



**Eye tracking in a nutshell:  
unpacking the modern technology  
with *iMotions*®**

**<https://imotions.com/>**

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# Eye tracking: where do we use it?

- Usability and UX
- Interface design
- Marketing
- Product testing
- Newspaper design
- E-commerce optimization
- Architecture and wayfinding
- Driver safety
- Human Factors in Engineering
- Medical/ clinical diagnostics
- Reading research
- Psychology
- Neurosciences
- Infant studies

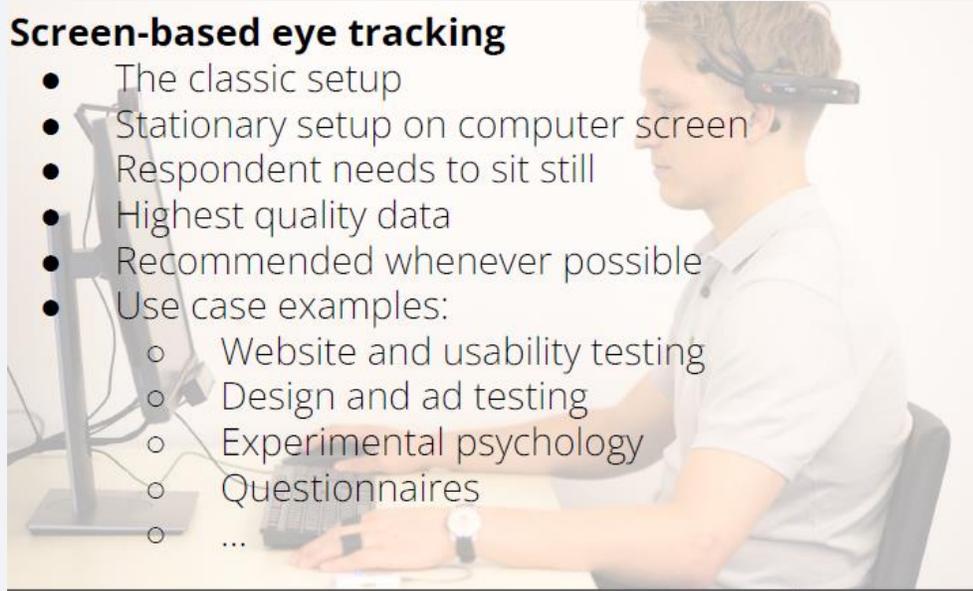
# Eye tracking: how do eye trackers look?



# Eye tracking: how do we use eye trackers?

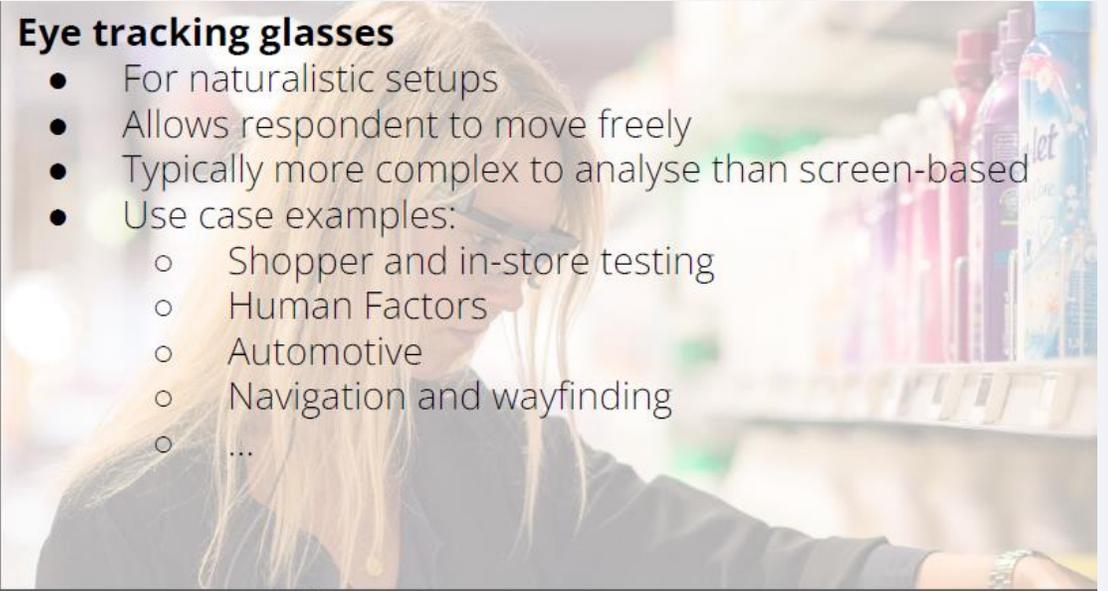
## Screen-based eye tracking

- The classic setup
- Stationary setup on computer screen
- Respondent needs to sit still
- Highest quality data
- Recommended whenever possible
- Use case examples:
  - Website and usability testing
  - Design and ad testing
  - Experimental psychology
  - Questionnaires
  - ...



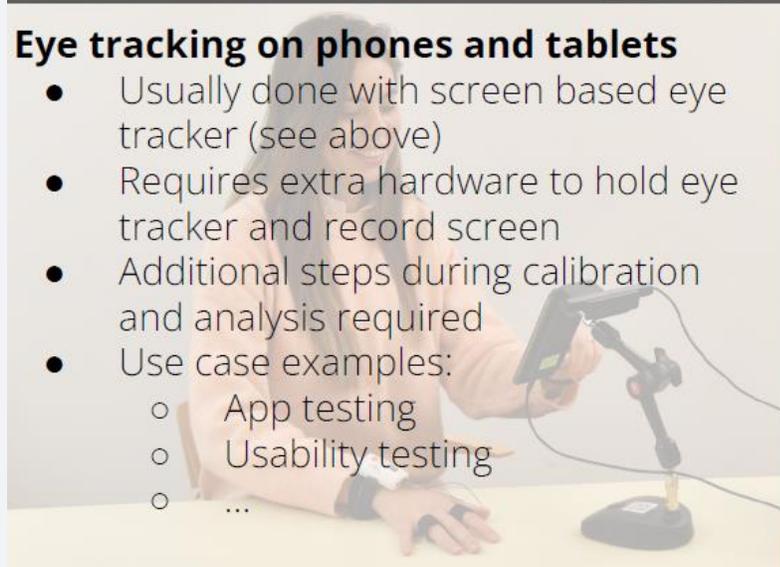
## Eye tracking glasses

- For naturalistic setups
- Allows respondent to move freely
- Typically more complex to analyse than screen-based
- Use case examples:
  - Shopper and in-store testing
  - Human Factors
  - Automotive
  - Navigation and wayfinding
  - ...



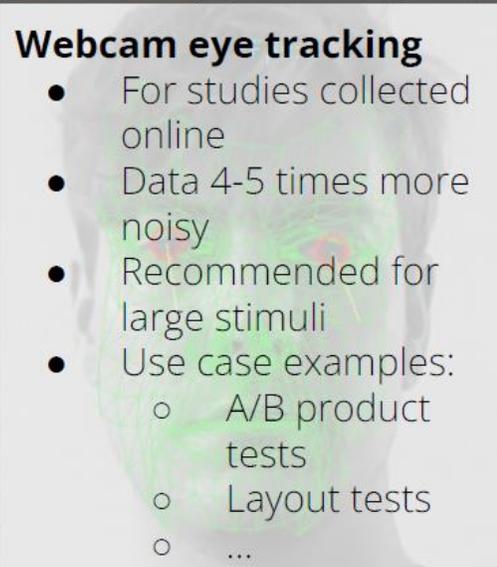
## Eye tracking on phones and tablets

- Usually done with screen based eye tracker (see above)
- Requires extra hardware to hold eye tracker and record screen
- Additional steps during calibration and analysis required
- Use case examples:
  - App testing
  - Usability testing
  - ...



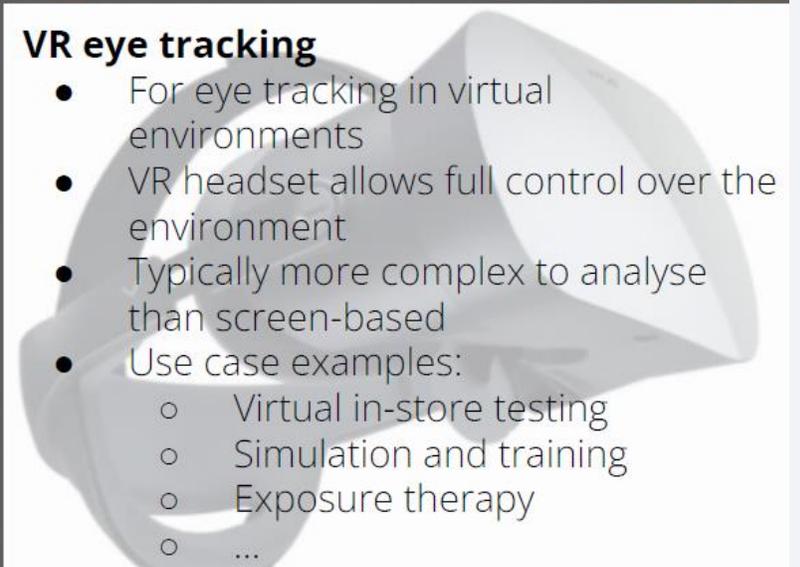
## Webcam eye tracking

- For studies collected online
- Data 4-5 times more noisy
- Recommended for large stimuli
- Use case examples:
  - A/B product tests
  - Layout tests
  - ...



## VR eye tracking

- For eye tracking in virtual environments
- VR headset allows full control over the environment
- Typically more complex to analyse than screen-based
- Use case examples:
  - Virtual in-store testing
  - Simulation and training
  - Exposure therapy
  - ...

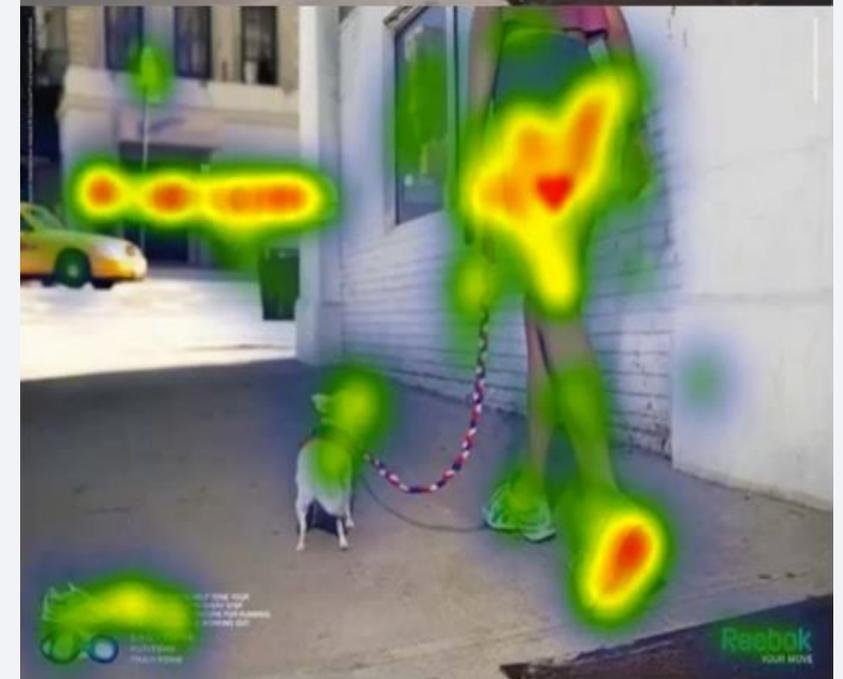
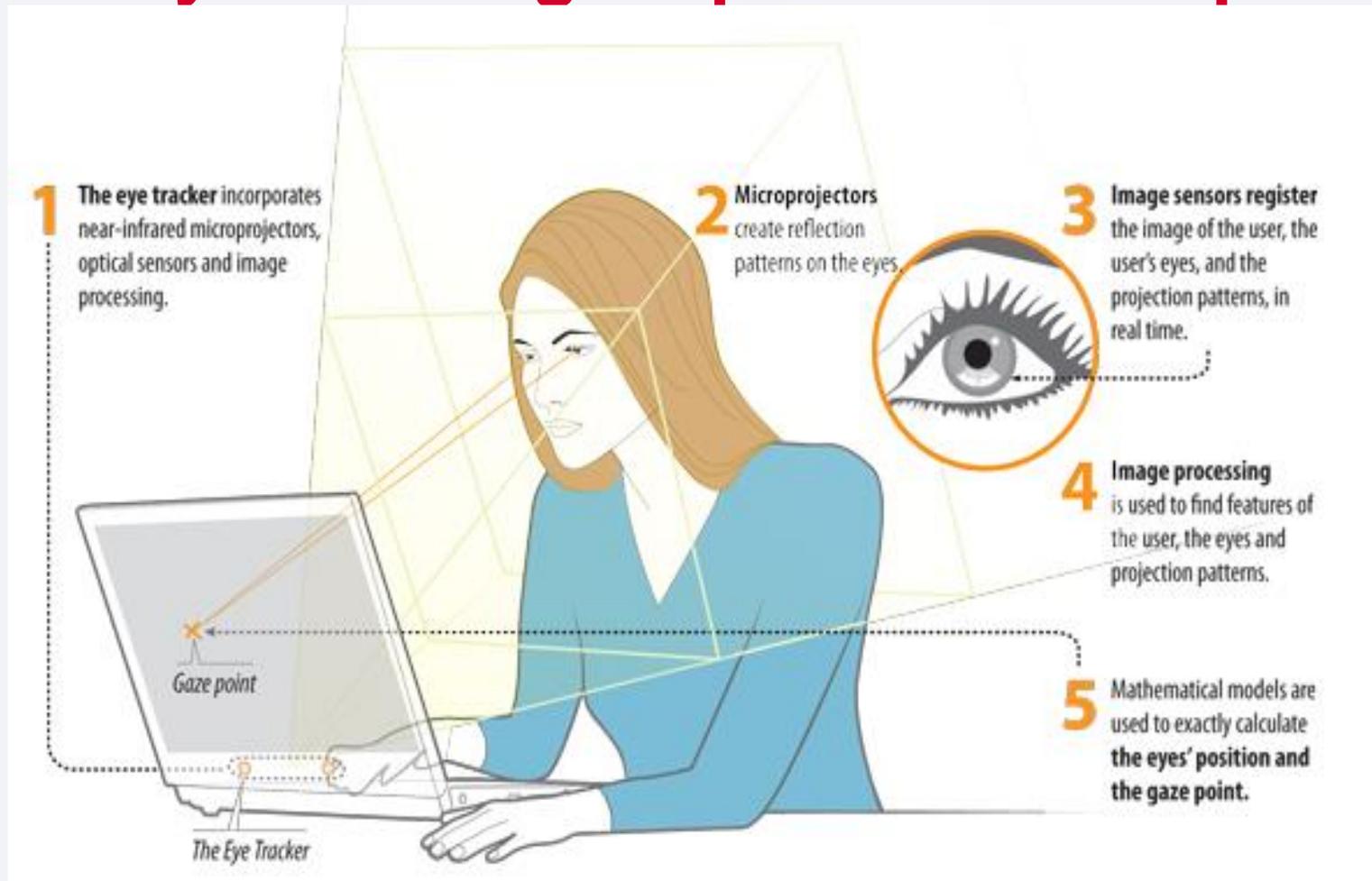


# Eye tracking: what do we measure?

## Popular eye tracking metrics

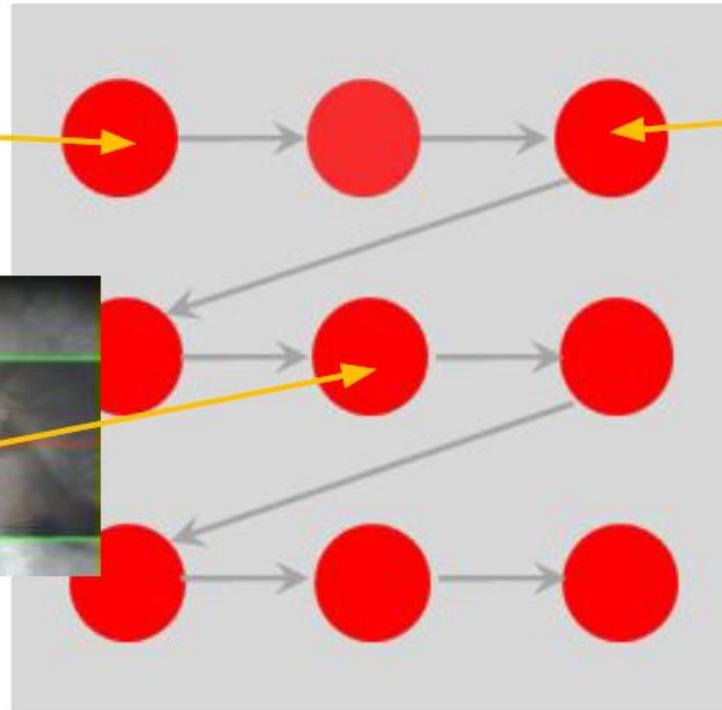
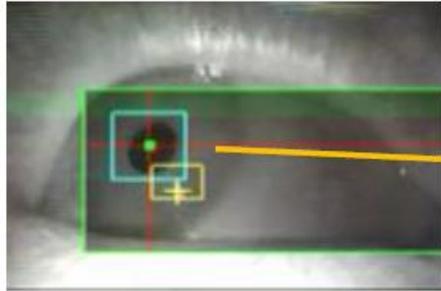
- Ratio: Percentage of respondents who looked at the AOI at all
- Time to first fixation (TTFF)/ Hit time: Time lapse until the AOI was seen the first time
- Dwell time: Time spent looking at the AOI
- Fixation counts and average duration of fixation: How many fixations it took to take in information, and how long they were
- Revisits: How often respondents looked back to the AOI

# Eye tracking: experiment setup

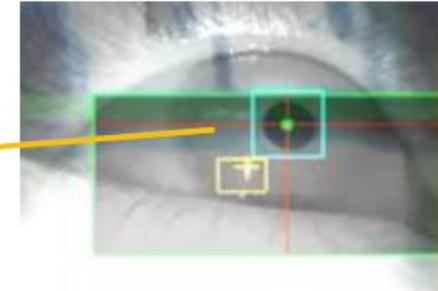


# Eye tracking: calibrating for precision

## The calibration



Calibration points displayed on screen

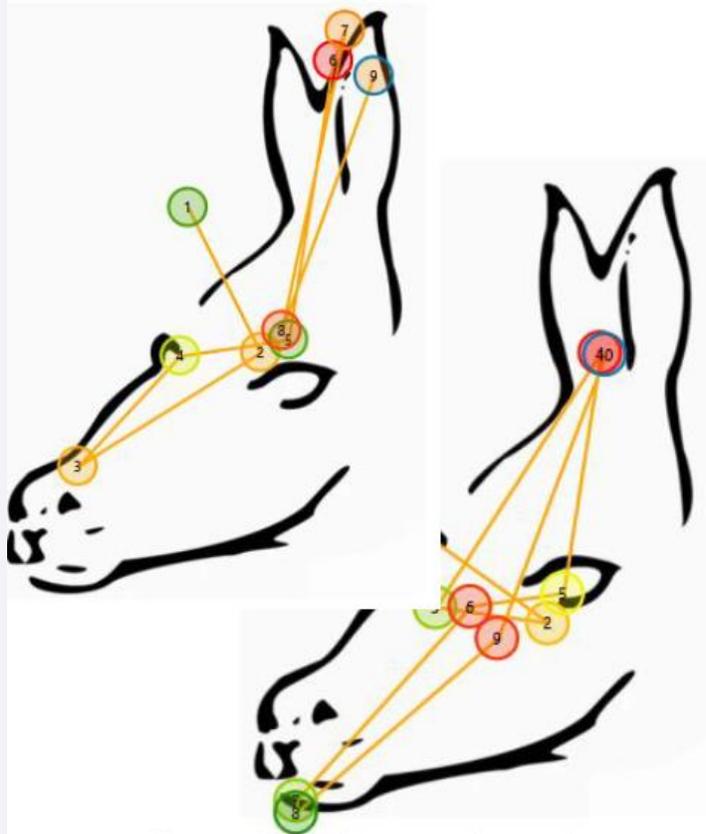


The eye tracker measures eye position and light reflection via light/dark pupil illumination and applies measurements to an internal 3D model of the eye.

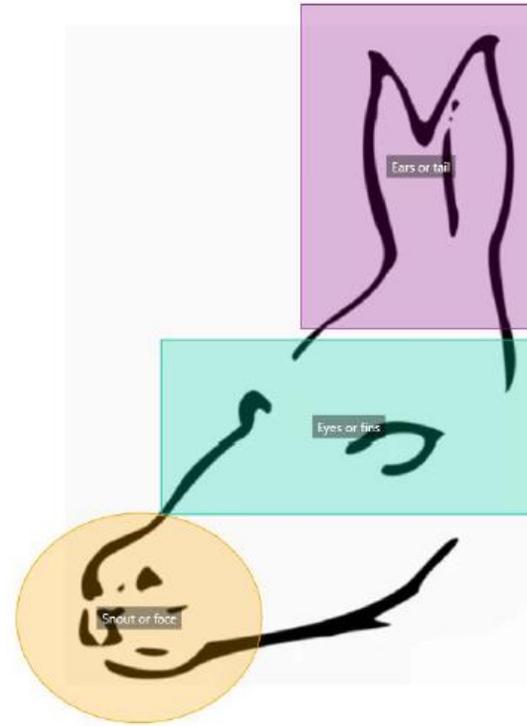
Goal is to maximize accuracy for each individual respondent's unique physiology.

# Eye tracking: AOI and data collection

## From gaze recordings to actual metrics



1. Collect individual respondents' data



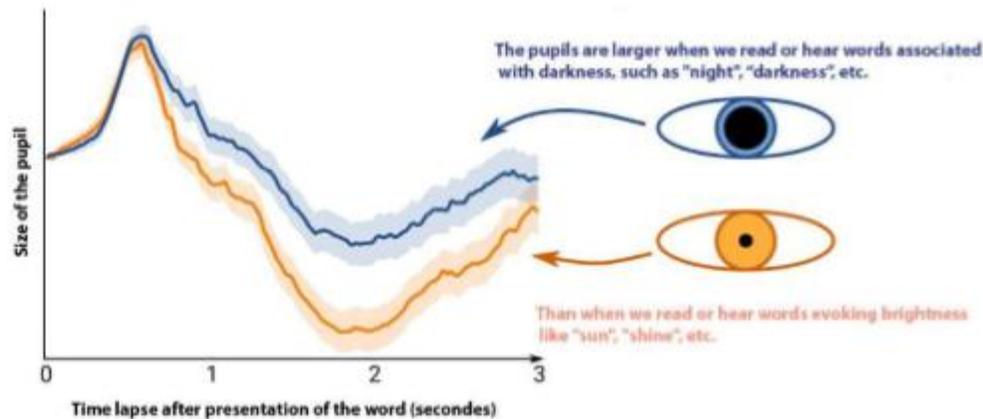
2. Define Areas of Interest (AOI)

# AOI metrics ***	Eyes or fins	Ears or tail	Snout or face
<b>Information</b>			
AOI duration (ms)	3773.4	3773.4	3773.4
AOI duration (%)	100	100	100
Size (cm <sup>2</sup> )	19.5	23.4	12.1
Size (%)	3.6	4.3	2.2
Respondent base	3	3	3
<b>Gaze based metrics</b>			
Respondent ratio (%)	66.7	100	66.7
Dwell count	3	1.7	1
Hit time AOI (ms)	99.7	1074.7	2089.8
Dwell time (ms)	2475.5	1509.6	495.5
First dwell duration (ms)	877.5	942.2	468.1
Skip count	0	0	0
<b>Fixation based metrics</b>			
Respondent ratio (%)	66.7	100	66.7
Dwells with fixations	2.5	1.7	1
Revisit count	1.5	0.7	0
Fixation count	5.5	2	1.5
TFFF AOI (ms)	81.9	1098.5	2013.8
Dwell time (ms)	2742.3	1414.7	482.2
Dwell time (%)	50	38.6	8.7
First fixation duration (ms)	354.2	650.6	451.8

3. iMotions computes eye tracking metrics

# Eye tracking: pupillary response

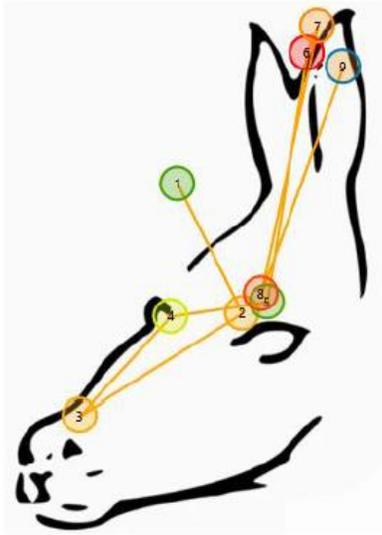
- Cognitive load
- Excitement



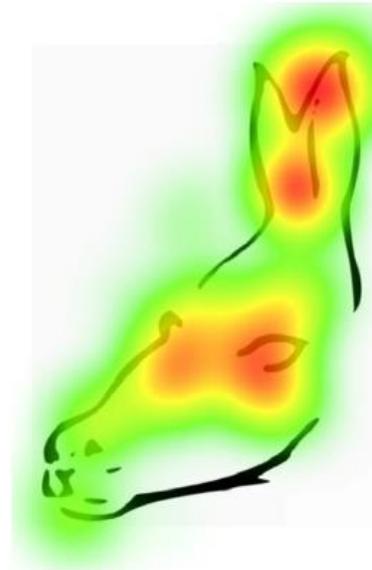
Eye trackers can detect the task-evoked pupillary response: subtle changes in pupil size which indicate cognitive load.

# Eye tracking: individual vs collective data

## Individual vs. aggregated data



- Scanpaths show the **individual** respondent's eye tracking data.
- Tell you the order in which a single person explored the content.
- Help understanding the individual user journey.
- Carry information about **sequences**, but only at the individual level.
- Can be reviewed dynamically as well as a static gaze plot.

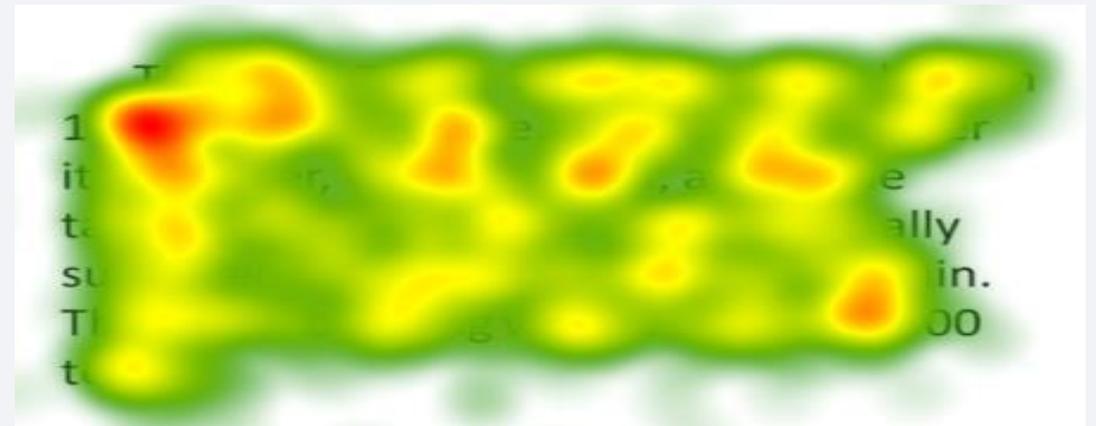


- Heatmaps are an **aggregation**, the sum of all respondents' eye tracking data.
- Tell you where most attention was paid to.
- No information about quantities or sequences.
- Purely **qualitative** visualization.

# Eye tracking: skimming vs reading

The Colosseum in Rome, Italy was built during the Roman Empire and can hold 50,000 people. During the 16<sup>th</sup> century, it was almost turned into a wool factory. It was completed 80 A.D., under the rule of Titus. Today it is a major tourist attraction.

The Eiffel tower is an iron tower built in 1889 in Paris, France. It was named after its designer, Gustave Eiffel, and is the tallest building in Paris. It was originally supposed to be built in Barcelona, Spain. The entire building weighs about 10,000 tons.

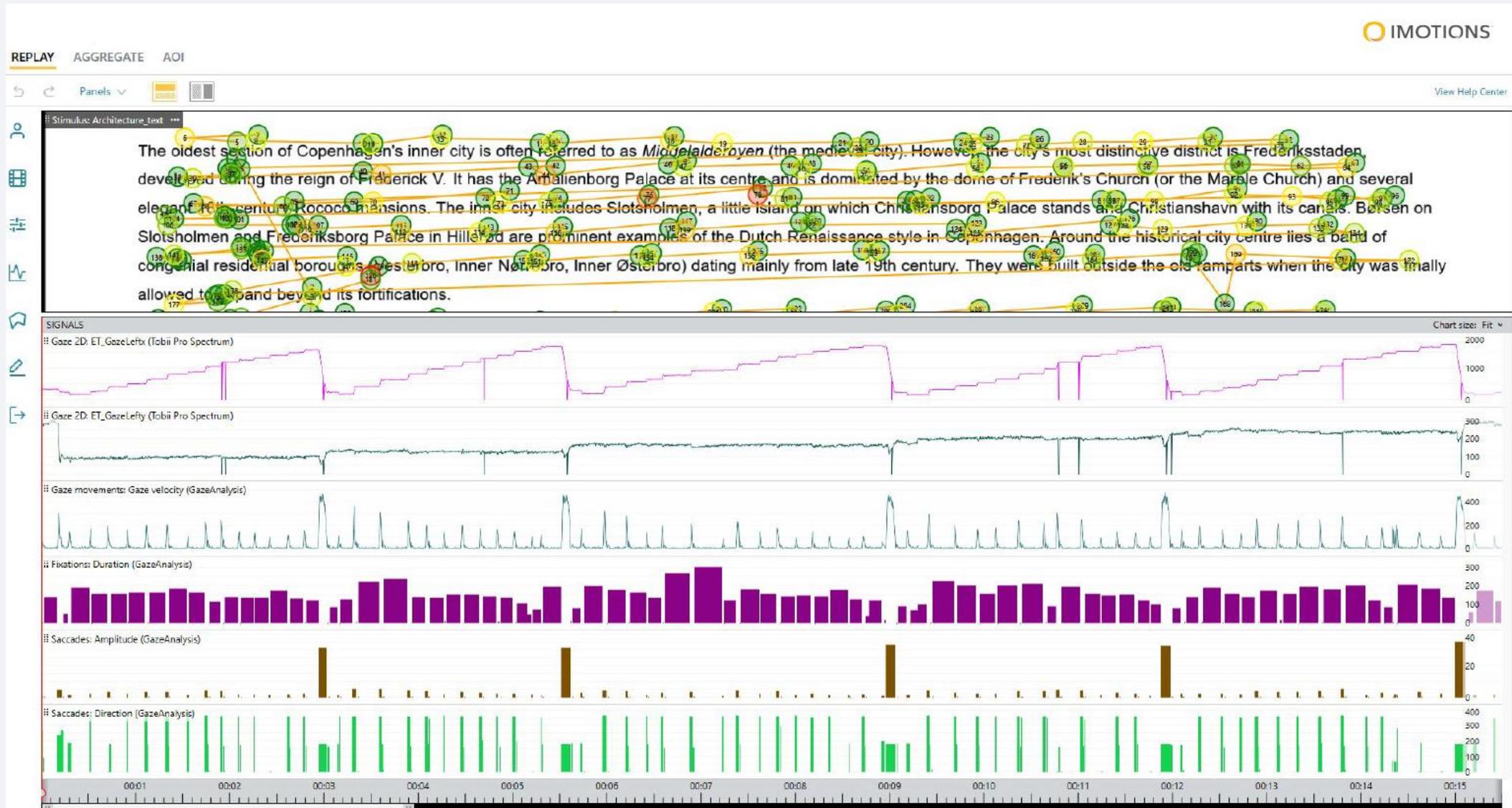


# Eye tracking: thinking aloud

- Think aloud (TA) vs retrospective TA (RTA)

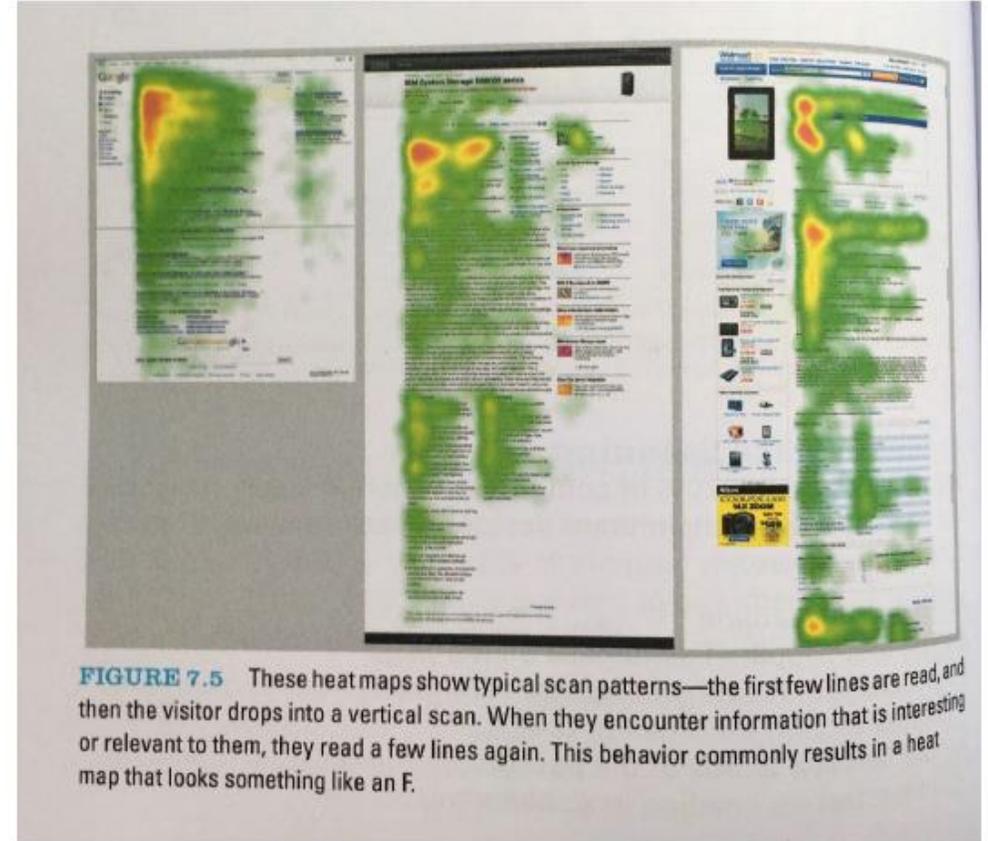
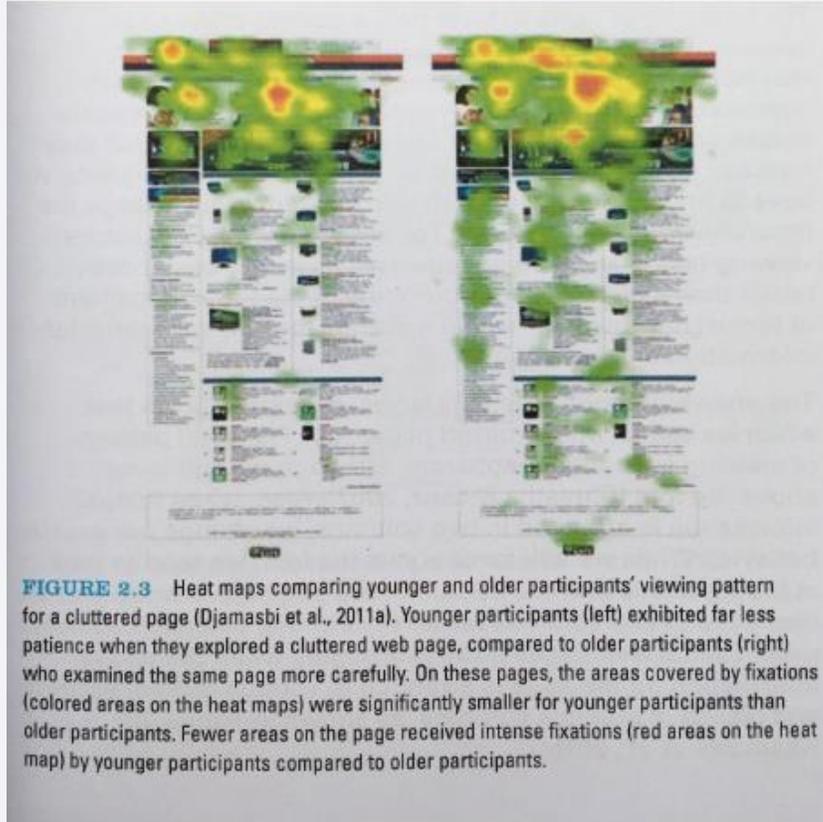


# Eye tracking: analysing with *iMotions*® software



# Eye tracking: practical implications

People rarely explore the entire website



- Are users reading below the fold?
- How do groups differ?

**Coming next:  
the use of eye tracking  
in mathematics education**