How do we interact with an interactive System?

Using a computer, mobile device, or any other interactive System

- Write a message
- Check something on the internet
- Write code
- Watch a video

How do we interact with an interactive System?

Write a message on a smartphone:

1. Looking at the phone

2. Unlocking the phone

3. Searching for the message app

4. …

How do we interact with an interactive System?

Check something on the internet on a computer:

1. Looking for the mouse
2. Grabbing the mouse
3. Looking at the screen to find the browser
4. Move the mouse cursor on top of the browser
5. …

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Gaze Input

Simon Voelker
SS 2018

RWTH AACHEN UNIVERSITY

The Human Eyes

- Primary sensor organ
- We always look first
- Data rich
- No fatigue

Gaze

- Eye examines environment by saccades and fixations:
- **Saccades**: rapid eye movements
  - Last for 30 – 120 msec
  - Area of 1-40 degrees of visual angle
- **Fixations**: focusing a target
  - Last for 200-600 msec
  - Tiny, jittery movements < 1 degree of visual angle


CASIO

Possible Problems with Gaze Tracking?

Problems with Gaze Tracking

- Technology
- Accuracy (eye jittery)
- Unintended selection (Midas touch)
- No muscle memory
- Distraction

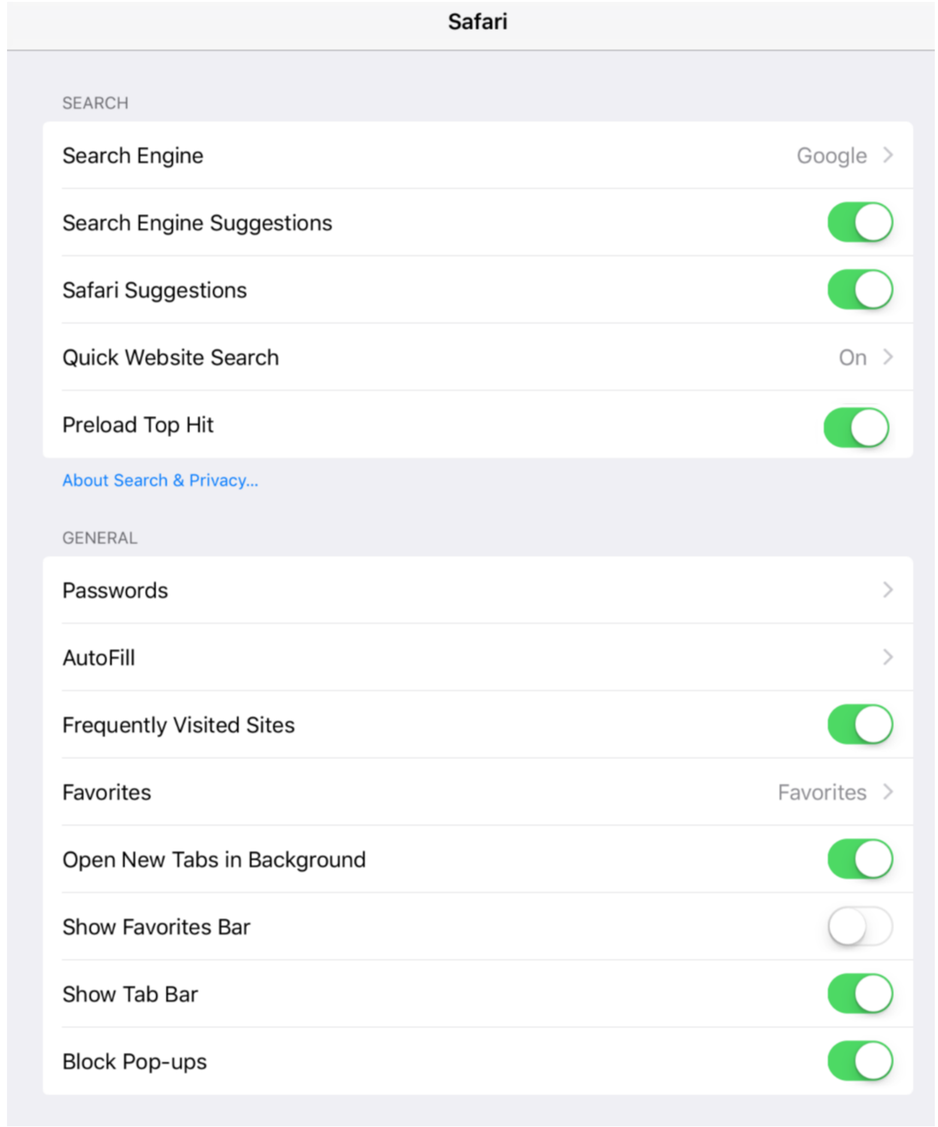
How to select an object or location?

Gaze: Selection

- Blinking
  - Backtrack origin target
  - Unintended blinks!?
    - Unnatural behavior

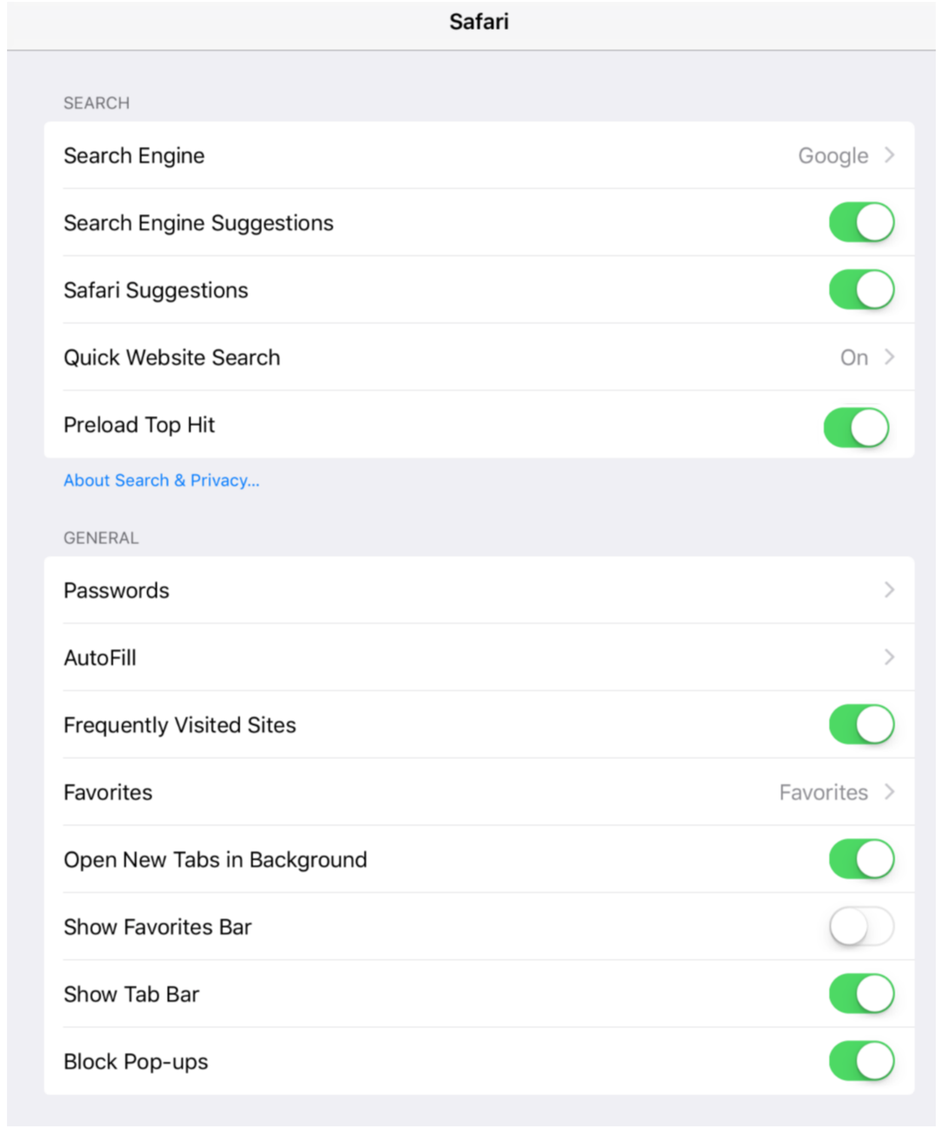
Gaze: Selection

- Dwell Time
  - 150-250ms



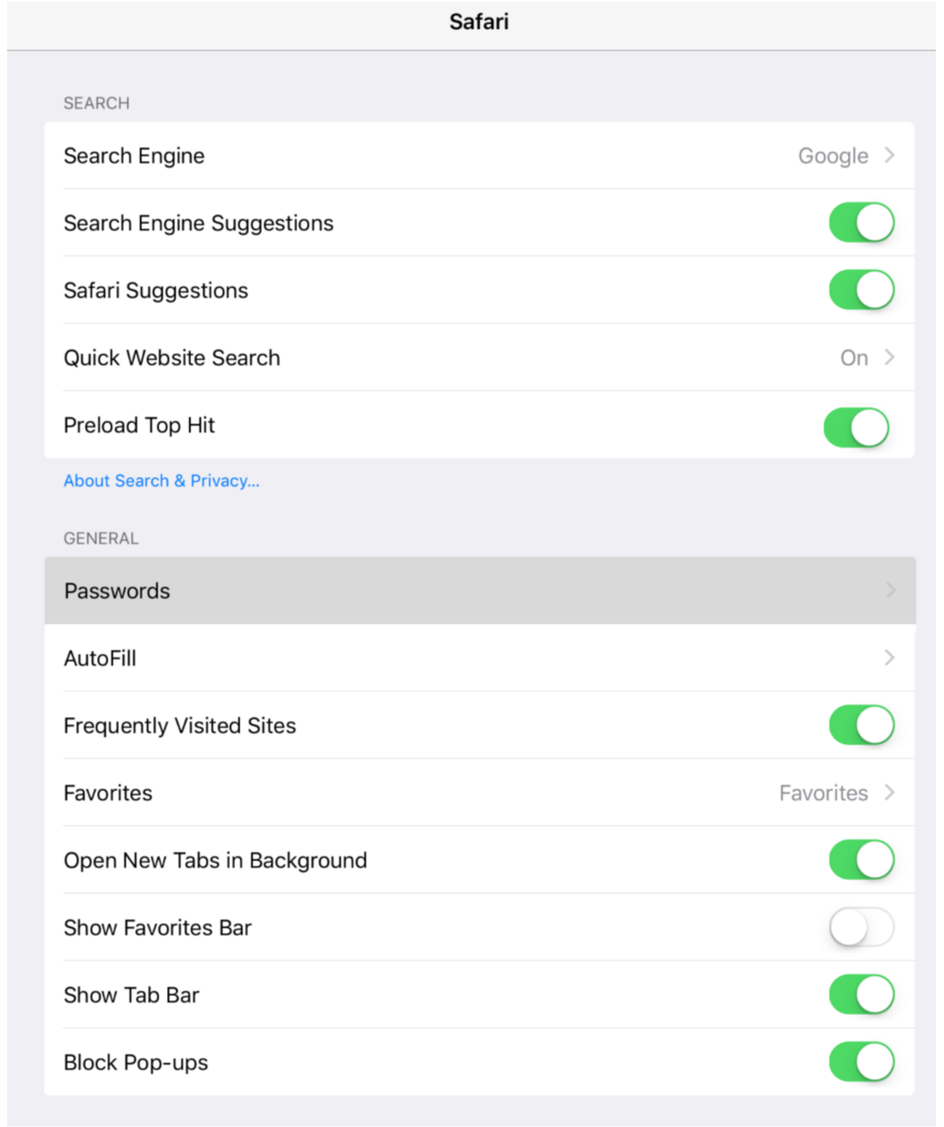
Gaze: Selection

- Dwell Time
  - Inaccuracy

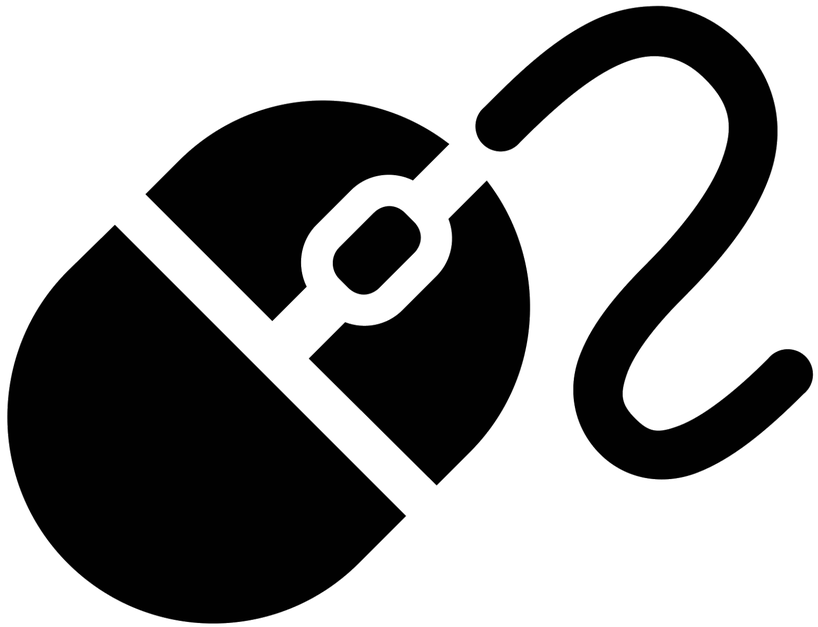


Gaze: Selection

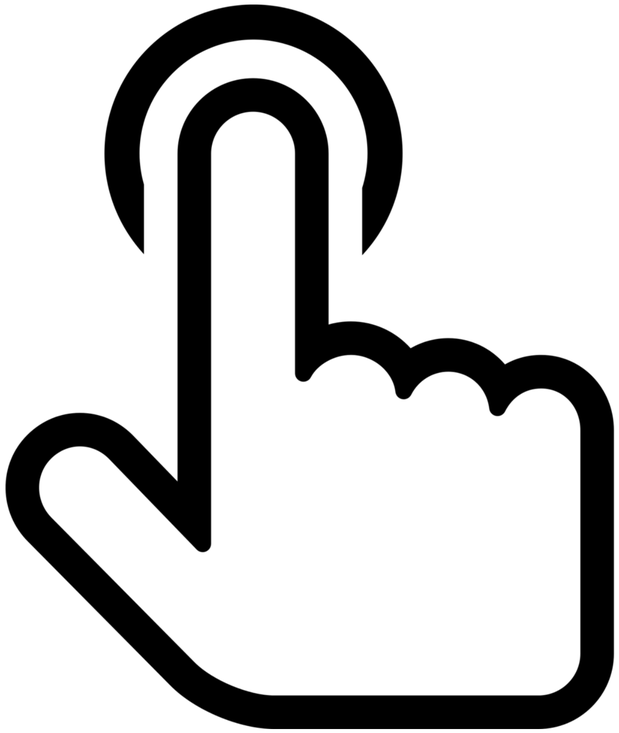
- Dwell Time
  - Midas Touch Problem



Gaze + Other Modalities



Mouse



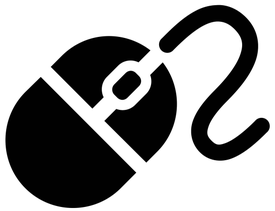
Touch

VR

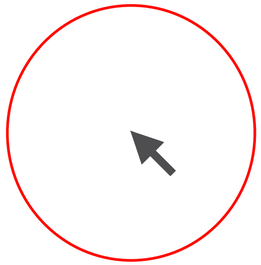
Gaze Suggests, Touch Confirms


86.23
112.29

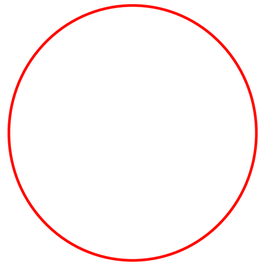
MAGIC Pointing [CHI ’99]

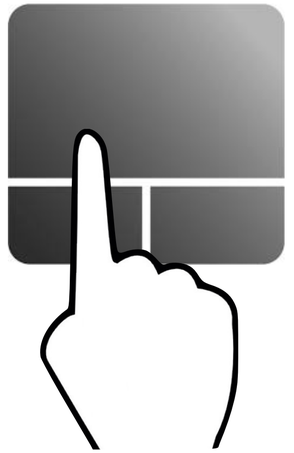


Liberal



Conservative





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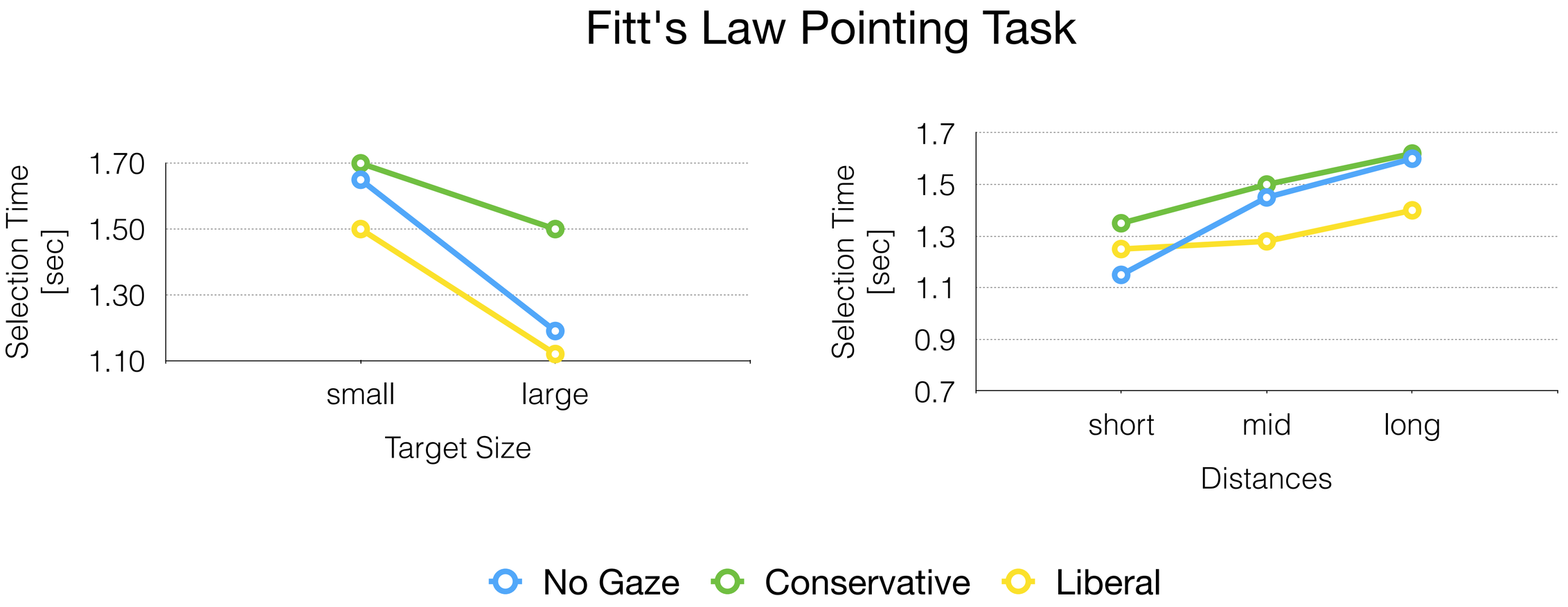
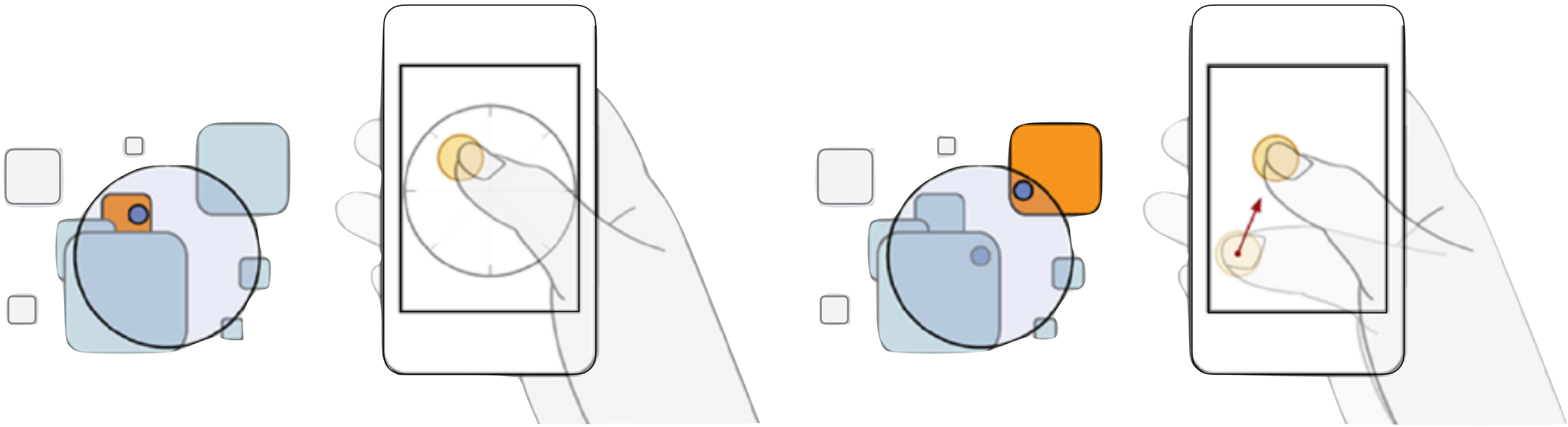


Target Selection: Look & Touch

[CHI ’12]

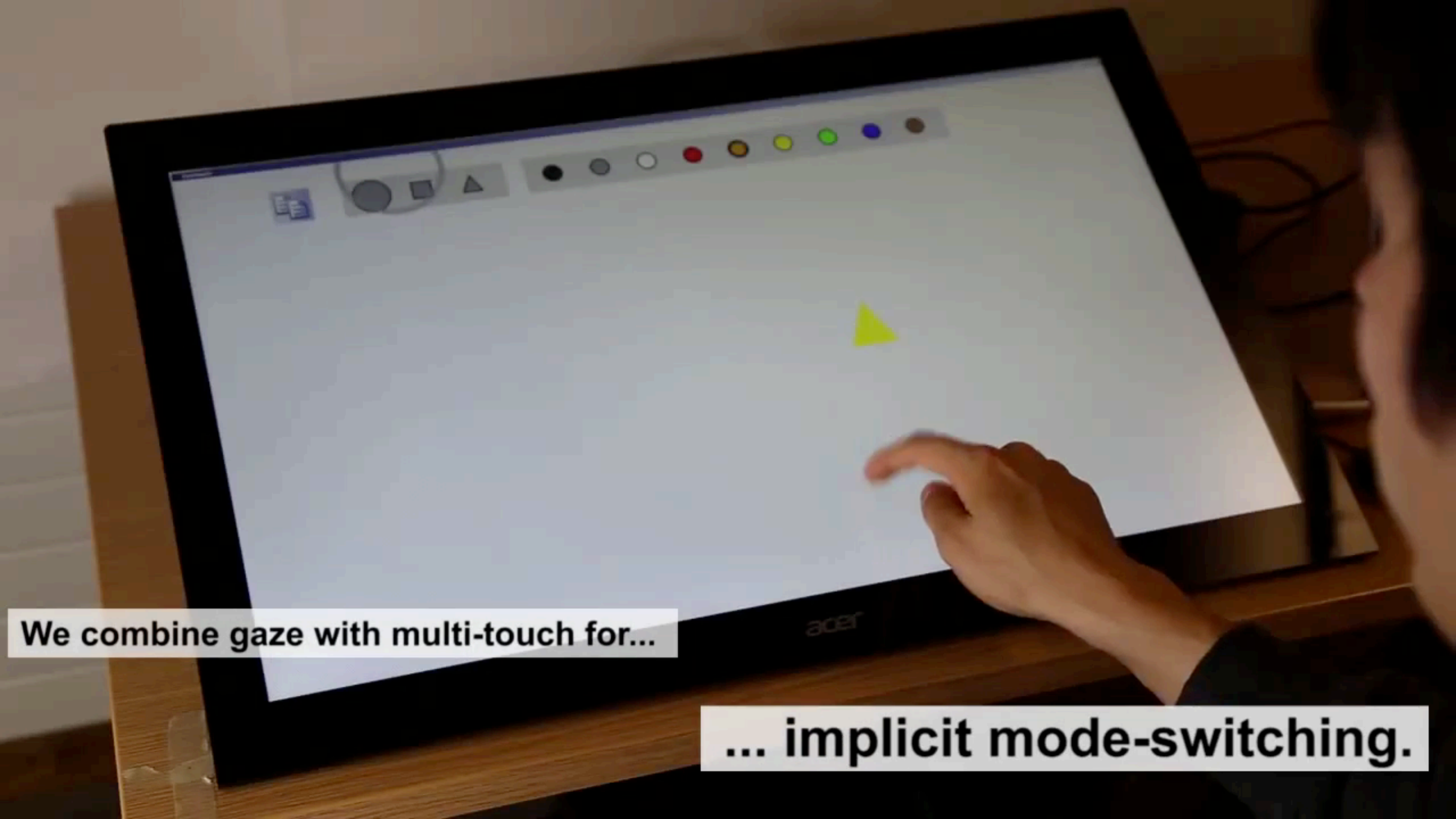
Target Selection: Look & Touch

[CHI ’12]

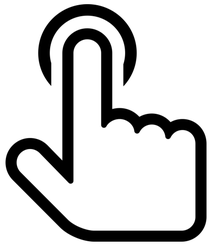


We combine gaze with multi-touch for...

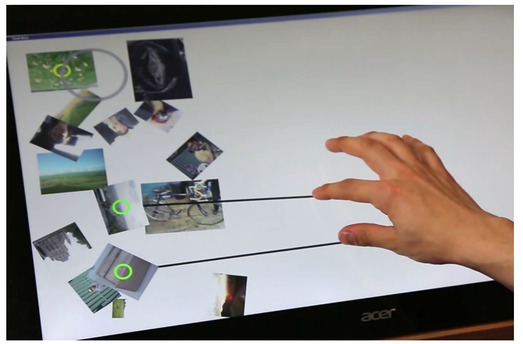

We combine gaze with multi-touch for...
... seamless gaze based zooming.


We combine gaze with multi-touch for...
... implicit mode-switching.

Gaze-Touch [CHI'15]



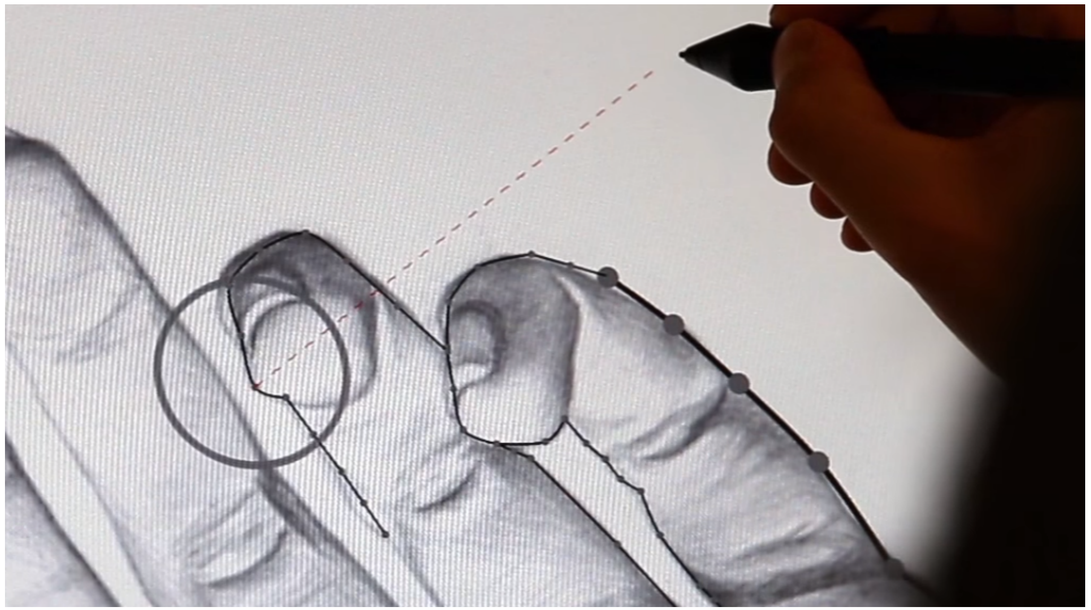
- Study Design:
  - Applications: Drawing, Maps & Image gallery
- Results:
  - **Less fatigue**/physical movement
  - **Seamless switching** of direct & indirect input
  - No muscle memory
  - **Late-Trigger errors**

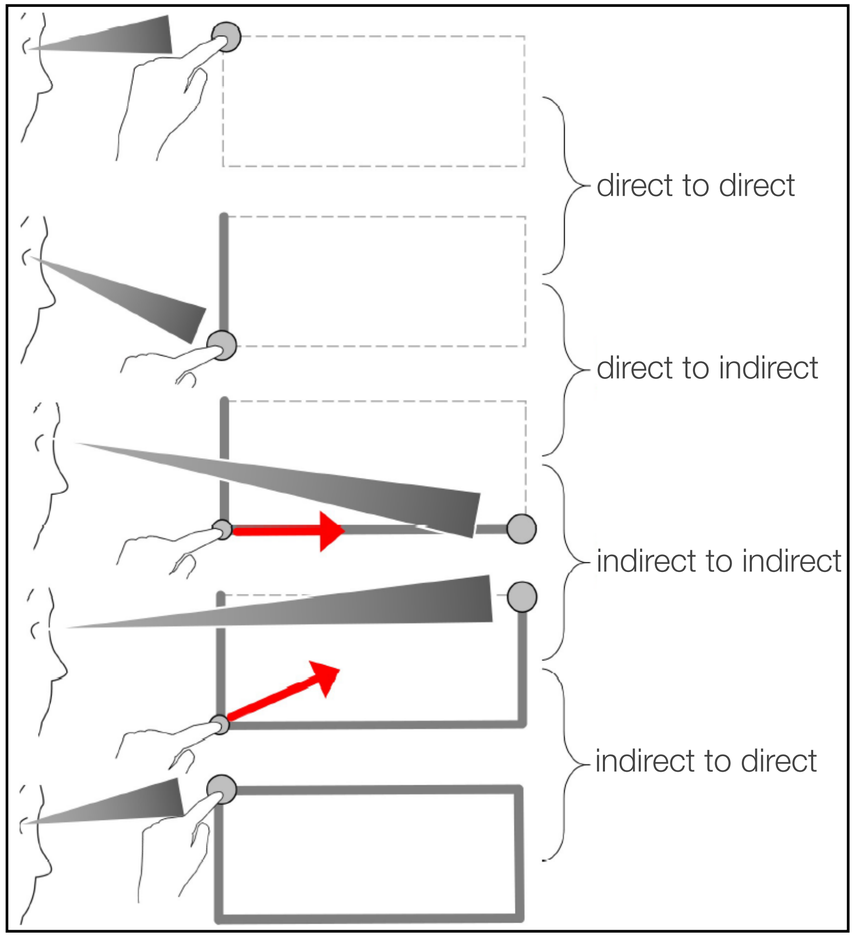


Gaze-Shifting

[UIST'15]

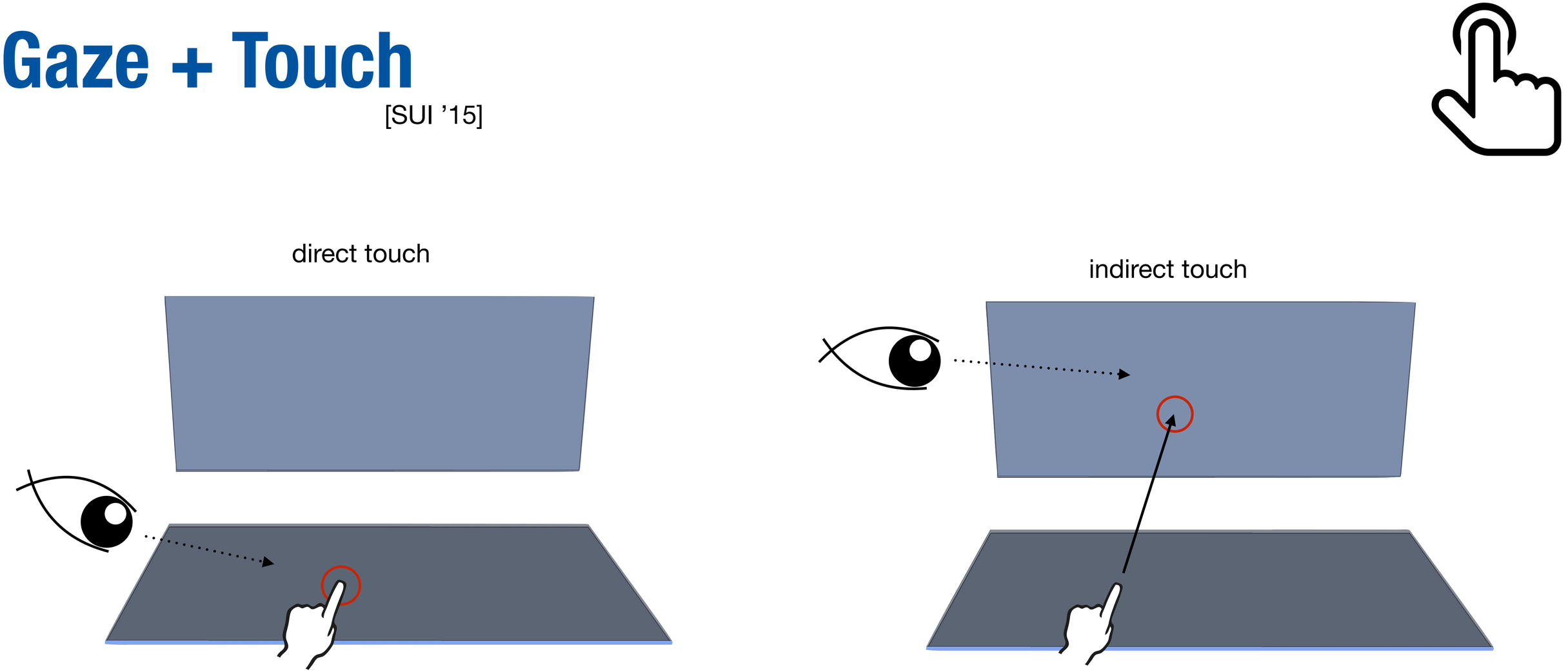
- Generic mechanism to switch between direct and indirect input
- Define how the system should react on direct/indirect input **and** transitions





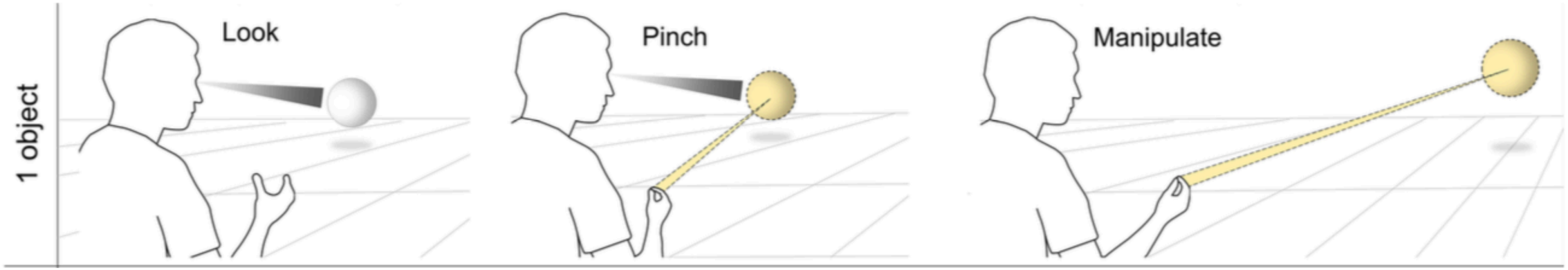
Gaze + Touch

[SUI ’15]



Gaze + Pinch Interaction in Virtual Reality

[SUI ’17]



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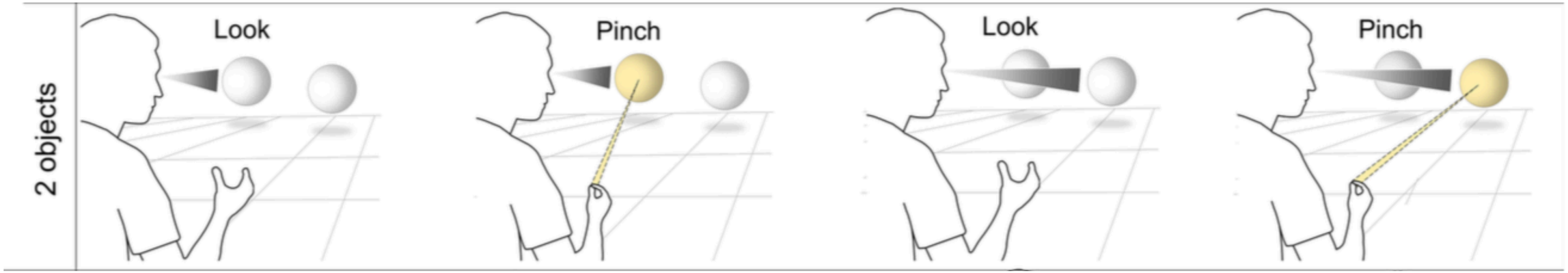

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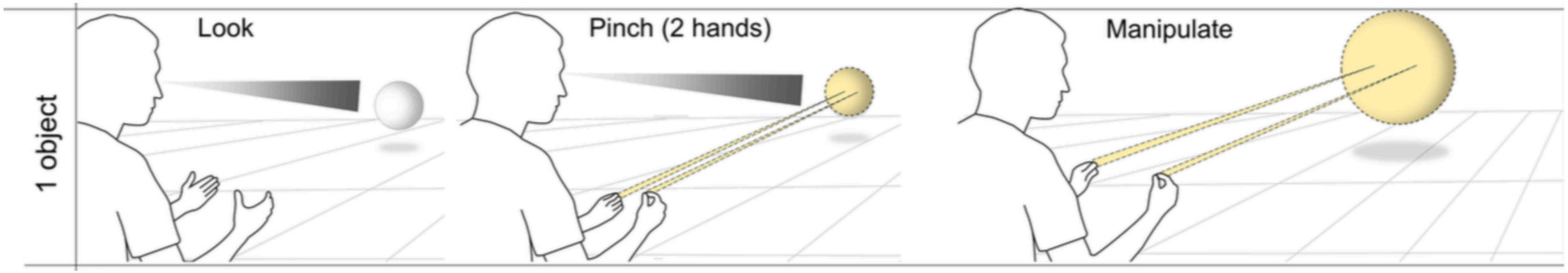

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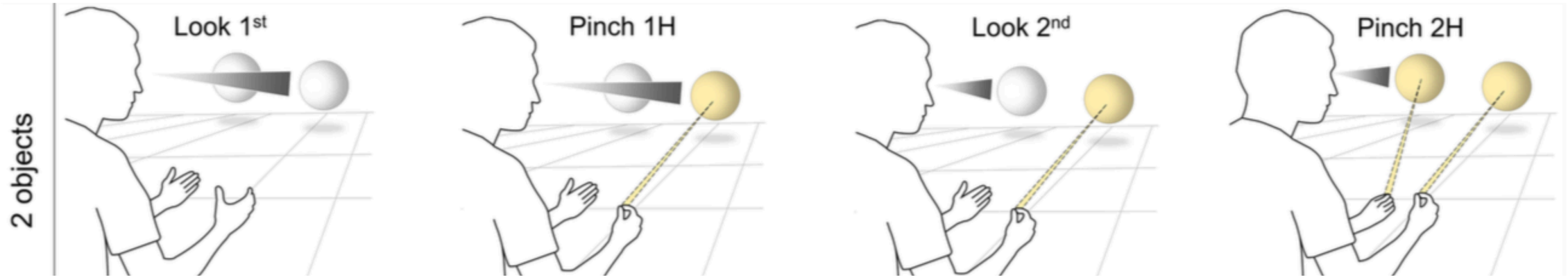

Conclusion

- Primary sensor organ
- We always look first
- No fatigue
- Accuracy
- Midas touch problem