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. …
How do we interact with an interactive System?

Write a message on a smartphone:

1. Looking at the phone
2. Searching for the message app
3. ...
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
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5. …
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
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
MAGIC Pointing [CHI '99]

Liberal

Conservative

😁

ifiant
MAGIC Pointing [CHI '99]

Fitt's Law Pointing Task

Selection Time [sec]

Target Size

- small
- large

Selection Time [sec]

Distances

- short
- mid
- long

- No Gaze
- Conservative
- Liberal
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]

direct touch

indirect touch
Gaze + Pinch Interaction in Virtual Reality

[SUI '17]
Gaze + Pinch Interaction in Virtual Reality

[SUI '17]
Gaze + Pinch Interaction in Virtual Reality

[CTHCI: Simon Voelker]

[34]

Gaze + Pinch Interaction in Virtual Reality [SUI '17]

Diagram showing the steps of interaction:

1. Look
2. Pinch (2 hands)
3. Manipulate
Gaze + Pinch Interaction in Virtual Reality

[SUI '17]
Conclusion

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