Eye-tracking

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Basics

• Majority of all perceived stimuli through the eyes
• Only 10% through ears, skin, nose
• Eye-tracking – measuring movements of the eyes
• Record eye movements to subsequently analyze different research questions
The structure of the eye

Pupil:

• aperture in the iris that allows light to enter
• appears black

Iris

• colored part of the eye, controls the pupil size

sclera

• white part of the eye
Types of eye movements

Fixations

- Focus on a certain location
- Minimal fixation duration: 100ms
- Most often less than 200ms
- Most analyses concern number of fixation and fixation duration
Types of eye movements

Saccades

• Fast, sudden movements between fixations
• Very short (10-80ms)
• No processing of any information
Types of eye movements

Others

- Drift: slow deviation from location of fixations
- Microsaccades: Correction for drifts
- Trembling
- Changes in pupil dilation
How does eye tracking work?

Different techniques

Most common: Corneal Reflection technique
Corneal Reflection technique

relationship between two eye features:

• the black pupil

• mirror reflection from the front surface of the cornea

• allows to compute gaze within a scene
Corneal Reflection technique

• a set of 3 near infra-red lights is projected on the eye

• relative position of mirror reflection to the pupil is important

• eye rotation in its socket
  → pupil moves relative to the reflection of lights
  → pointing direction of the eye

• teaching the system how it relates to the image of a second camera
Eye-tracking devices

different devices:

• mobile systems

• external systems
Eye-tracking devices

different devices:

- mobile systems
- external systems
Mobile devices

- head-mounted eye-tracker
- attached to the head (usually glasses)
- eye camera and environment camera
- advantage: mobility
- disadvantage: statistical analysis used to be more extensive
Mobile devices

- recording of eye and visual field
- data saved on memory card

- very important: calibration of the system to ensure data quality!
Asl mobile eye

- lightweight
- Wifi mode
- computes gaze coordinates and pupil diameter
- durable (to a certain extent)
gaze = attention
Analysis/Output

Landscape of attention:

- Distribution of attention across areas
Analysis/Output

Scanpath analysis:

- fixations and saccades
- sequence of all events
- circles = fixations
- lines = saccades
- bigger circles = longer fixations
Analysis/Output

Object-related analysis:

- predefined areas of interest (AOI)
- relative and total number of fixations
- fixation durations
Analysis/Output

Others:

• heat map
Advantages:

- allows to analyze gaze behavior
- quite reliable
- field studies
Disadvantages:

• why is gaze directed at a certain stimulus
• gaze not the same as perception
• no peripheral vision
• eye tracker affects behavior
Thank you very much for your attention!

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