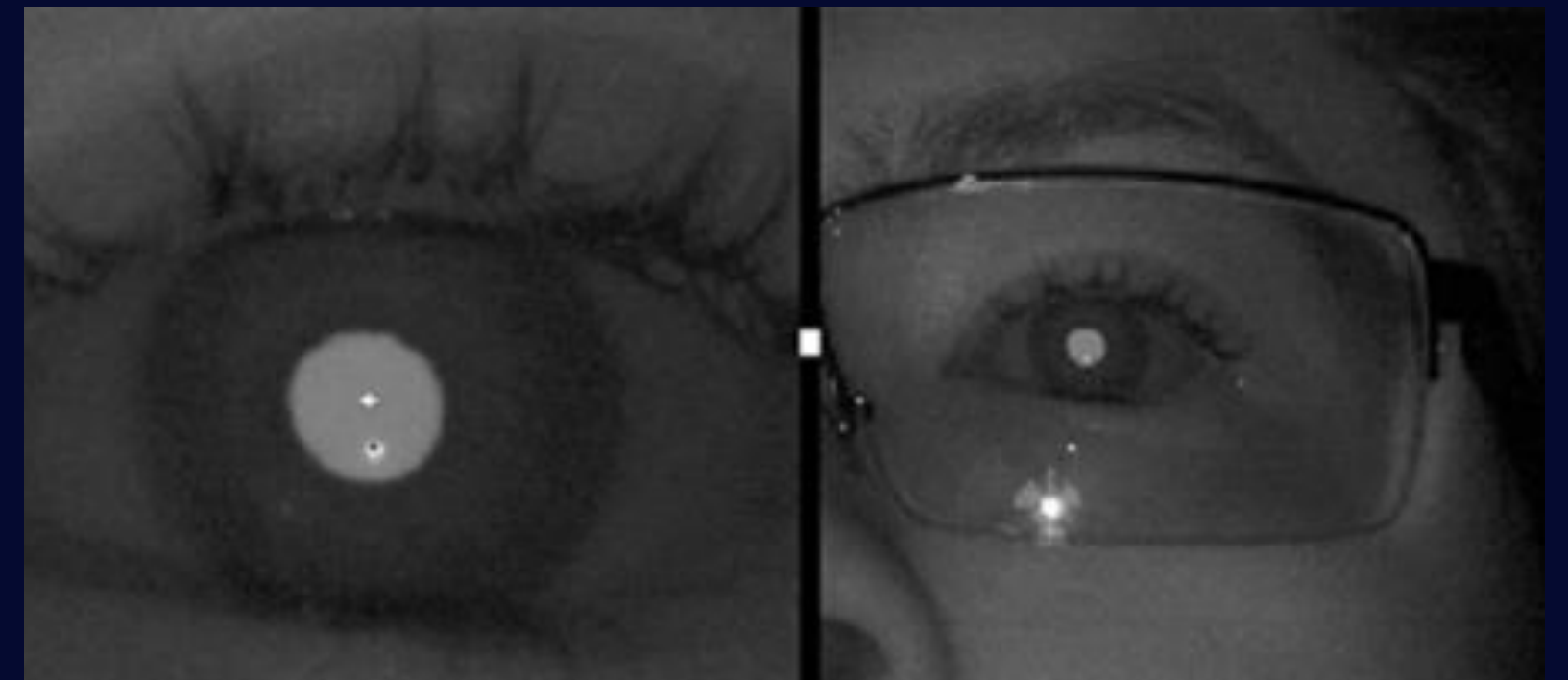
Skill Level 5: Functional Communication





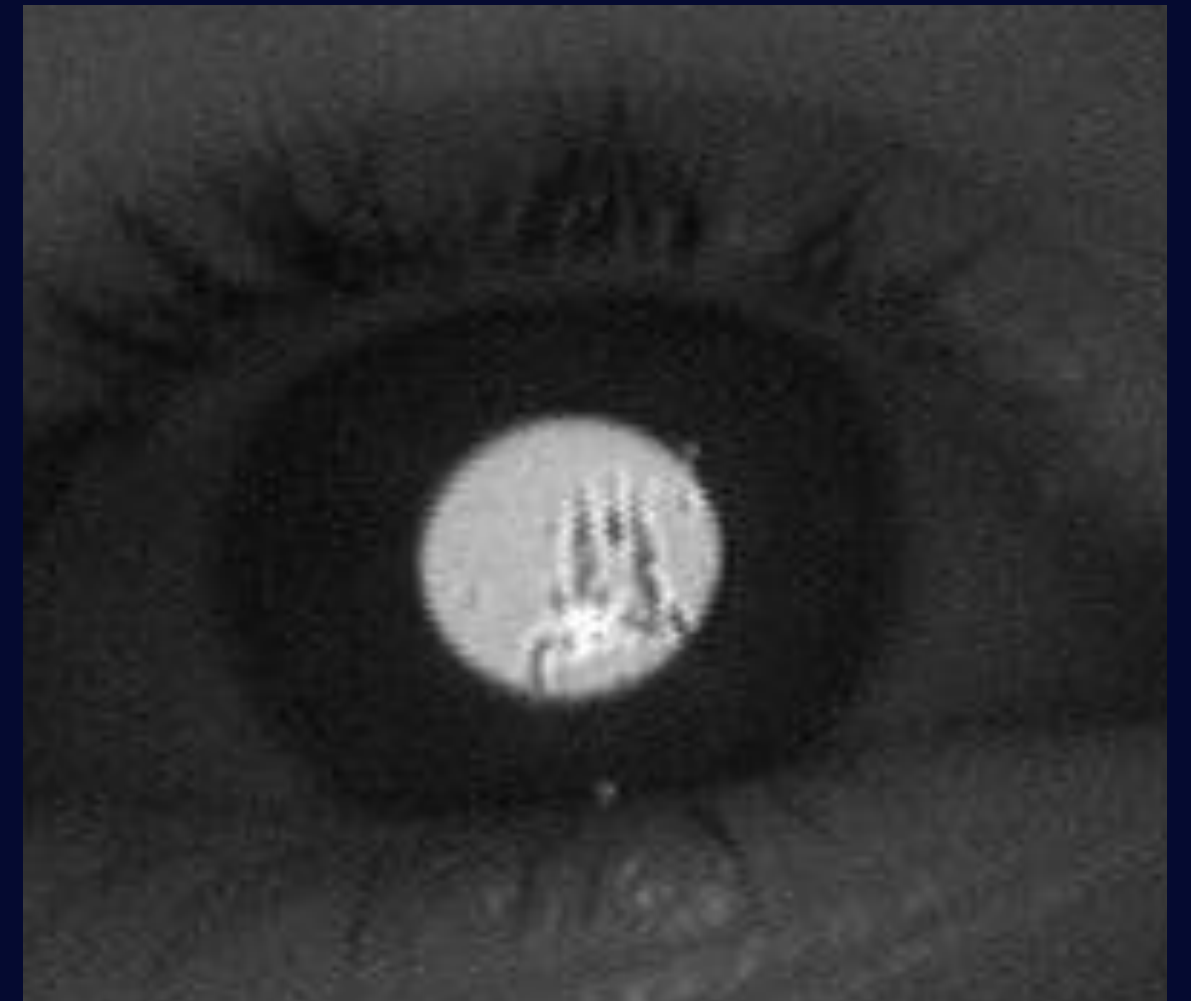
Common Challenges & Solutions

- ✓ Positioning
- ✓ Various eye trackers
- ✓ Intentionality



Dry Eyes & Goopy Eyes

- Corneal surface becomes dry
- Reduced tear production
- Reduced blink rate
- Decreased Accuracy across screen



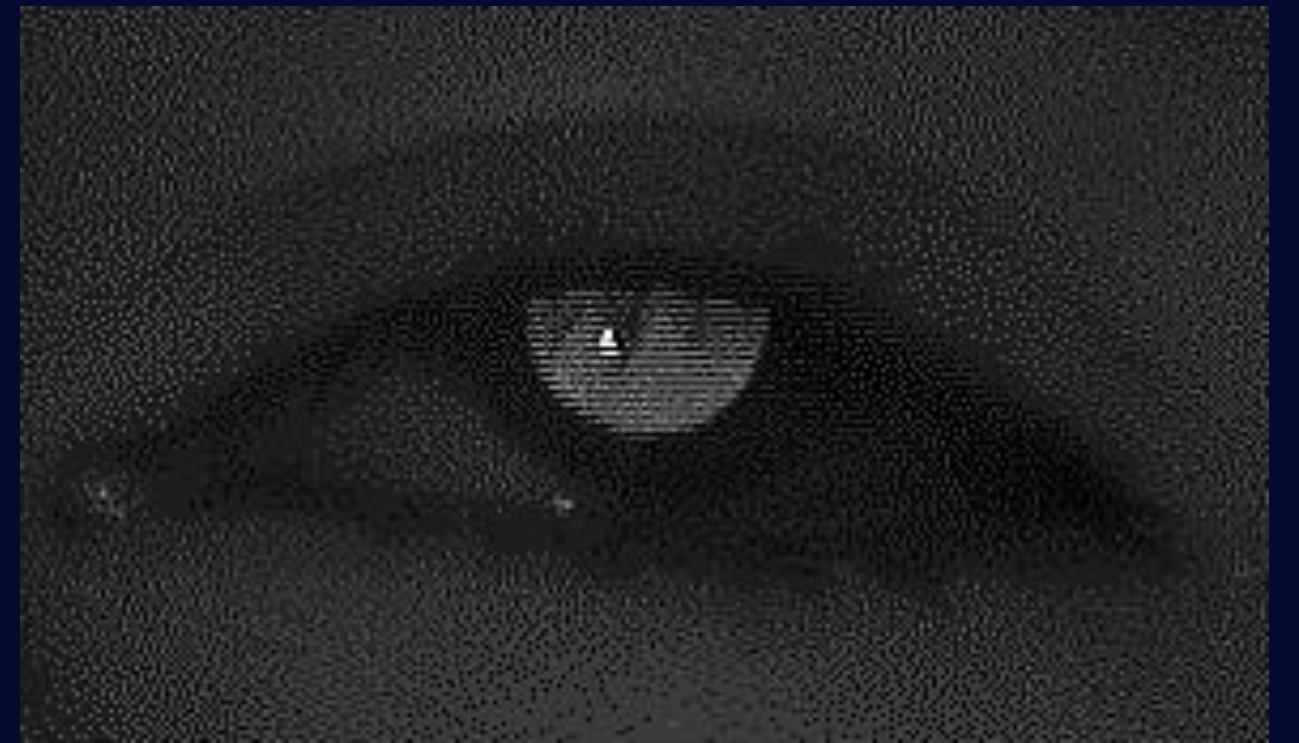
Solution

- Use artificial tears
- Understand environmental factors
- Implementing daily routine



Ptosis

- Drooping eyelid over pupil
- From top or bottom
- Provides insufficient data to eye tracker
- Eye gaze stops working



Solution

- Raise screen to lift eyelids
- Eyelash curler
- Other cosmetic approaches
- Understanding impact
- Ptosis accommodation software
- Try other access methods



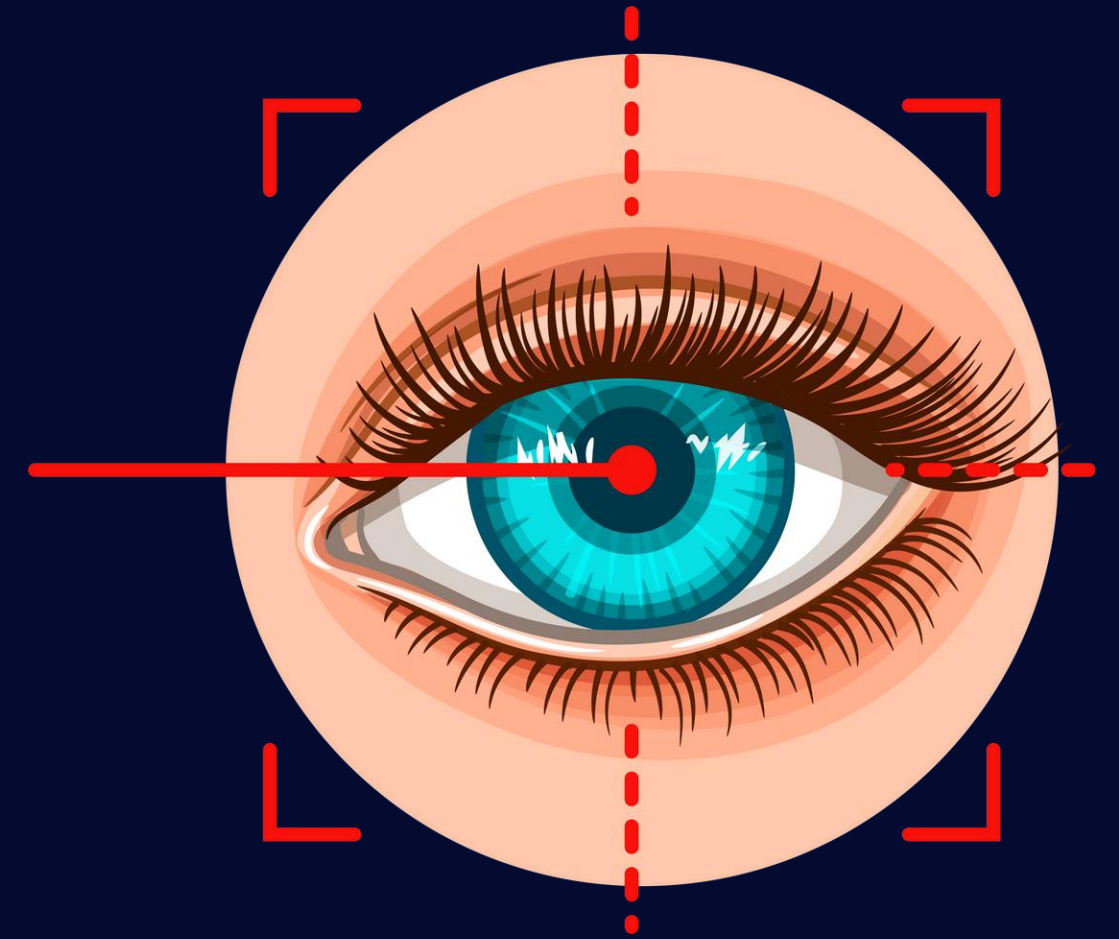
Cataracts

- Clouding of lens
- Blocks path of infrared light
- Appears as black spots
- Accuracy & access issues



Solution

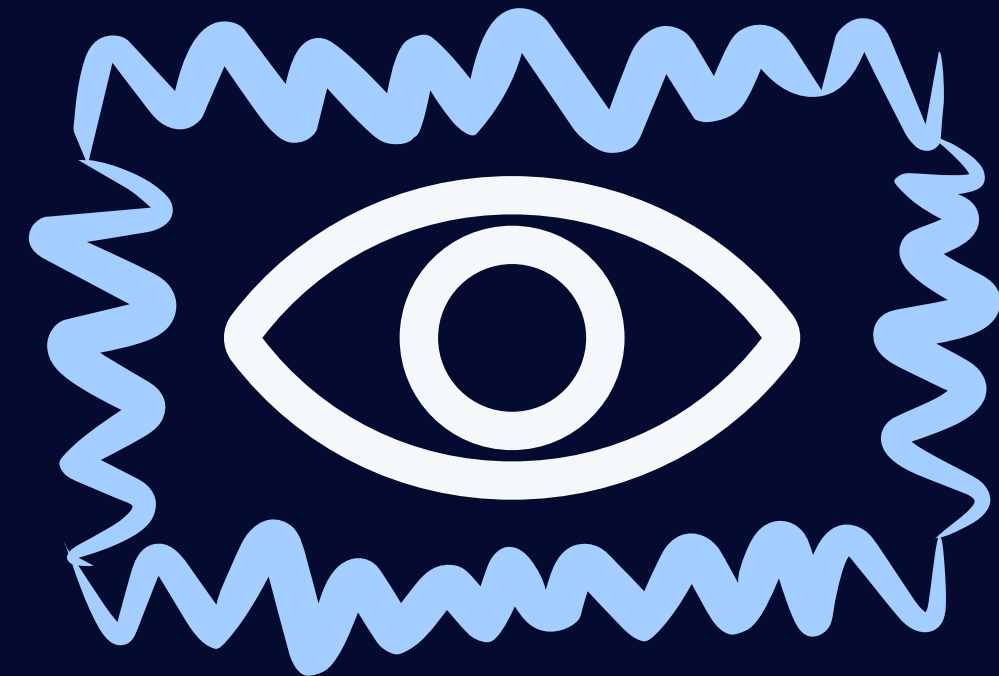
- Reposition screen
- Lens replacement surgery
- Introduces additional challenge:
May show inability to access lower portion of screen
- Lens replacement software accommodation



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Nystagmus

- Involuntary eye movement
- Fast or slow
- Possible impacts
 - Inability to calibrate
 - to dwell on targets
 - to select targets



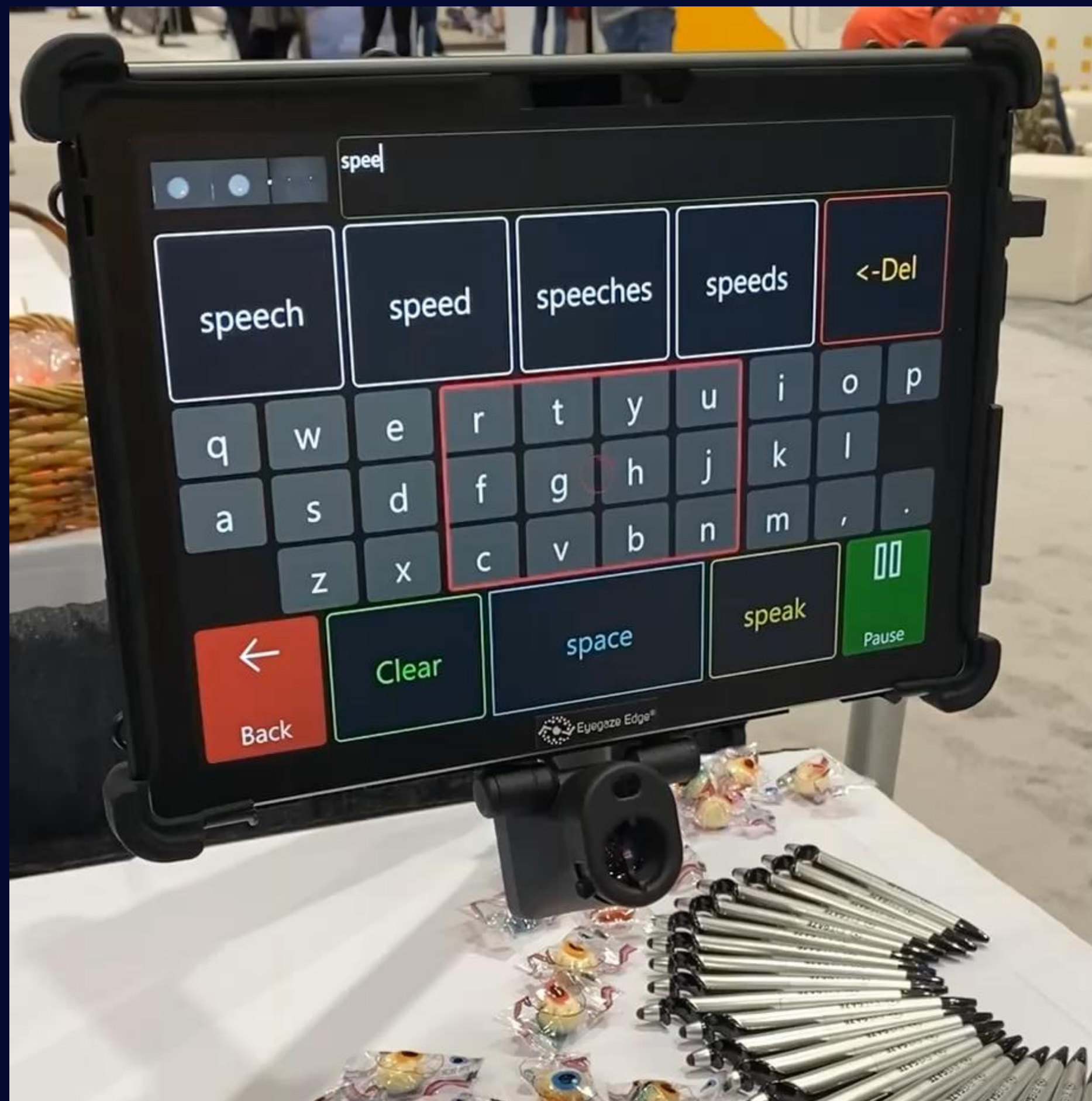
Solution

- Find point of breakdown
- Use simple 5-point calibration
- Decrease gaze duration/increase button size
- Turn dwell memory setting on
- Eyegaze Edge can accommodate nystagmus of up to 3 bounces per second

Nystagmus Example



Nystagmus Solution



Oculomotor Limits

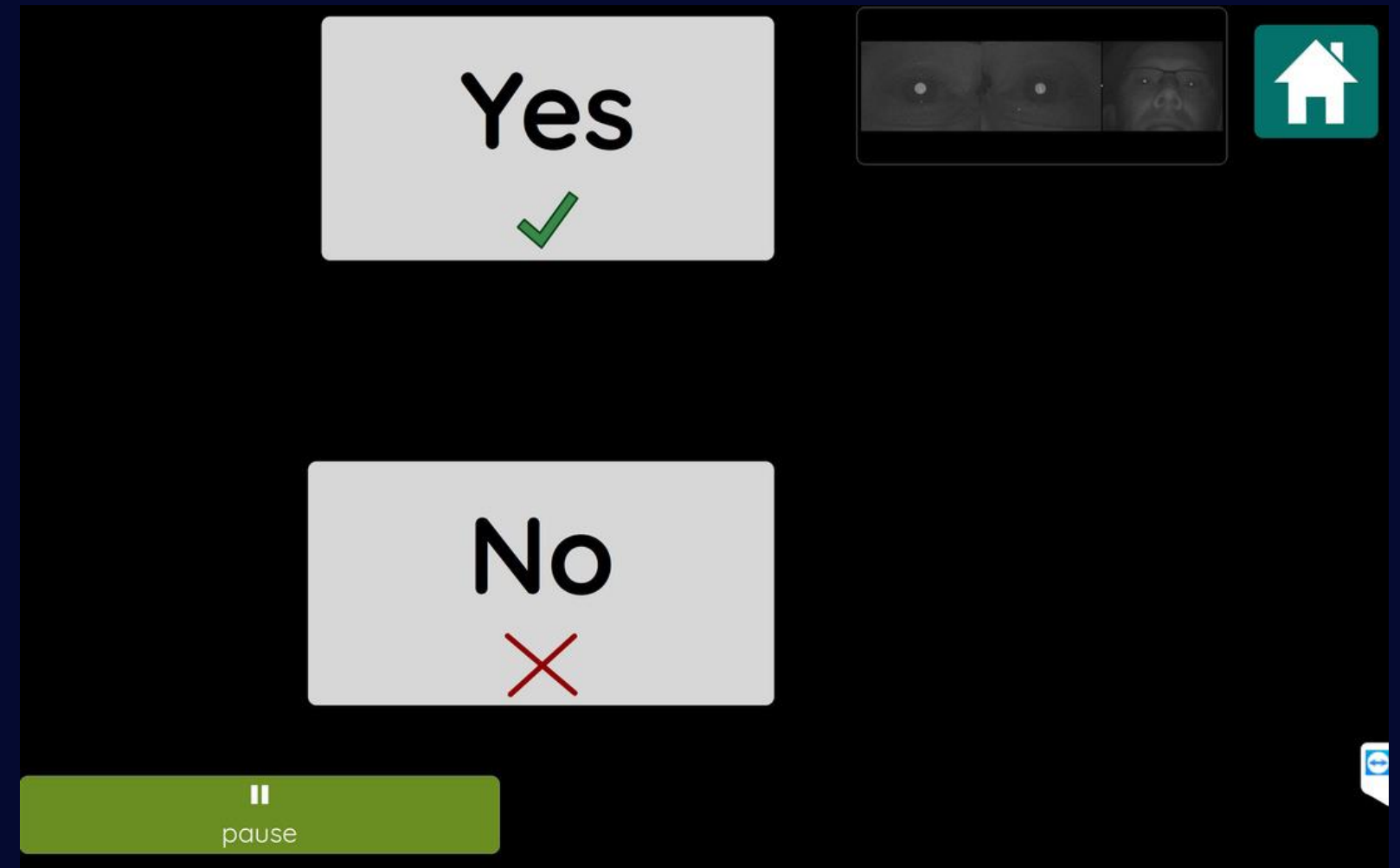
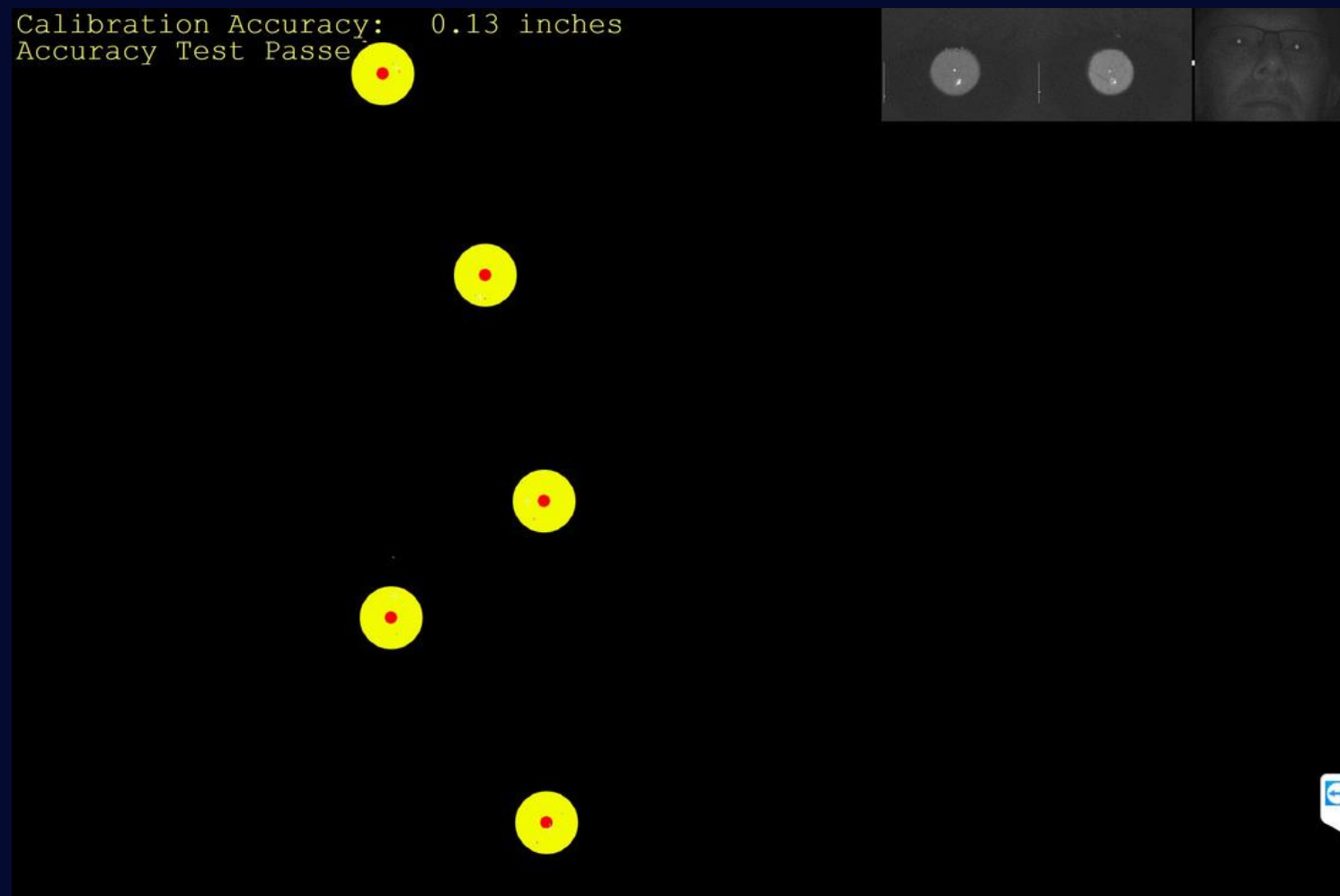
- Limits in eye range of motion
- Horizontal or vertical
- Inability to access screen
- Brainstem injuries
- Advanced-stage ALS
- Multiple Systems Atrophy



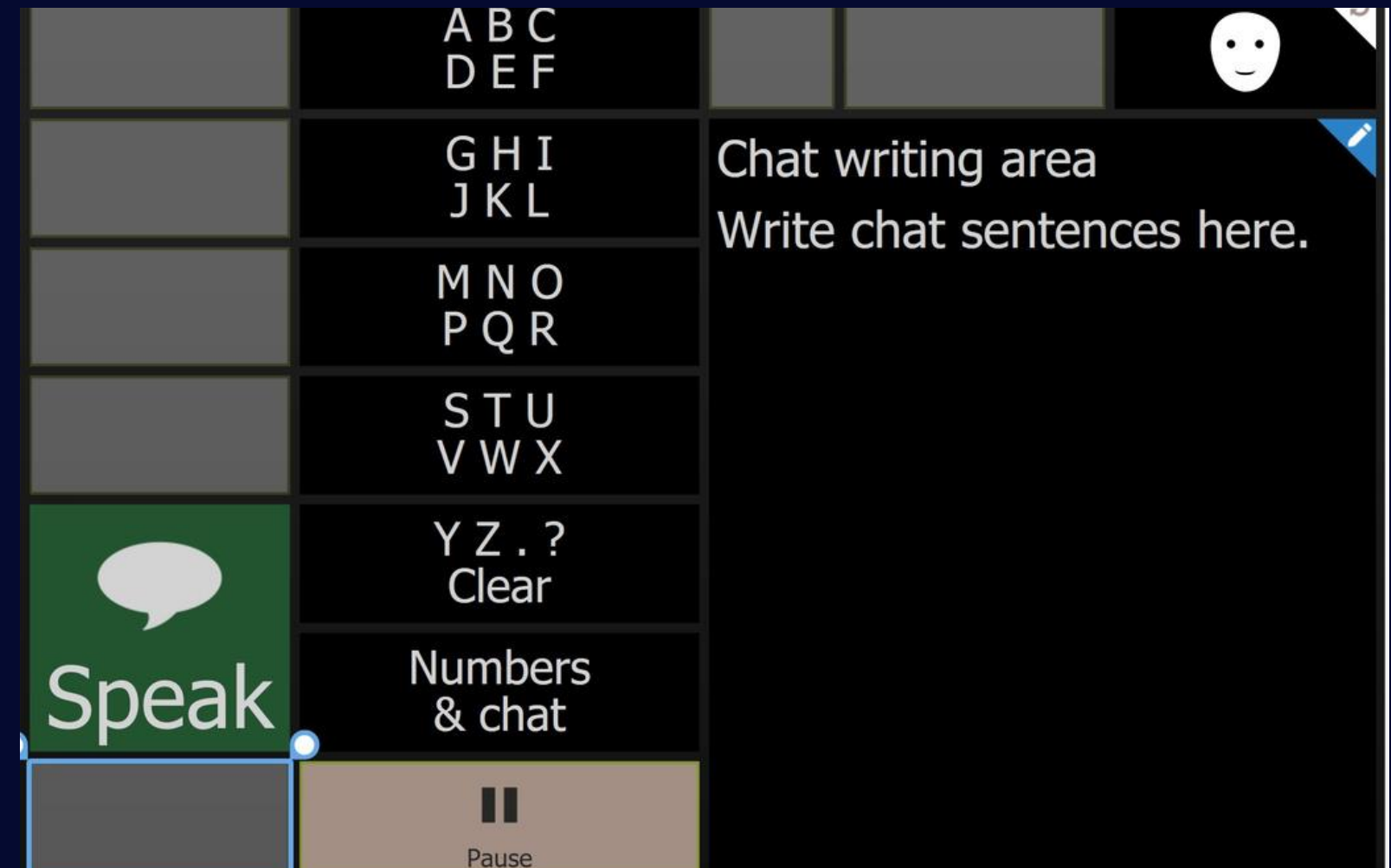
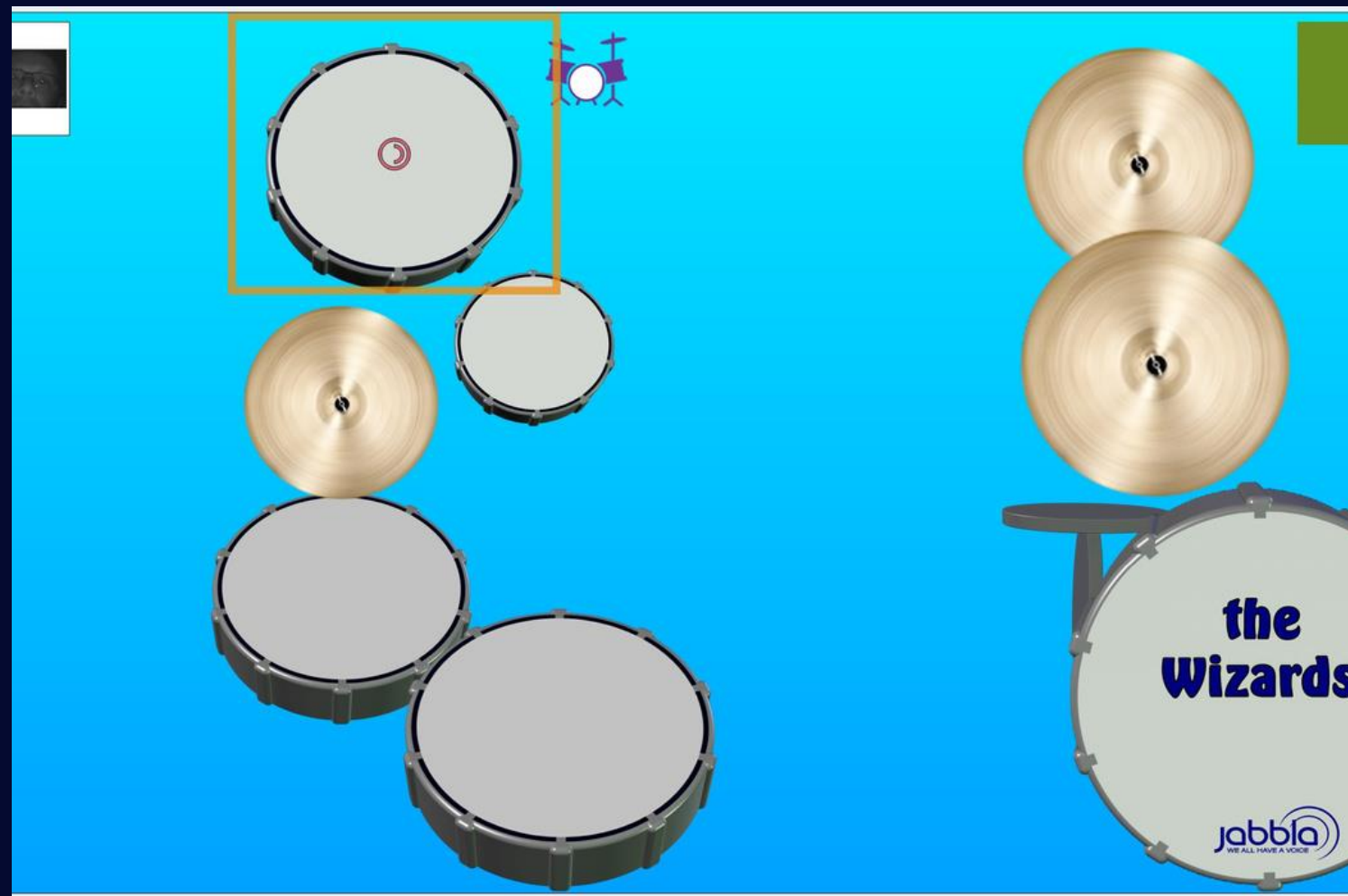
Solution

- Discover where movement /S happening
 - Use heat mapping features
- Adjust calibration to the area of ROM
- Obtain strong calibration & customize screens to reflect their ROM
- Customize gaze duration timing

Brainstem Stroke Customization

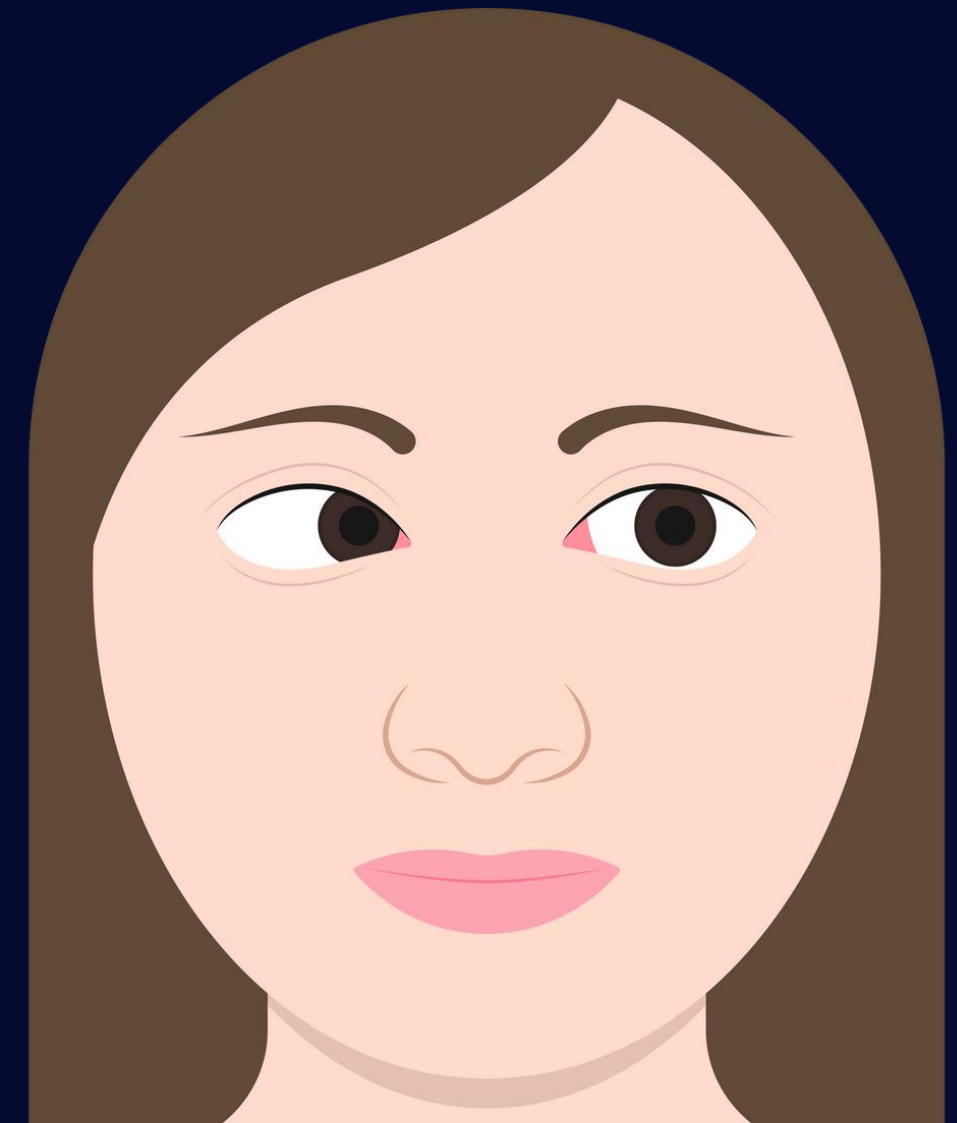


Brainstem Stroke Customization



Strabismus

- Both eyes not converging on intended target
- Disconjugate gaze
- 1-eye only or alternating
- Can confuse an eye tracker's ability to predict true gaze point



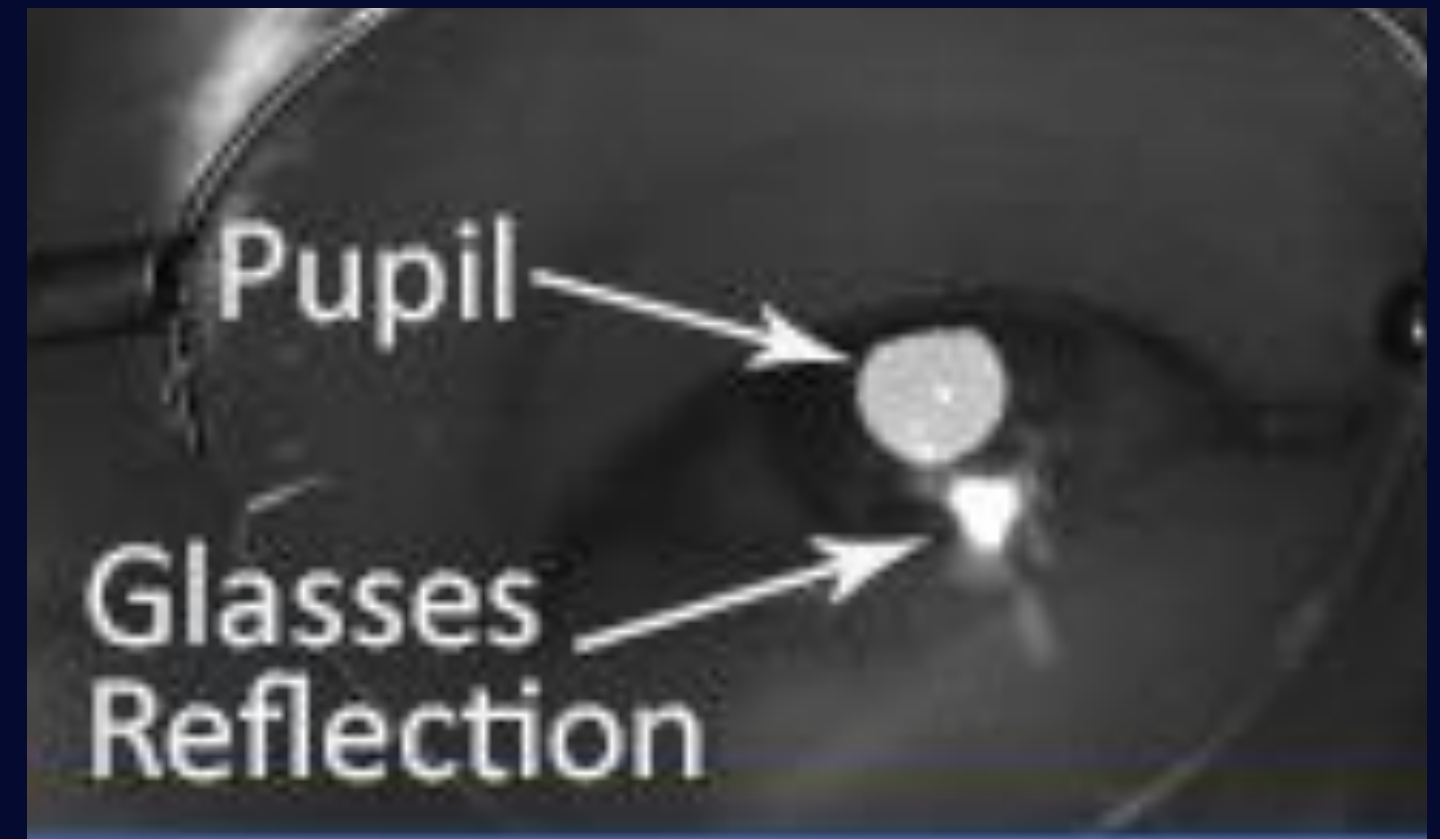
Solution

- ID dominant eye & track it!
- Monocular eye tracking mode
- Alternating strabismus?
 - Patch less-dominant eye
 - Partial nasal-side patch
- Track more dominant eye



Glasses & Contacts

- May not pose a problem
- Glasses = window
- Contacts = cornea
- Problematic if bright reflections cross pupil



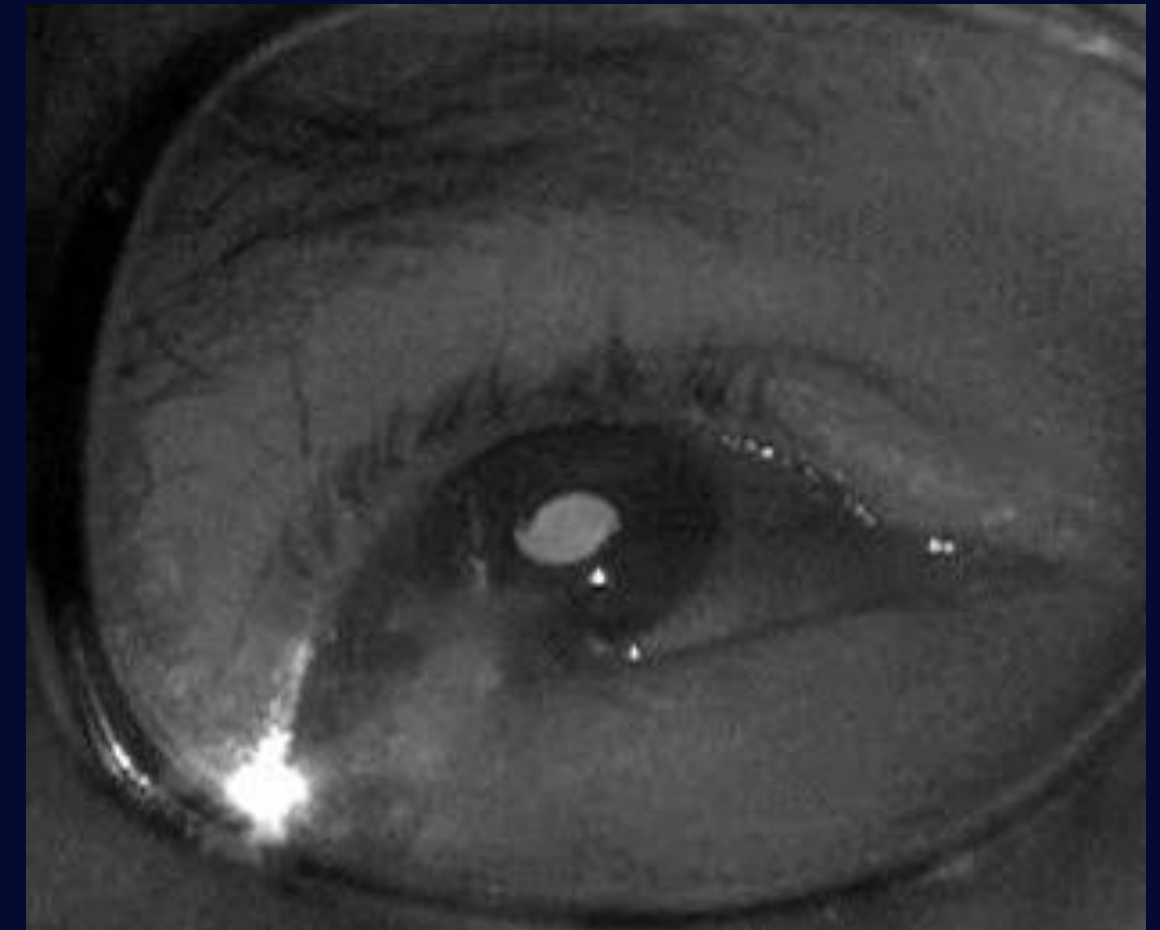
Solution

- Play with angles to shift reflection
 - Device angle
 - Head angle
 - Glasses lens angle
- Modify environmental light
- Contacts? Practice



Bifocals & Trifocals

- Shift line above or below pupil
- Try readers
- Task glasses/computer glasses
- Progressive lenses — OK!
- Less-reflective frames
- Clean lenses to remove oil and debris



Mydriasis

- Dilation of pupils
- Allows less IR light in
- Less reflection out
- Eyes difficult to read



Solution

- Understand possible reasons
- Change light to modify pupil size
 - decrease environmental light
- Increase intensity of IR light from eye tracker
- Try various eye trackers with more light

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in the USA since 1988*



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