

# Combining Gaze with Manual Interaction to Extend Physical Reach

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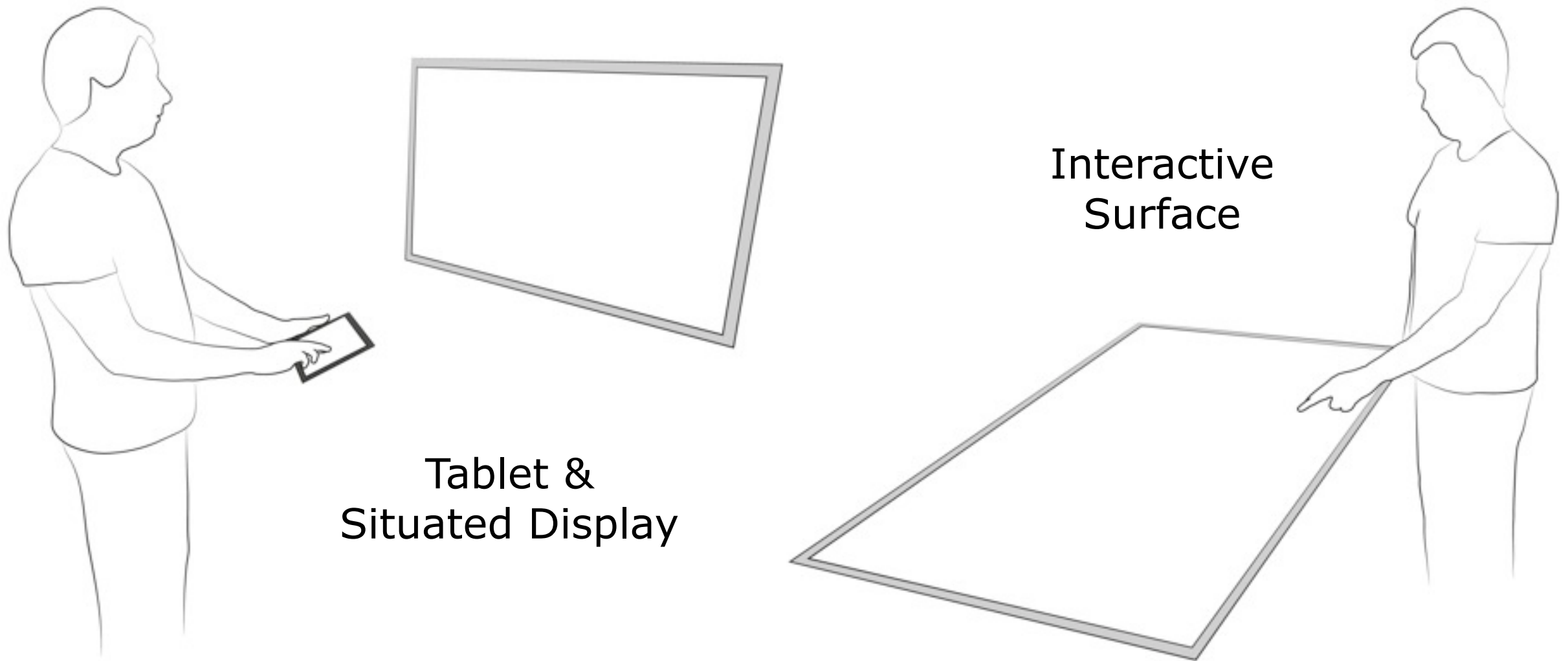
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# Pervasive Displays



# Moving Objects



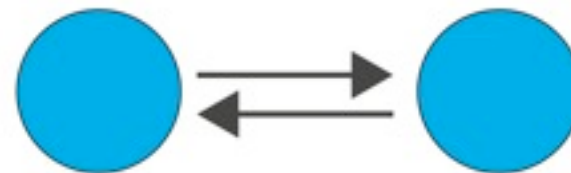
# Combining Modalities

- Eyes are accurate for pointing
- Jacob - The Use of Eye Movements in Human Computer Interaction Techniques: What you look at is what you get, 1991
  - Eyes give  $\sim 1$  degree of accuracy
  - Dwell-time
- Mobile devices (Smartphone, Tablet etc)
  - Many sensors for input (touch, acceleration, rotation)

# Design

- We identified two tasks

- Retrieve/Return



- Relocate



- What information does the system need?
  - Object Selection (Location, Action)
  - Target Selection (Location, Action)

# Proposed Techniques

- Eye Cut & Paste
- Eye Drag & Drop
- Eye Summon & Cast
- Each has associated touch event (could be any manual input)

# Eye Cut & Paste

Object Selection	
Location	Action
Gaze	Tap

Target Selection	
Location	Action
Gaze	Tap



# Eye Drag & Drop

Object Selection	
Location	Action
Gaze	Hold

Target Selection	
Location	Action
Gaze	Release





# Eye Summon & Cast

	Object Selection	
	Location	Action
Summon	Gaze	Swipe Down
Cast	Swipe Up	Swipe Up

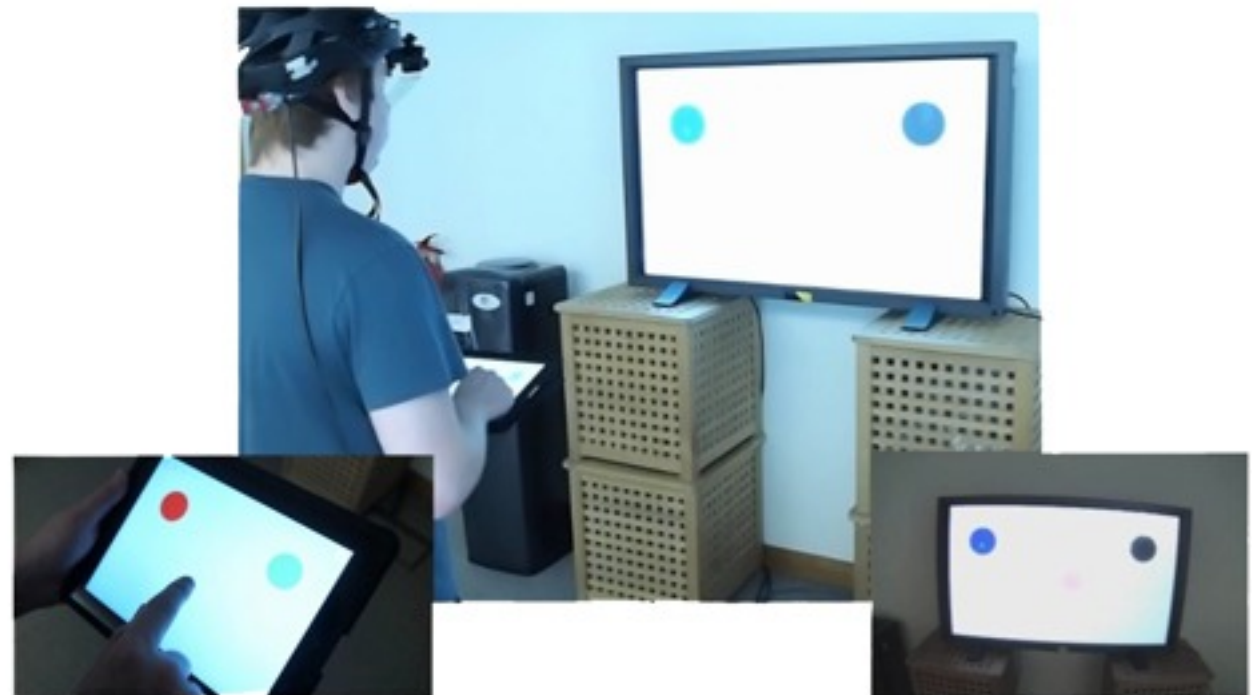
Target Selection	
Location	Action
Swipe Down	Swipe Down
Gaze	Swipe Up



# Tablet & Situated Public Display

(Prototype System)

- SMI iView X HED - Head-worn eye-tracker
- 50'' Plasma TV
- iPad



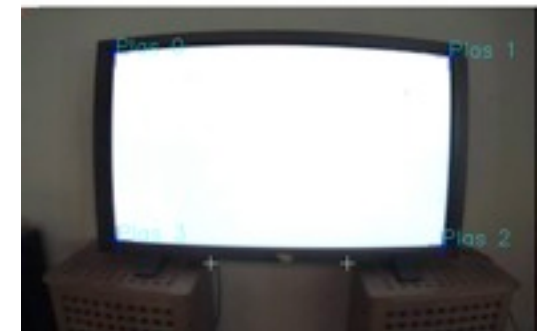
# Tablet & Situated Public Display

(Prototype System)

- SMI's scene video - 10 fps
- Brightness threshold
- Rectangle detection
- Use Corners to calculate homography
- Use homography to map gaze to screen



iPad



TV



# Tablet & Situated Public Display

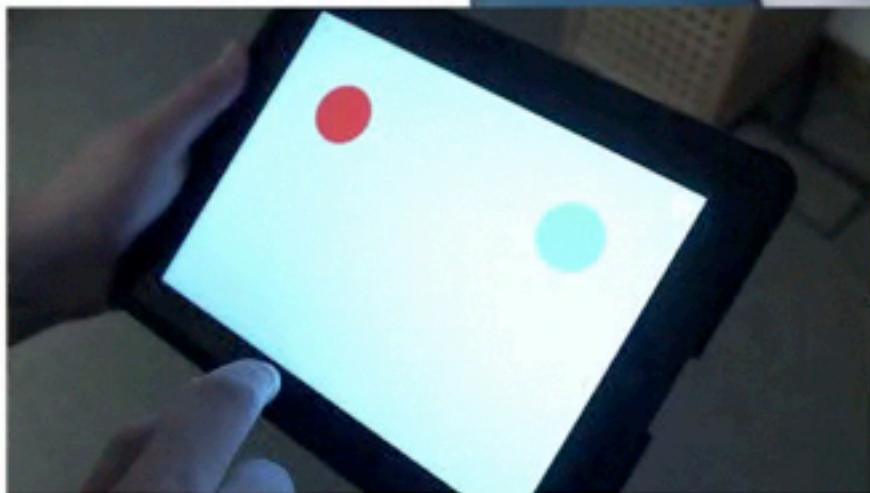
## Eye Cut & Paste - Retrieve/Return





# Tablet & Situated Public Display

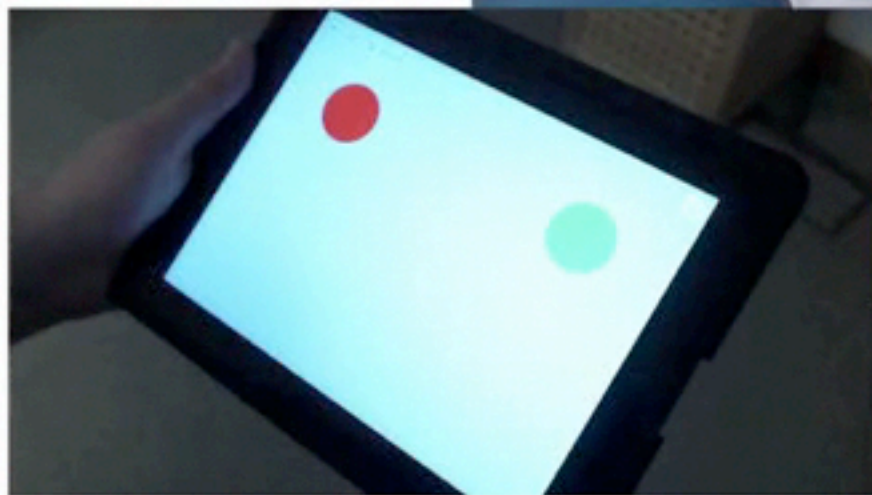
## Eye Cut & Paste - Relocate





# Tablet & Situated Public Display

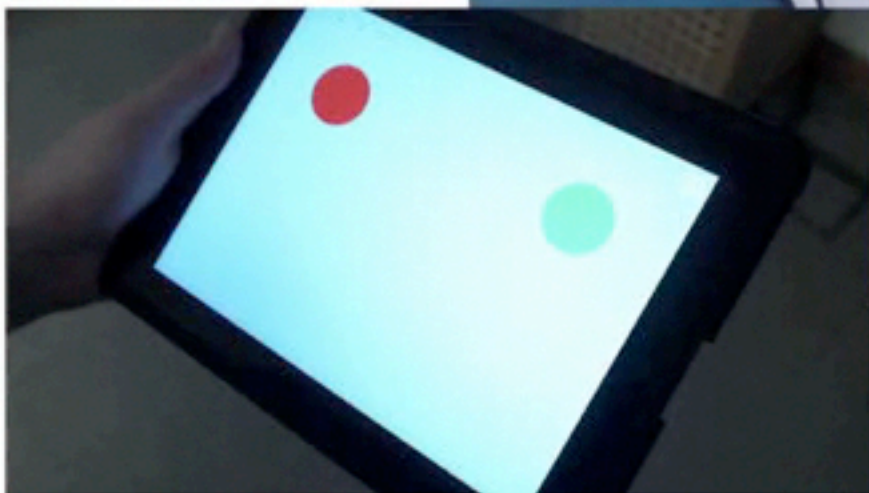
## Eye Drag & Drop - Retrieve/Return





# Tablet & Situated Public Display

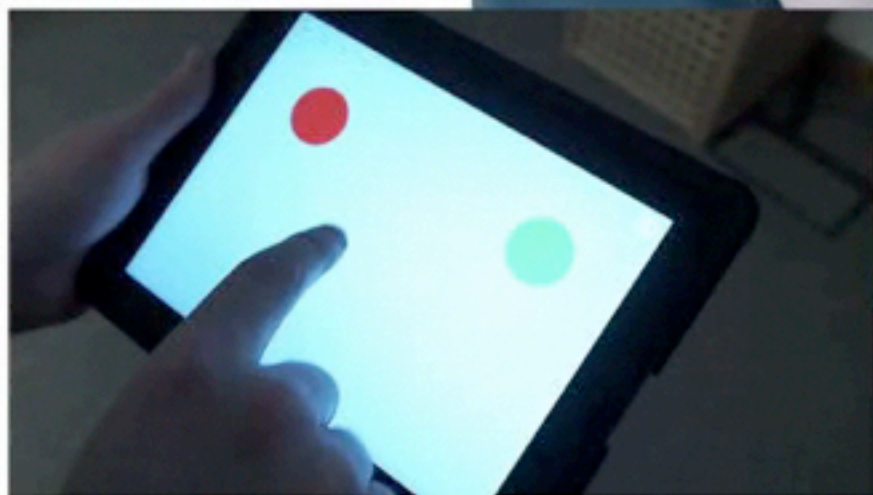
## Eye Drag & Drop - Relocate





# Tablet & Situated Public Display

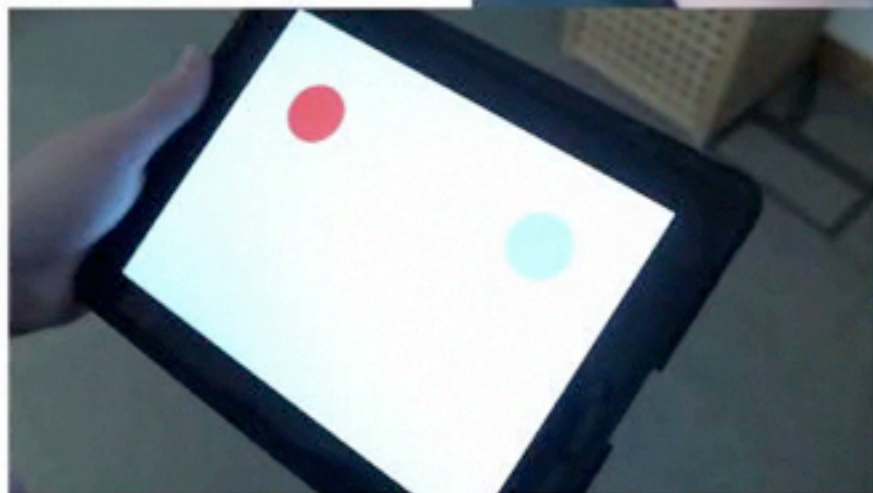
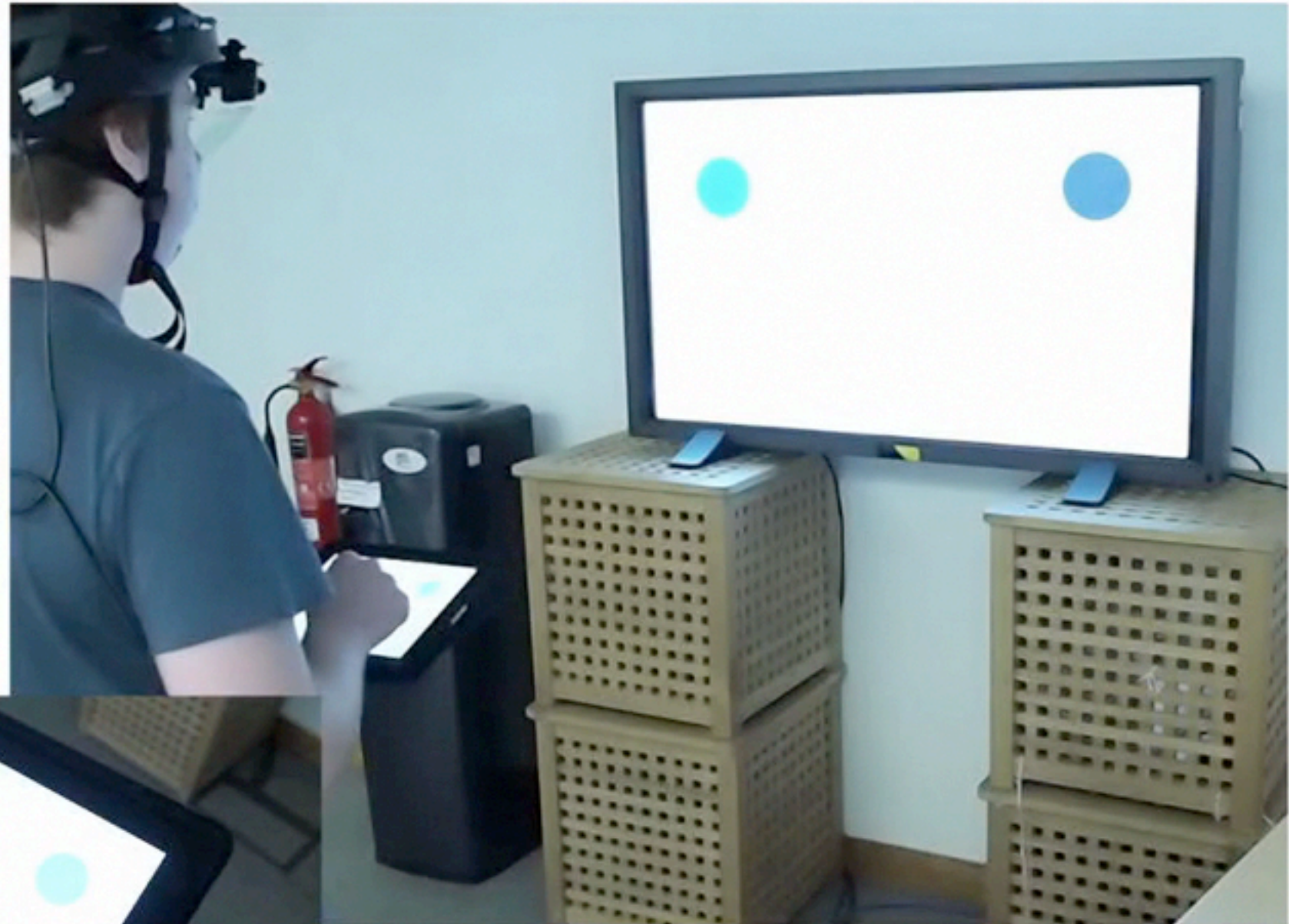
## Eye Summon & Cast - Retrieve/Return





# Tablet & Situated Public Display

## Eye Summon & Cast - Relocate



# Next Step

- Study to evaluate accuracy and speed of the techniques against each other and dwell-time
- Which is performs better for the defined tasks

# Conclusion

- **Combination of Gaze and Manual Interaction**
- **Two Tasks** (Retrieve/Return and Relocate)
- **Three Techniques** (Eye Cut & Paste, Eye Drag & Drop, Eye Summon & Cast)
- **Prototype System**

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