Eyetracking

Focus: *eyetracking during reading*

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Program

Time	Part	Program		Room
10:30-11:20	Part I	Introduction		1.306
11:30-12:00	Part II	Groups A, B, and C: Experimental Materials and Interest Areas	Group D: Lab (11:30)	Experimental Materials and Interest Areas: 1.306 Lab: 3.330
			Group E: Lab (11:40)	
			Group F: Lab (11:50)	
12:05-12:35		Groups D, E, and F: Experimental Materials and Interest Areas	Group A: Lab (12:05)	
			Group B: Lab (12:15)	
			Group C: Lab (12:25)	
12:40-13:30	Part III	Data Preparation with Data Viewer		1.306

Outline Introduction

- Eye movements: What and Why?
- Eyetracking History
- Eyetracking Techniques
- Eye Movements During Reading: General Characteristics
- Eyetracking in Psycholinguistic Research
- Lab-Prep

Eyetracking

Definitions

Eyetracking is the process of measuring the motion of an eye relative to the head.

An **eye tracker** is a device for measuring eye movements.

Source: https://en.wikipedia.org/wiki/Eye_tracking

Eyetracking

What are eye movements?

They are the interplay of…

1. Saccades: Fast eye movements (up to 700°/sec.)
2. Fixations: Eye is standing (relatively) still

But there are various other types of eye movements!

Other Eye Movements

Even during a fixation, the eye is never still

- Nystagmus: tremor of the eye
  - Can be pathological
  - Optokinetic nystagmus: observing landscape out of a moving train
- Drifts: small slow movements away from the fixated point
- Micro saccades: quick correcting movements

Other Eye Movements

Pursuit eye movements

- Eyes follow a moving target
- Much slower than saccades

Vergence eye movements

- Eyes are moving inward to fixate a close object

Vestibular eye movements

- Eyes rotate to compensate for head and body movements

Other Eye Movements

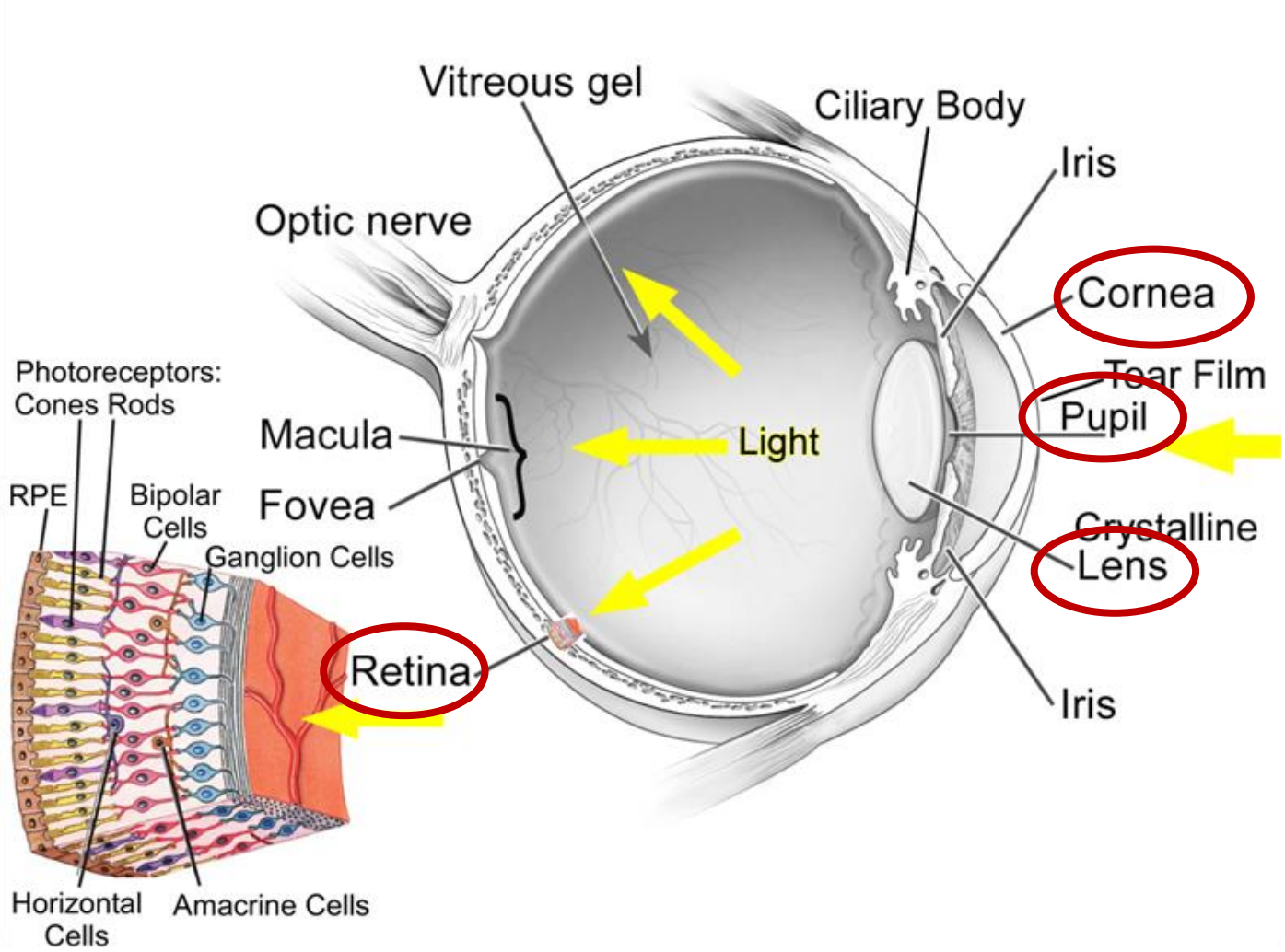
For information processing we are interested in (the interplay of) saccades and fixations!

Eyetracking

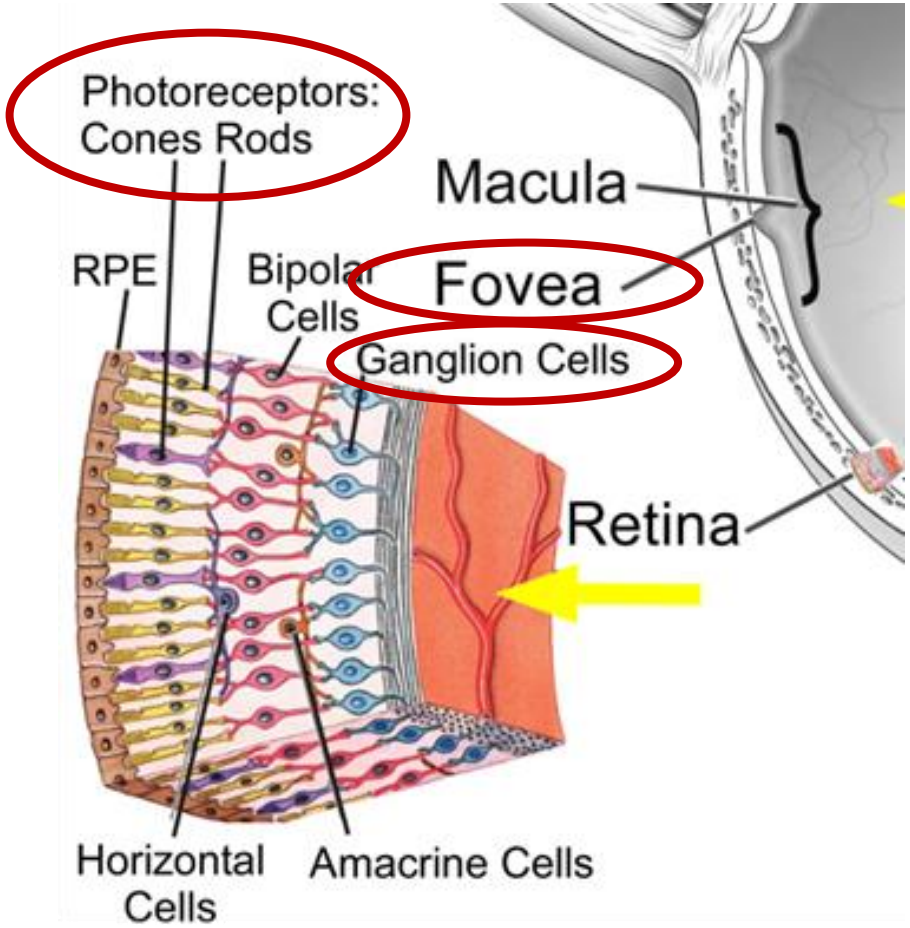
Why do we make eye movements?

- Anatomy of the eye
- Consequences for the visual field

Anatomy of the Eye



Anatomy of the Eye



Retina

- Photoreceptors and nerve cells (Ganglion Cells)

Fovea

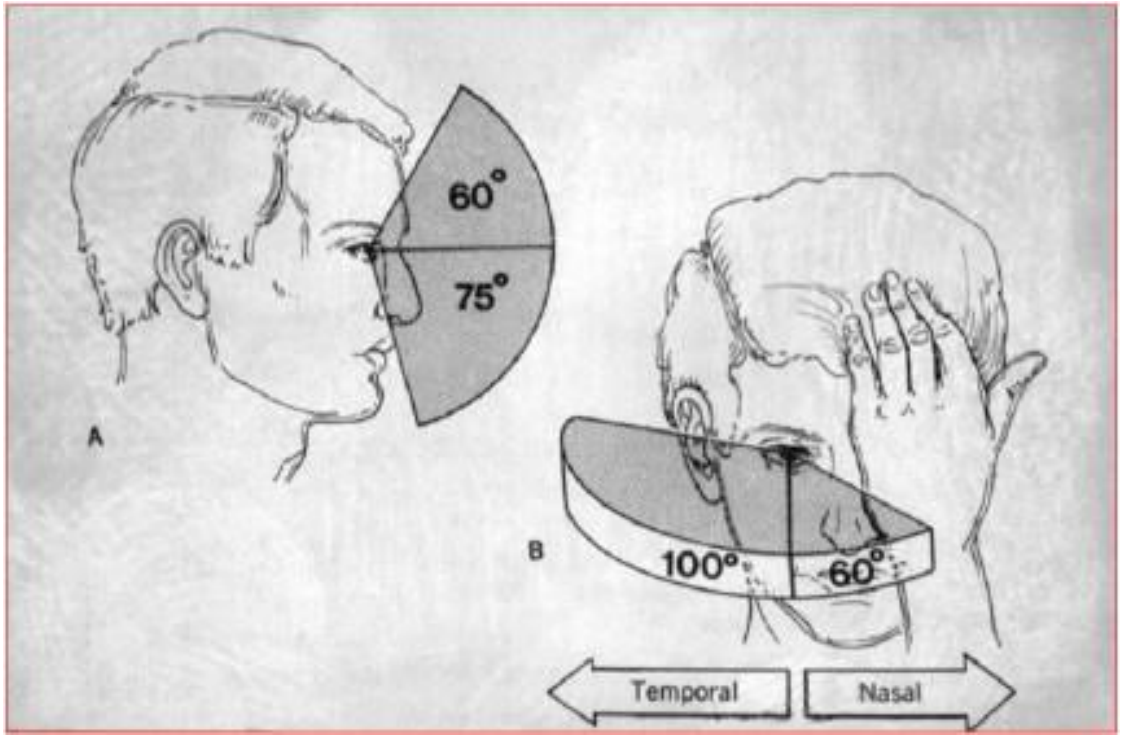
- Special area of the retina
- 1:1 relation of photoreceptors and nerve cells

➢ Highest resolution / highest visual acuity reached

Consequences for the Visual Field

Visual field

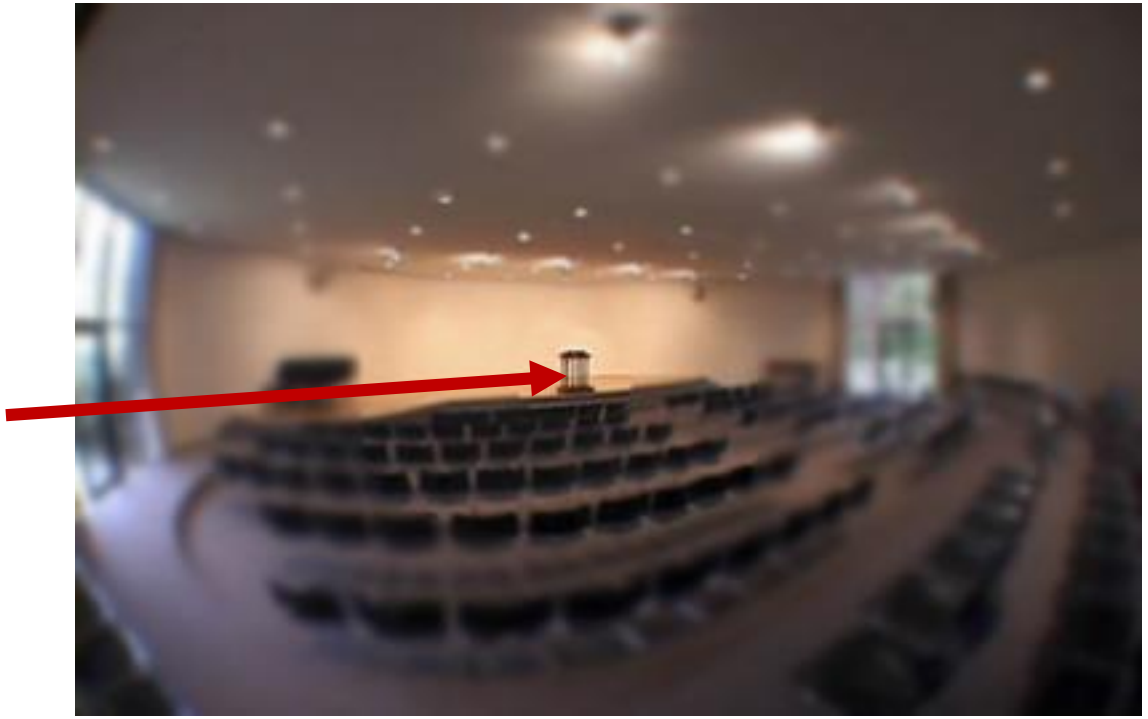
- Visual environment represented on the retina when fixating one point
- Vertical orientation: 130°
- Horizontal orientation: 180°
- From the fixated point, the visual field can be divided into three areas
    1. Fovea
    2. Parafovea
    3. Peripheria



Areas of the Visual Field

1. **Fovea**

- Up to 2° around the point fixated
- Sharp vision
- Size of your thumb nail when stretching out your arm



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Areas of the Visual Field

2. Parafovea

- Up to 5° around the point fixated
- Vision less clear

Areas of the Visual Field

3. Peripheria

- Remaining area of the visual field
- Blurry vision

Eye Movements on a Visual Scene

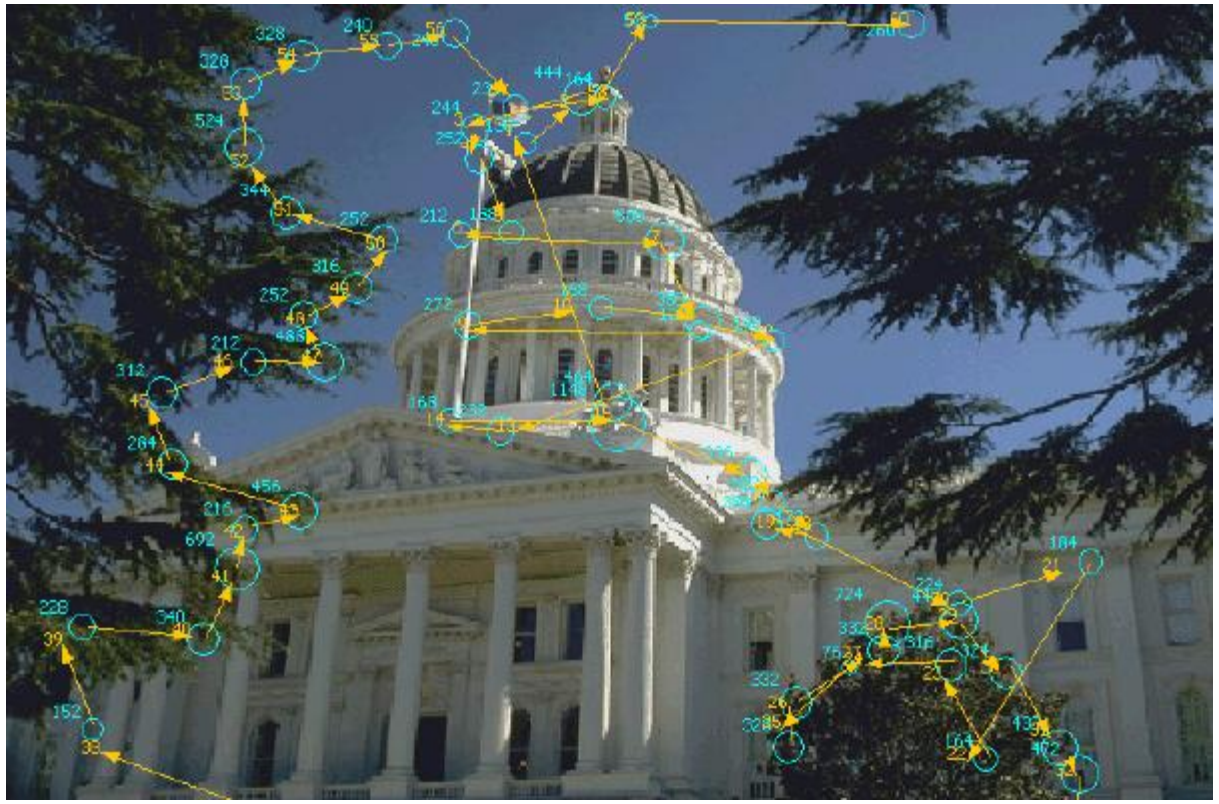
We need to make eye movement in order to perceive all the details of a visual scene!

Saccadic supression

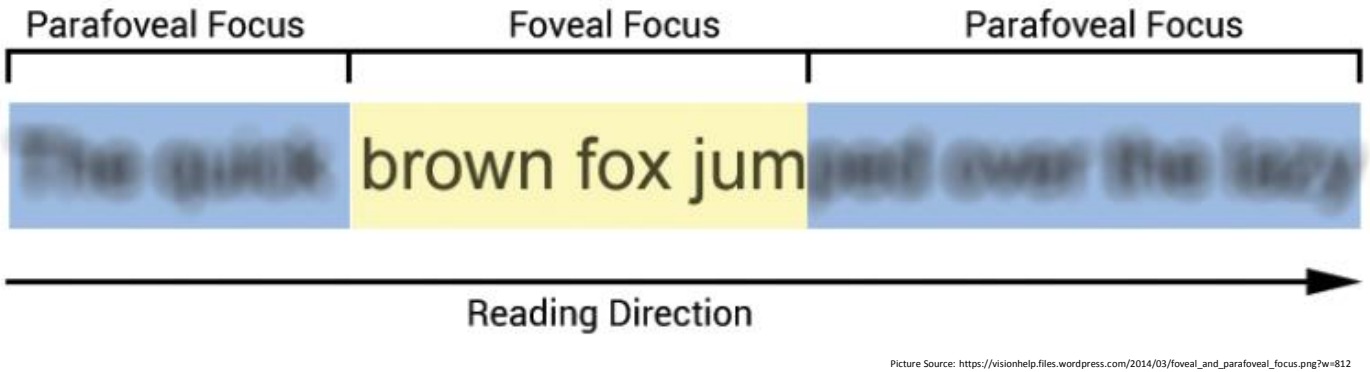
- Reduced sensitivity for visual input during a saccade

How come we perceive the world as one coherent visual scene?

- Brain “puts together the picture”



Consequences for Reading



Picture Source: https://visionhelp.files.wordpress.com/2014/03/foveal_and_parafoveal_focus.png?w=812

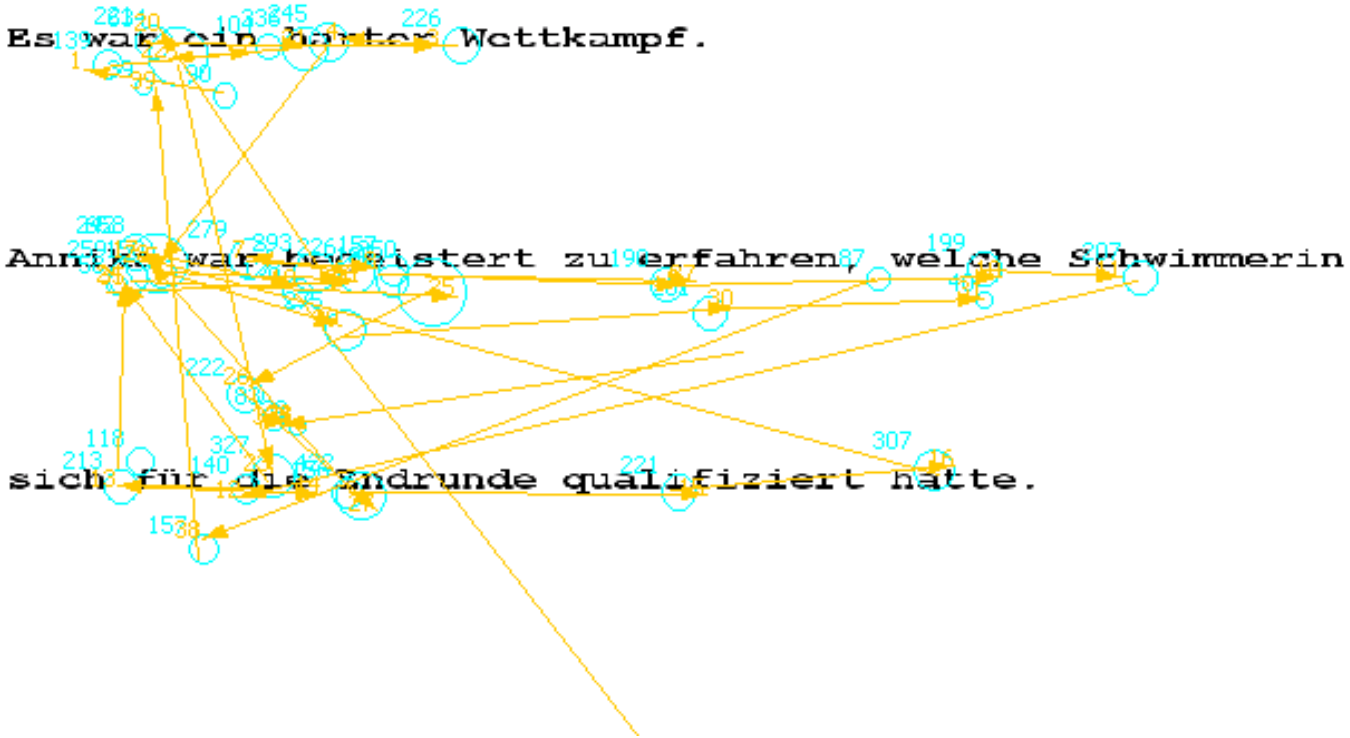
Fovea

- Letters clearly recognizable

Parafovea

- Letters cannot be seen sharply, but (partly) recognizable

Eye Movements on a Text



Interest in Eye Movements

Why observe eye movements?

Interest in Eye Movements

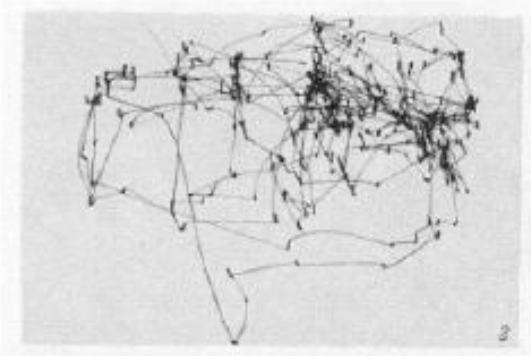
General assumption: Relation to attention

- Fovea is placed on the object of interest
- Focus placements as indirect measure of the **orientation of attention**

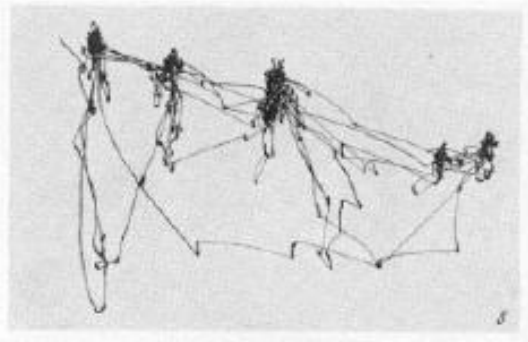
Interest in Eye Movements

Yarbus (1967)

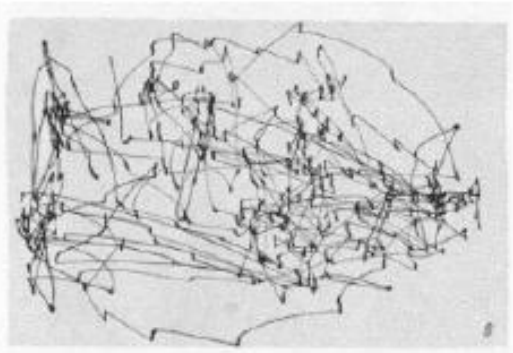
„The Unexpected visitor“



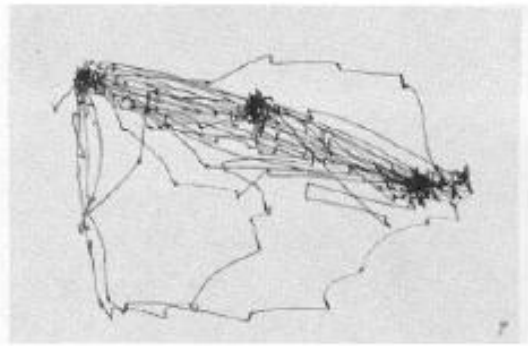
„Schätze materiellen Wohlstand“



„Schätze Alter“



„Erinnere Position“



„Wie lange war „Unexpected visitor weg?“

Picture Source: VL Prof. Sommer WS 12/13

Interest in Eye Movements

Indirect measure of cognitive processes

Presence of dreams

- REM sleep: Probability of reporting dreams increases from 7% to 80%

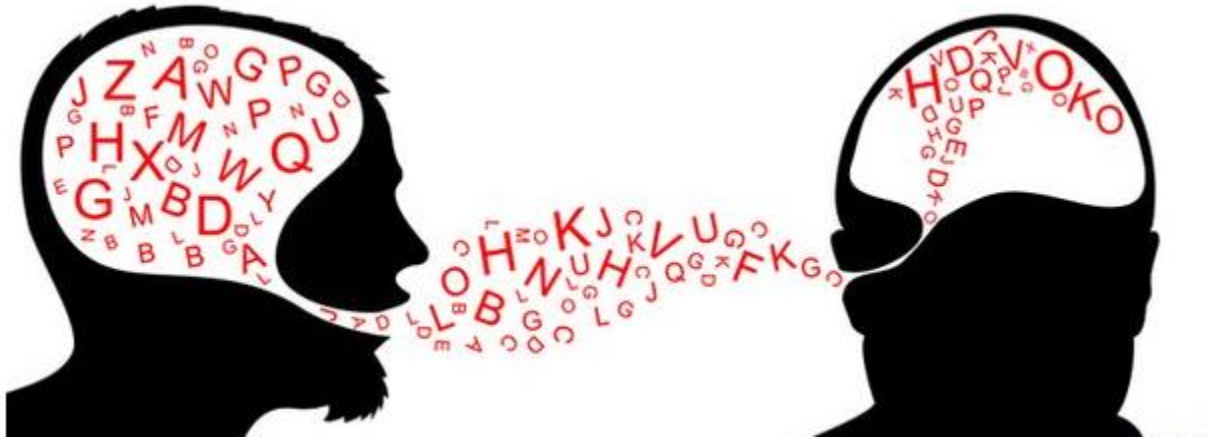
„Acting out“ of mental images

- When listening to stories that contained movement information, participants moved their eyes into the respective direction (Spivey & Geng, 2001)

Interest in Eye Movements

Eye movements and language processing

- Information on cognitive processes involved in language processing
- Moment-to-moment (*online*-) measuring provides information on the temporal order of these processes



Picture Source:
http://www.attensity.com/wordpress/wp-content/uploads/2015/06/Screen-Shot-2015-06-19-at-4.21.14-PM.png

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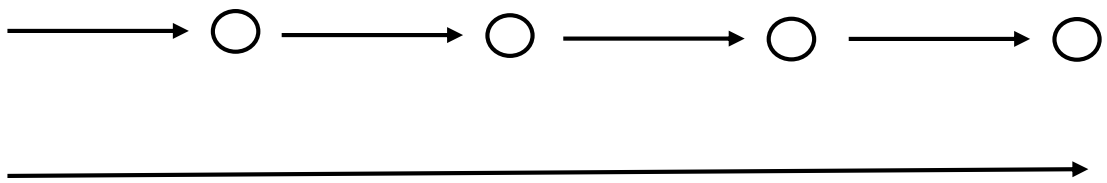
History Eyetracking During Reading

Émile Javal (1839-1907)

- French eye specialist and politician
- Director of the ophthalmological laboratory at Sorbonne University (1878-1900)
- Given credit for the discovery of the interplay of saccades and fixations during reading



History Eyetracking During Reading

Examples provided by Wade & Tatler (2009)

"Until the research of Emil Javal (1839-1907), the French oculist, it had been believed that the eyes move across text in one continuous and smooth movement." (Reed and Meyer, 2007, p. 162)

"By 1879, experiments undertaken by Emile Javal in France at the University of Paris had led to the discovery that the eyes of a reader do not move smoothly over a line of print, as one might think, but actually take little leaps across the line being read." (Monaghan, 2007, p. 10)

History Eyetracking During Reading

Wade and Tatler (2009)

- No evidence of this in Javal's writing!
- Evidence for the first use of the term "saccades" in relation to eye movements (common word in French, meaning "jerk") when describing work by M. Lamare

> "Following the research of M. Lamare in our laboratory, the eye makes several saccades during the passage over each line, about one for every 15-18 letters of text. It is probable that in myopes the eye reacts with a rapid change in accommodation with every one of these saccades" (1879e, p. 252).

- Javal can be given credit for having used the word saccade for the first time, but he was not the one who conducted the experiments
- There are two "unsung saccadic heroes"

The Unsung Saccadic Heroes

M. Lamare

- Very little information on him available
- Discovered saccades in Javal‘s laboratory

Ewald Hering (1834-1918)

- German physiologist
- 1879: described jerky eye movements when eyes go over a line of text

Eyetracking History

Three eras of eye movement research (Rayner 1998)

First Era

- 1879 (first observations on eye movements during reading) – 1920
- Discovery of basic facts on eye movements
  - Saccadic suppression
  - Saccadic latency
  - Size of perceptual span

Eyetracking History

Three eras of eye movement research

Second Era

- 1920 - 1950
- Time of behaviorist movement in psychology
- Little research on the relation of eye movements and cognitive processes, but on eye movements per se
- Miles Tinker (1958): Everything that can be learned about reading from eye movements has been discovered

Eyetracking History

Three eras of eye movement research

Third Era

- Mid 1970 - today
- Technical improvements
  - Eye movement recording becomes more accurate and easier to conduct
- Together with development of theories of language processing: Today a tool for understanding underlying cognitive processes

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Eyetracking Techniques

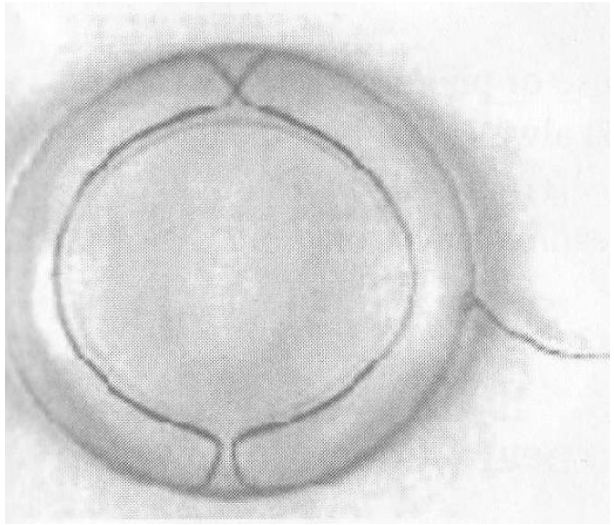
Early methods

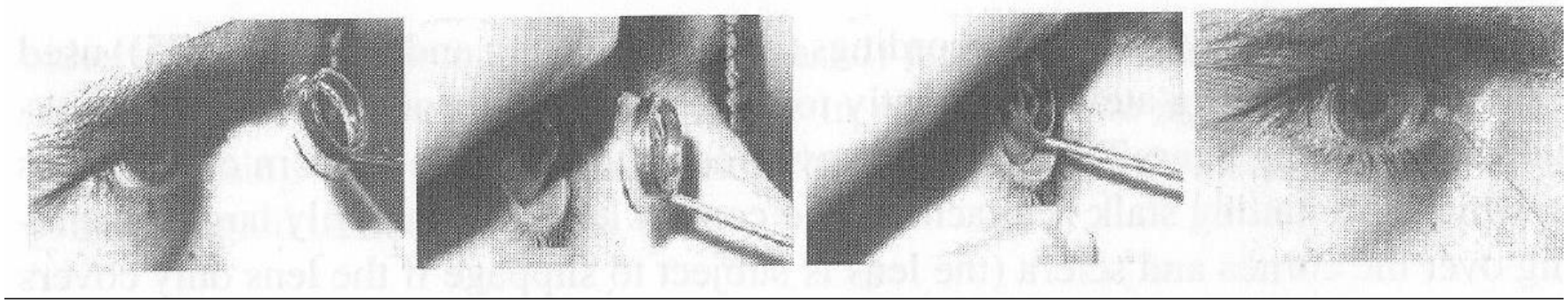
- Earliest eye trackers built in the late 1800s
- Invasive (measuring of the movement of an object in the eye)
- Uncomfortable for the participant: Delabarre (1898) solution with cocaine to anaesthetize the eyeball
- Before photographing / camera techniques were used: Auditory techniques more promising

Eyetracking Techniques

Contact lenses method (1950s)

- Contact lens with wire coil
- Eye movements within electromagnetic field
- Advantage: very precise

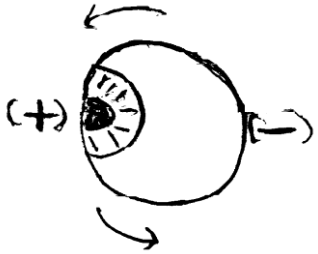


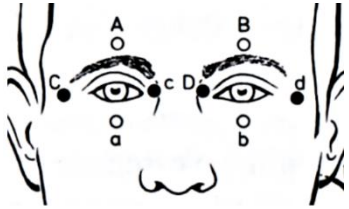


Picture Source: Duchowski (2007)

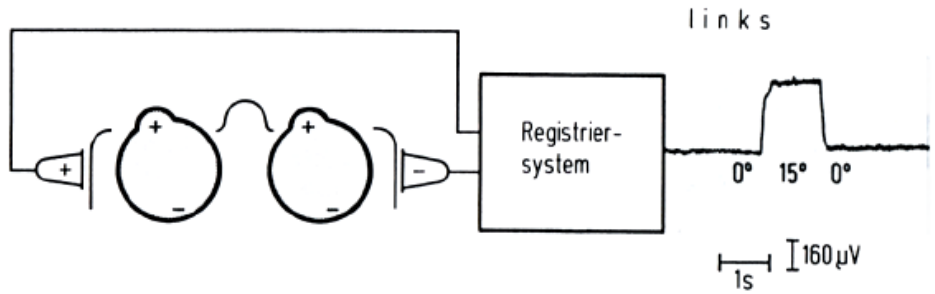
Eyetracking Techniques

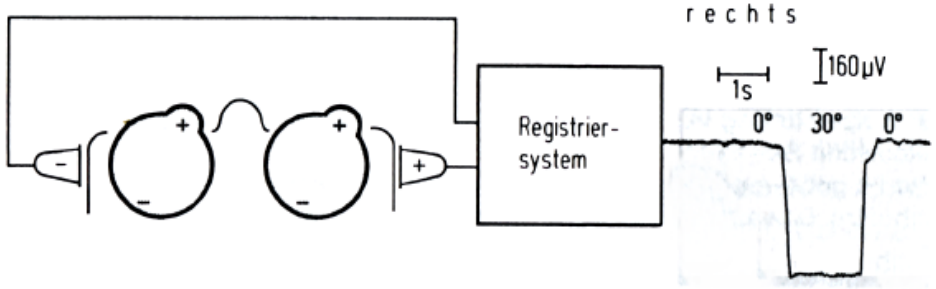
Electrooculography (EOG)





- Eyeball: Dipole
- Resting position: Poles symmetric to electrodes
- Eye movements cause potential differences which can be measured
- Disadvantage: less precise



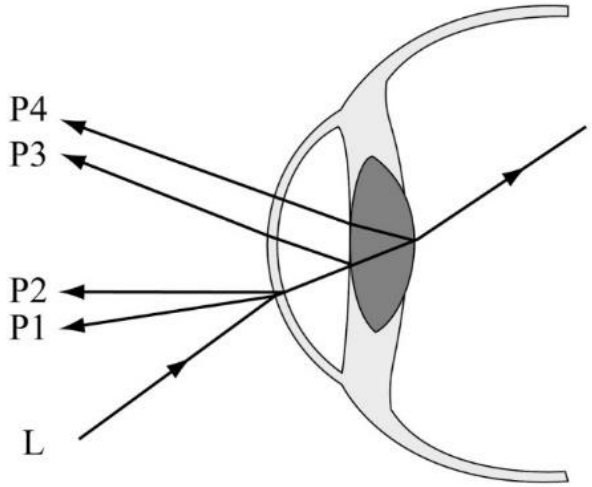


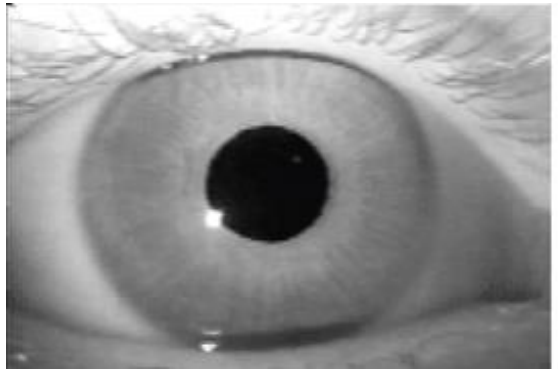
Picture Source: VL Prof. Sommer WS 12/13;
http://images.google.de/imgres?imgurl=http%3A%2F%2Fwww.susqneuro.com%2Fpublications%2Fdizzy%2F7eye.gif&imgrefurl=http%3A%2F%2Fwww.susqneuro.com%2Fpublications%2Fdizzy%2F&h=612&w=752&tbnid=ukENjFQWNn_UpM%3A&docid=ceXk7mOia4icIM&ei=KZTEVomHIi6nt6QTu35D4Cw&tbm=isch&iact=rc&uact=3&dur=923&page=1&start=0&ndsp=55&ved=0ahUKEwjJv53ukP_KAhWpdpoKHe4vBL8QrQMIMzAH

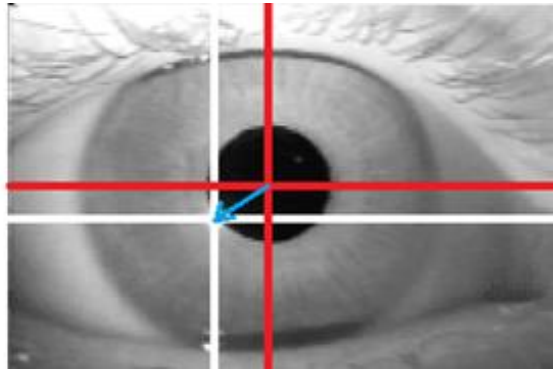
Eyetracking Techniques

Video-based approaches

- Camera recording the eye
- Light source projected onto the eye (infrared light)
- Light reflected by cornea (and lens)
- Position of the eye: Calculated based on relation of corneal reflection and middle of pupil







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Eye Movements During Reading: Characteristics

Task	Mean fixation duration (ms)	Mean saccadic size (degree)
Silent reading	225	2 (about 8 letters)
Oral reading	275	1.5 (about 6 letters)
Scene perception	330	-
Music reading	375	-

(Rayner, 1998)

Eye Movements During Reading: Characteristics

Skipping words

- Most words in a text are fixated, some are skipped
  - Content words: fixated about 85% of the time
  - Function words: fixated about 85% of the time

Word length has an influence

- 2-3 letter words: fixated about 25% of the time
- 8 letter words: nearly always fixated

Eye Movements During Reading: Characteristics

Text line

- First fixation not on the beginning of the text line, but 5-7 letters to the right
- First fixation on a text line is longer, the last is shorter than the average fixation

Blank spaces

- Not fixated

Eye Movements During Reading: Characteristics

Regressions

- Mostly forward saccades (English: left to right)
- But 10-15% of saccades are regressions (English: right to left movements)
- Short regressions within a word
  - Correction of “overshooting”
  - Processing problems of the current word
- Longer regressions are likely to be related to (problems with) text comprehension

Eye Movements During Reading: Characteristics

With the increase of the conceptual difficulty of a text…

- Fixation duration increases
- Saccade length decreases
- Frequency of saccades increases

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Eyetracking in Linguistic Research

Two paradigms

Eyetracking during reading

- Participants read sentences on the screen
- Reading times of a specific word (a group of words) in different conditions
- (Scan-Path analysis)

Visual world eyetracking

Eyetracking in Linguistic Research

Eyetracking during reading

- Has been used extensively to study reading processes in psychology
- In linguistics, this method has been adopted to study both **word-level** and **sentence-level** phenomena
- Populations: Usually adults
  - Sometimes other populations, such as bilinguals

Eyetracking in Linguistic Research

Eyetracking during reading: word-level

- Processing of homonyms and homographs

Duffy, Morris & Rayner (1988)

- Question: Are multiple meanings of the word activated, and how is this affected by context?
- Presented both **ambiguous (and unambiguous)** lexical items
- Disambiguating context presented before or afterwards

Eyetracking in Linguistic Research

	Reading Times (Mean)	
	ambiguous (pitcher)	unambiguous (whiskey)
Disambiguating context before	264	264
Disambiguating context after	279	261

- Ambiguous lexical items are fixated for longer, but this is modulated by the prior context
- ➢ Multiple meanings are activated but (degree of) activation is influenced by context

Disambiguating context before	Because it was kept on the back of a high shelf, the **pitcher (whisky)** was often forgotten.
Disambiguating context after	Of course the **pitcher (whiskey)** was often forgotten, bacause it was kept on the back of a high shelf.

Eyetracking in Linguistic Research

Eyetracking during reading: sentence-level

- Used to look at various sentence-level phenomena in linguistics
- Dependency processing
  - Filler-gaps, reflexives, pronouns, subject-verb dependencies
- Influence of semantic information on incremental structure building

Eyetracking in Linguistic Research

Eyetracking during reading: sentence-level

- Used to look at various sentence-level phenomena in linguistics
- Dependency processing
  - Filler-gaps, reflexives, pronouns, subject-verb dependencies
- **Influence of semantic information on incremental structure building**
  - Is there a “syntax only” stage of comprehension which only takes structure into account and not context/semantics/plausibility?
  - To investigate this **garden-path sentences** have been particularly popular

Eyetracking in Linguistic Research

Pickering & Traxler (1998)

As the woman edited the magazine about fishing amused all the reporters.

As the woman sailed the magazine about fishing amused all the reporters.

- Initially favored analysis, noun phrase serves as the object of the preceding verb
  - *the woman edited the magazine*
- Correct analysis: noun phrase serves as the subject of a main clause
  - *the woman edited, the magazine…amused…*
- Plausibility of object analysis manipulated: implausible now

Eyetracking in Linguistic Research

Pickering & Traxler (1998)

As the woman edited the magazine about fishing amused all the reporters.

As the woman sailed the magazine about fishing amused all the reporters.

Findings

- Object analysis plausible: Disruption after disambiguation
- Object analysis implausible: Disruption during processing of the noun phrase

Conclusion

- Readers performed substantial semantic processing on the initial analysis and committed strongly when it was plausible

Eyetracking in Linguistic Research

Two paradigms

Eyetracking during reading

- Participants read sentences on the screen
- Reading times of a specific word (a group of words) in different conditions
- (Scan-Path analysis)

Visual world eyetracking

- Auditory presentation of words/sentences
- While participants look at visual scene

Eyetracking in Linguistic Research

Visual world eyetracking

Underlying assumption

- Eye–mind hypothesis: We fixate on things we are mentally paying attention to

Common research questions addressed

- Questions about sentence processing
- In particular: prediction and the integration of semantic information during structure-building
- Also: pronoun resolution studies

Eyetracking in Linguistic Research

Visual world eyetracking

Advantage

- Does not require literacy skills
- Can be used with populations for whom reading (word or sentence) might be problematic
- Used often with children

Eyetracking in Linguistic Research

Altmann & Kamide (1999)

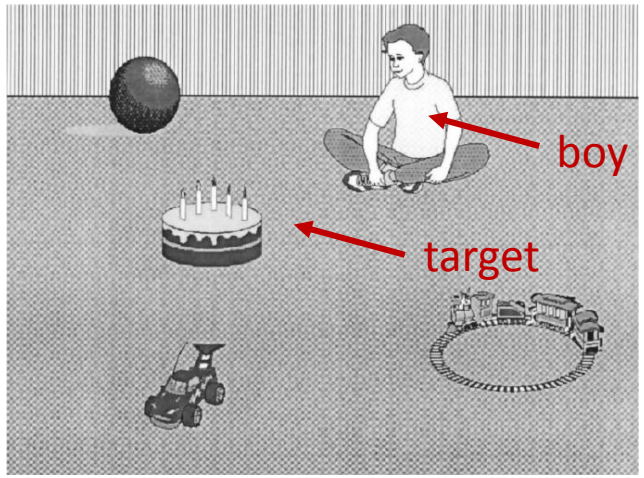
- Presentation of a visual scene
- Participants listened to sentences…

*The boy will **eat** the cake*

*The boy will **move** the cake*

Finding

- By the time participants heard the verb (**move**/**eat**): More fixations to the cake in the **eat**-condition



Conclusion

- Semantic information of the verb is used to predict the upcoming noun before it is heard

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Lab Preparation

- Video-based system
- Camera records corneal reflection

- Where is the camera placed?
- ➢ Different systems….

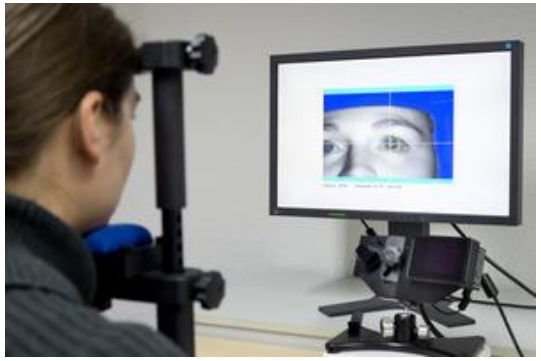
Position of the Camera

Monitor-mounted

SMI
(SensoMotoric
Instruments)

Tower-mounted

Table-mounted

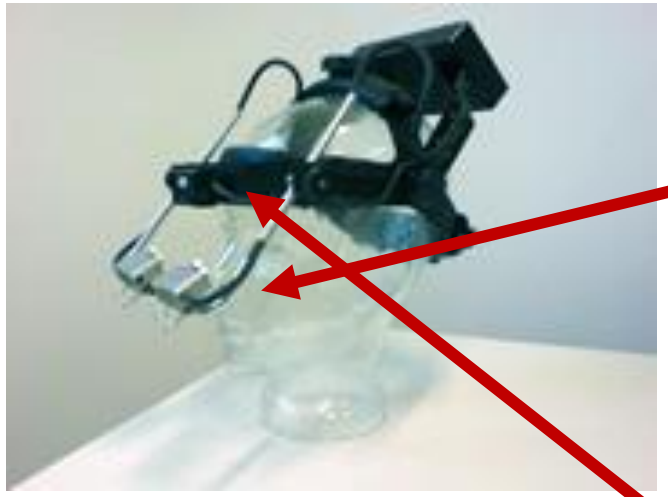


SR Research

Head-mounted

RED 250/500: http://www.eyetracking.com/Hardware/Eye-Tracker-List; SMI iView X™ Hi-Speed (http://www.smivision.com/en/gaze-and-eye-tracking-systems/products/iview-x-hi-speed.html); Eyelink 1000 Eyetracker, Photo: Thomas Roesez (AVZ, University of Potsdam); https://www.linguistik.hu-berlin.de/de/forschung/psyling-labor/et

Lab here



EyeLink I Eyetracker

Two eye cameras

- Directed towards the participant's eyes
- Monocular or binocular tracking possible

One head camera

- Directed in direction the participant is looking

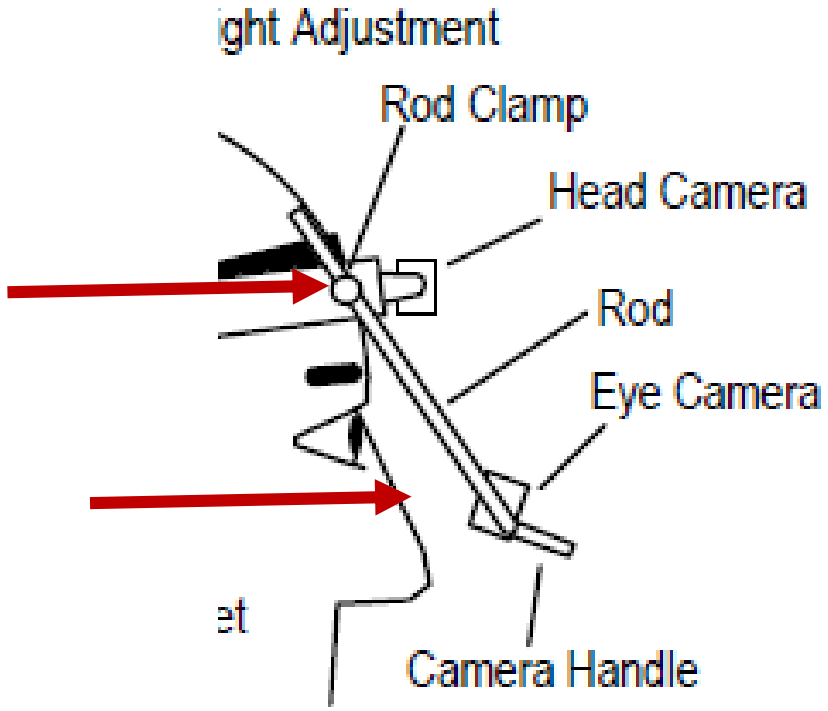
Cameras

Eye camera

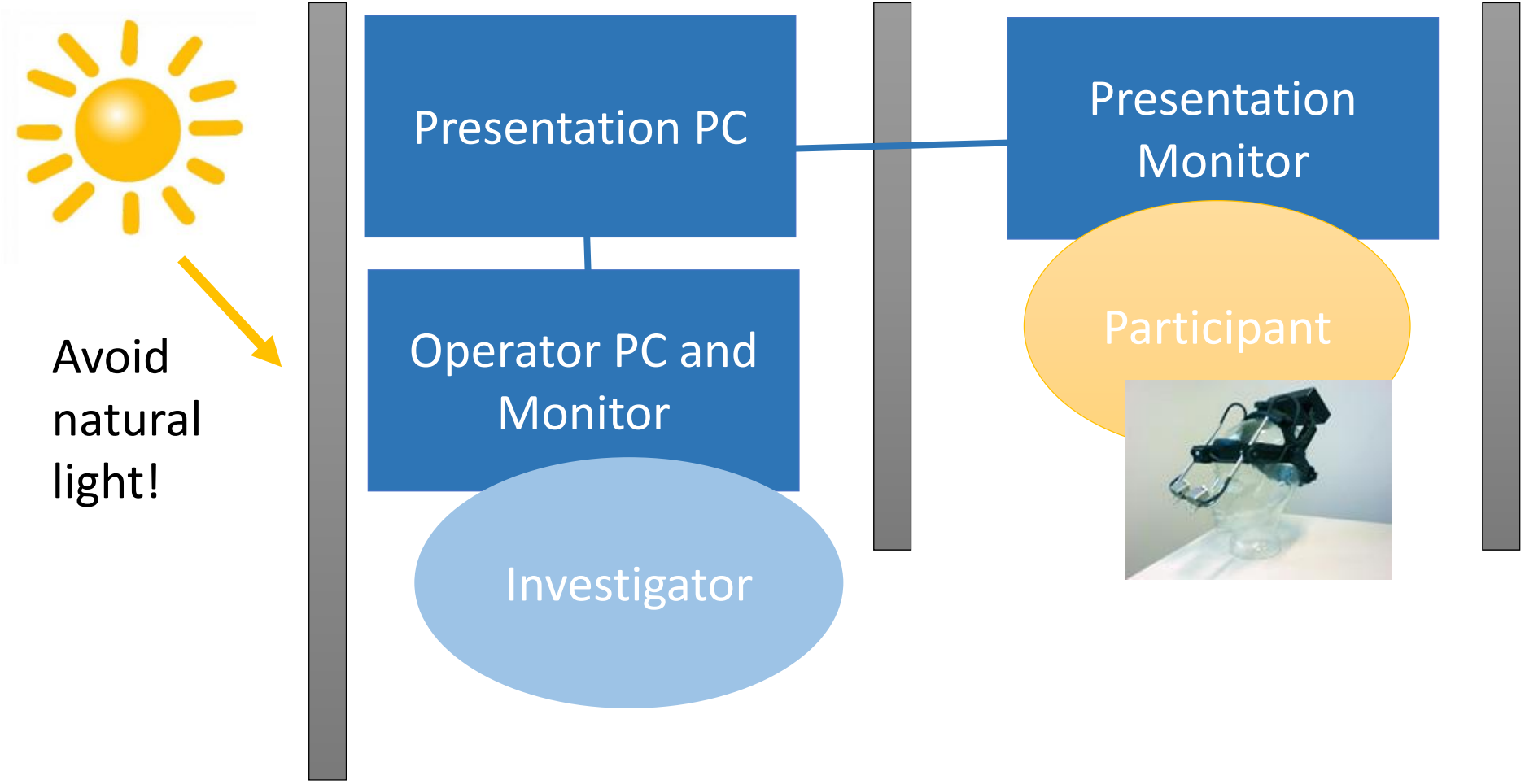
- Eye movement recording

Head camera

- Position of the head with the help of 4 reference points on the monitor
- Allows for compensation of head movements



Eyetracking Lab



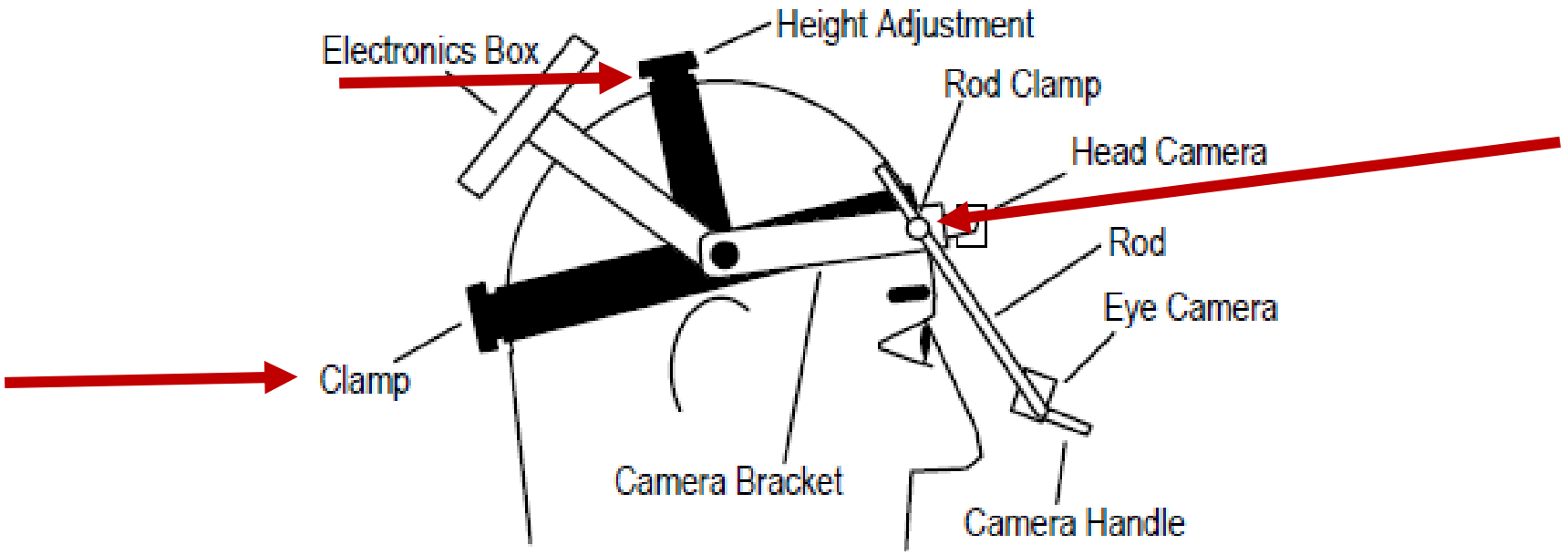
Picture Source: http://www.ingenieure-ohne-grenzen.org/de/Regionalgruppen/Mannheim/sonne

In the Lab: 7 Steps

1. Fitting the headband
2. Eye camera (just one eye!)
    - Adjusting position
    - Focusing
3. Setting pupil threshold
4. Head camera setup
5. Calibration and validation
6. Recording a test trial
7. Looking at the test trial

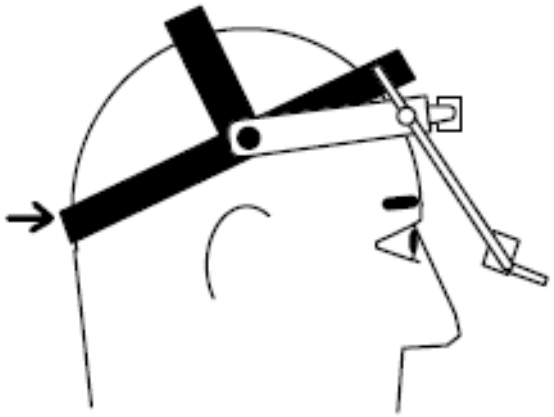
In the Lab

1. Fitting the headband

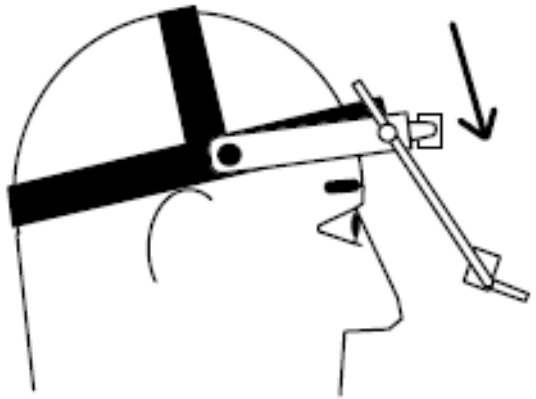


In the Lab

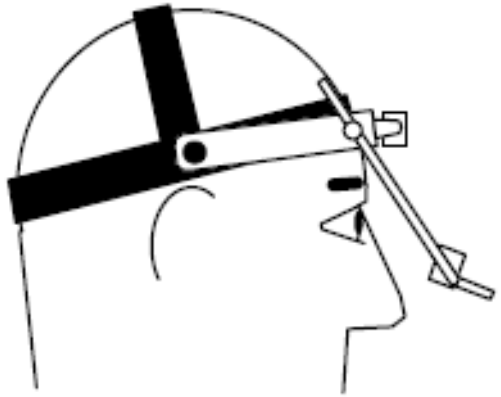
1. Fitting the headband



Open and place back against neck



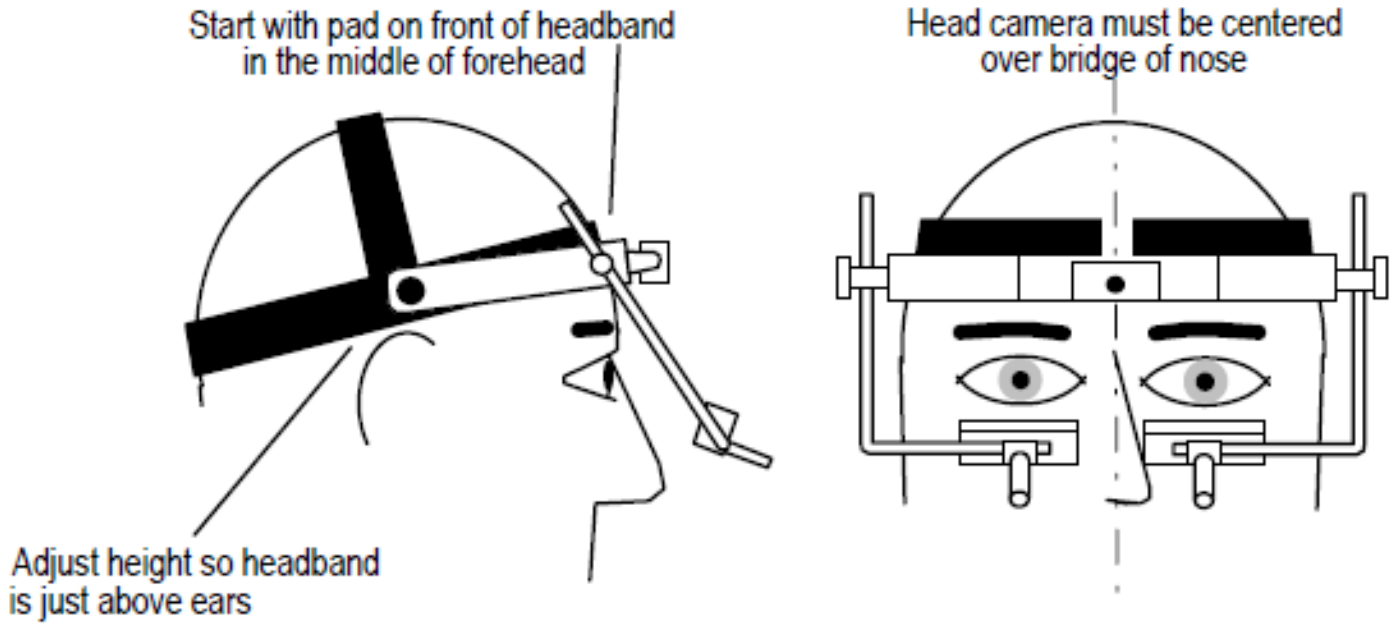
Lower front, hold back against neck
Check that cameras stay clear of eyes!



Tighten clamp at back of headband

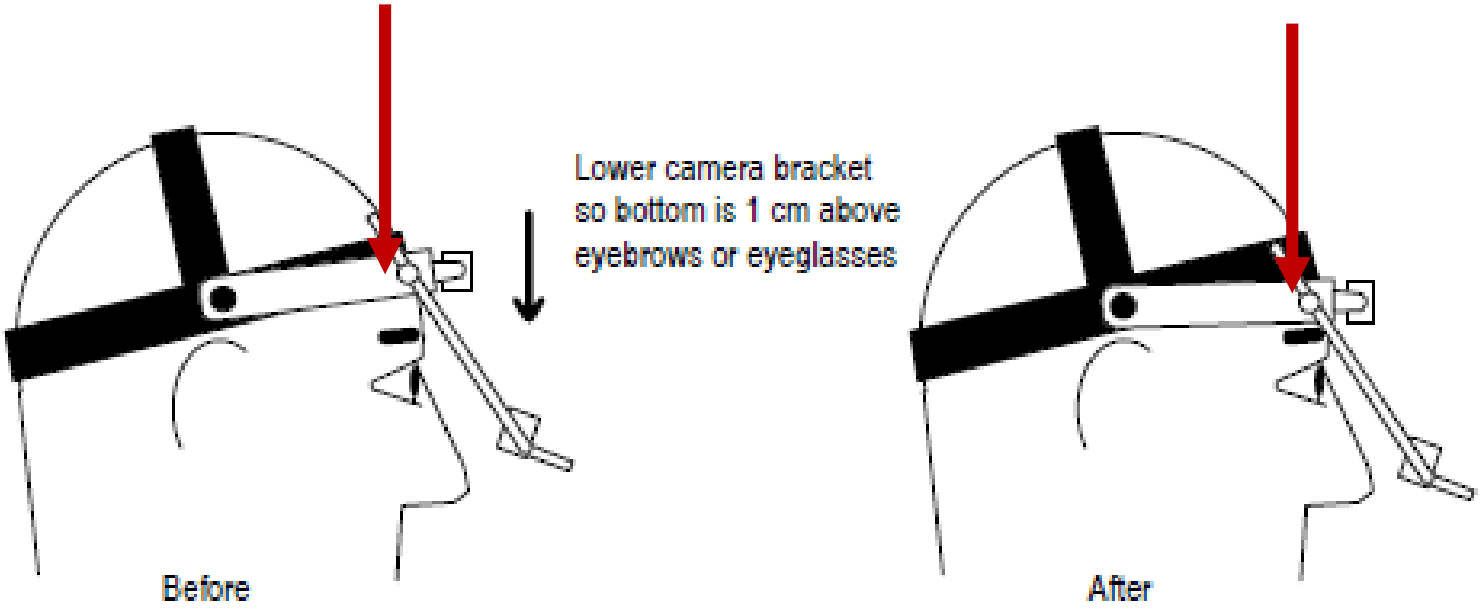
In the Lab

1. Fitting the headband



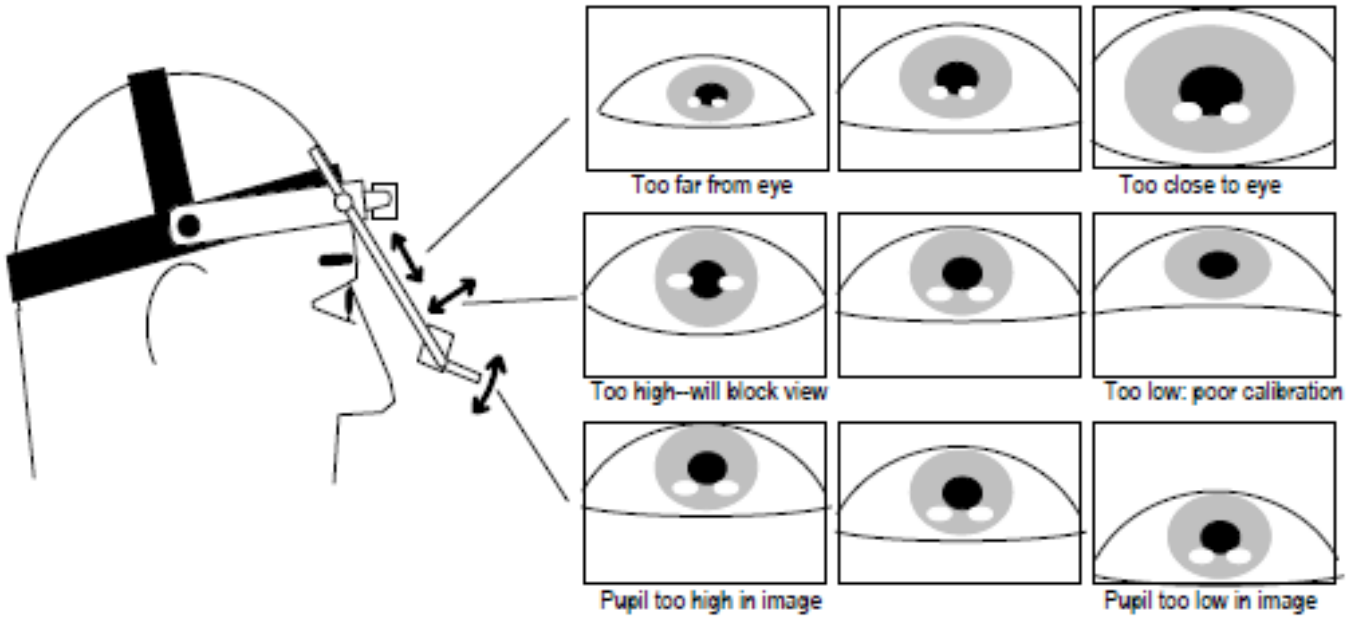
In the Lab

1. Fitting the headband



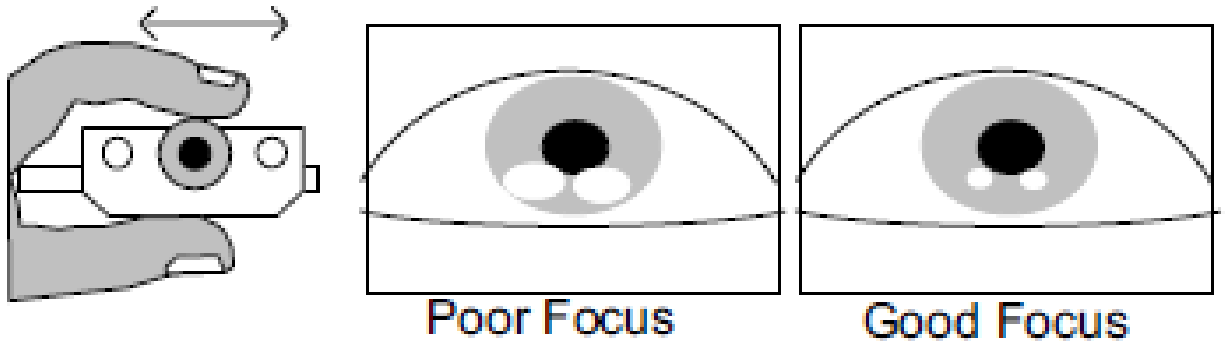
In the Lab

2. Eye camera: Adjusting position



In the Lab

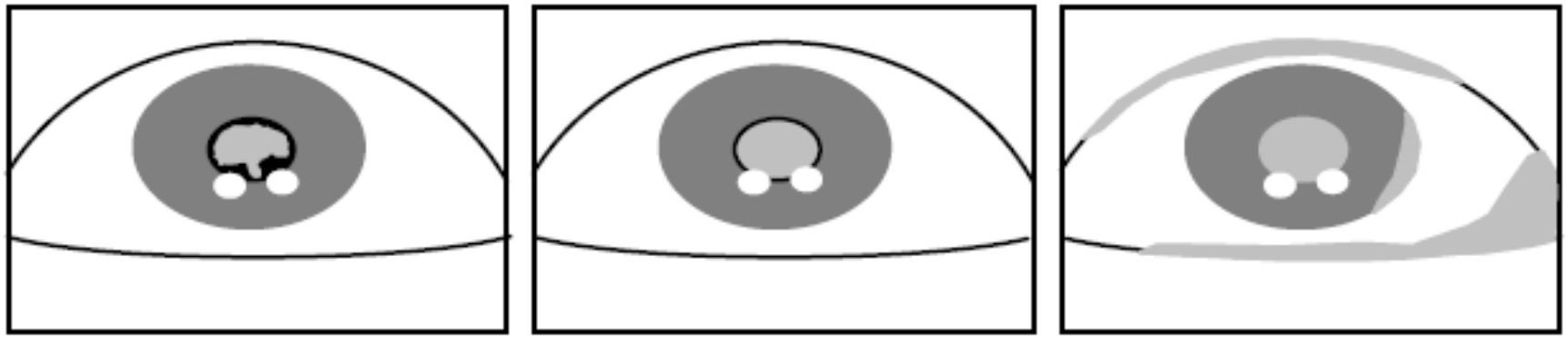
2. Eye camera: Focusing



In the Lab

3. Setting pupil threshold

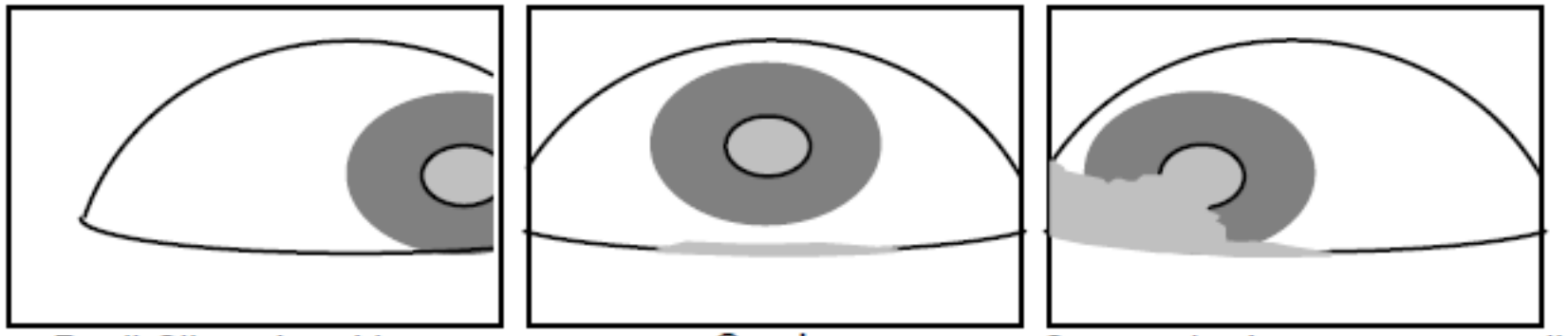
- Can be set automatically by pressing „A“
- Can be manually adjusted with the arrow keys (up/down)



In the Lab

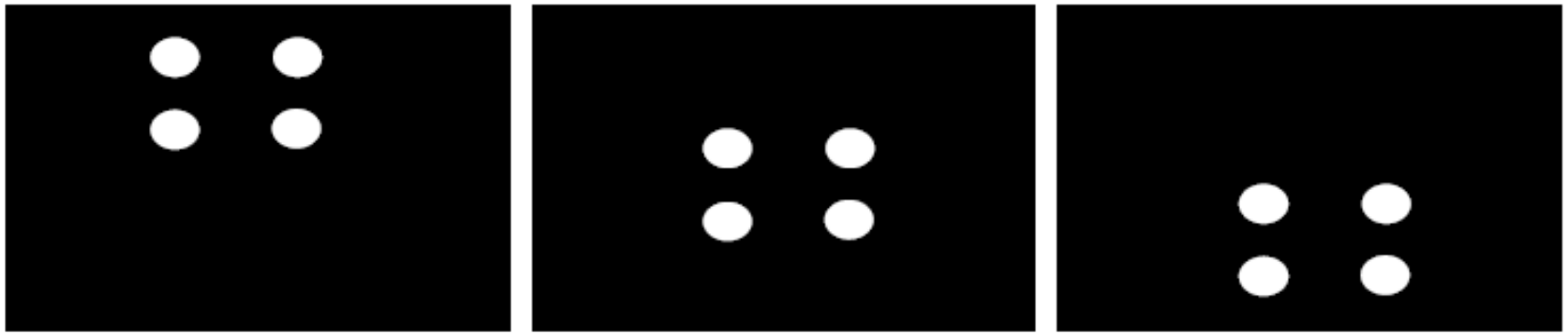
3. Setting pupil threshold

- Have participants look into all 4 corners of the screen



In the Lab

4. Head camera setup



Tilt head camera forwards | Good | Tilt head camera back

In the Lab

5. Calibration

- In order to compute the subject‘s fixation position on the screen: determine the correspondence between the pupil position in the eye camera image and the fixation position on the screen

➢ Participant has to fixate various points on the screen

In the Lab

5. Calibration

- „C“ key to calibrate

After successful calibration

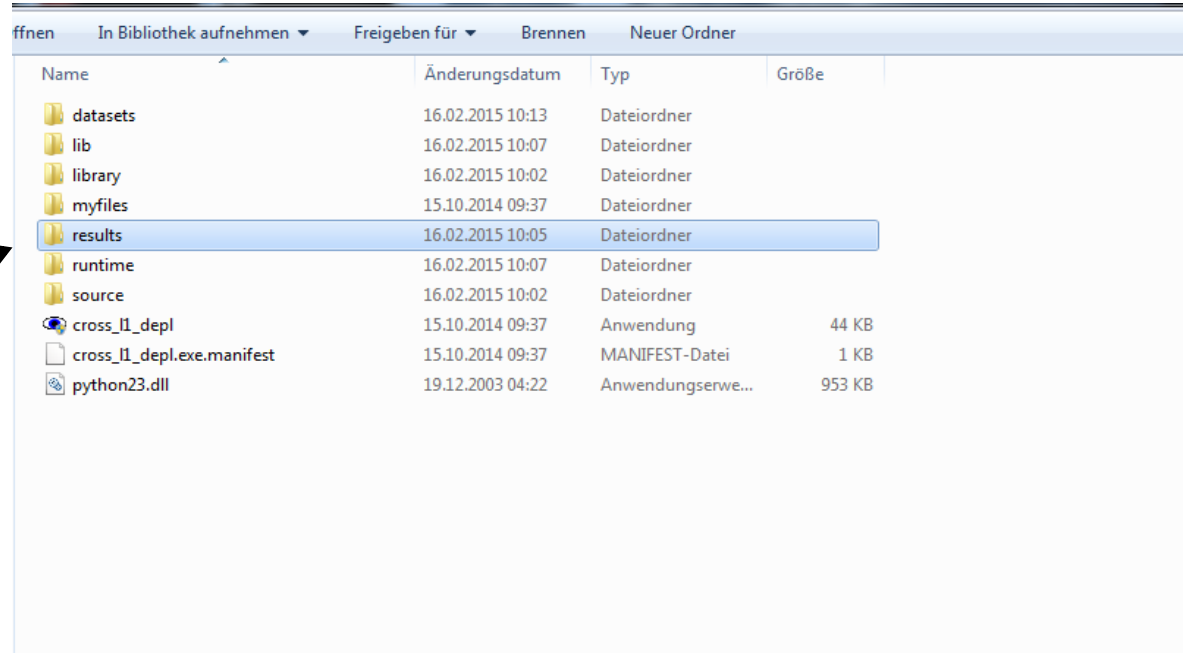
- Validation to test the accuracy of the system in predicting the fixation position
- „V“ key to validate

In the Lab

6. Recording a test trial

- Start the „experiment“ by pressing „O“ for output report
- Our subject will read through our test experiment with four trials

7. Looking at the test trial



End Introduction

EXPERIMENTAL MATERIALS AND INTEREST AREAS: WHAT AM I COMPARING?

Experimental materials

- Experimental items
  - Usually one critical sentence in several conditions
  - Sometimes presented with context sentences

(a) Sarah wishes that she could buy a horse.

(b) Peter wishes that she could buy a horse.

Experimental materials

- Experimental items
  - Usually one critical sentence in several conditions
  - Sometimes presented with context sentences

  (a) Sarah wishes that she could buy a horse.

  (b) Peter wishes that she could buy a horse.

- Good practice to separate the area of manipulation from the area of measurement.

Experimental materials

(a) As the woman **edited** the magazine about fishing amused all the reporters.

(b) As the woman **sailed** the magazine about fishing amused all the reporters.

Pickering MJ & Traxler MJ (1998). Plausibility and recovery from garden paths: An eye-tracking study. *J. Exp. Psychol.-Learn. Mem. Cogn.* 24, 940-961.

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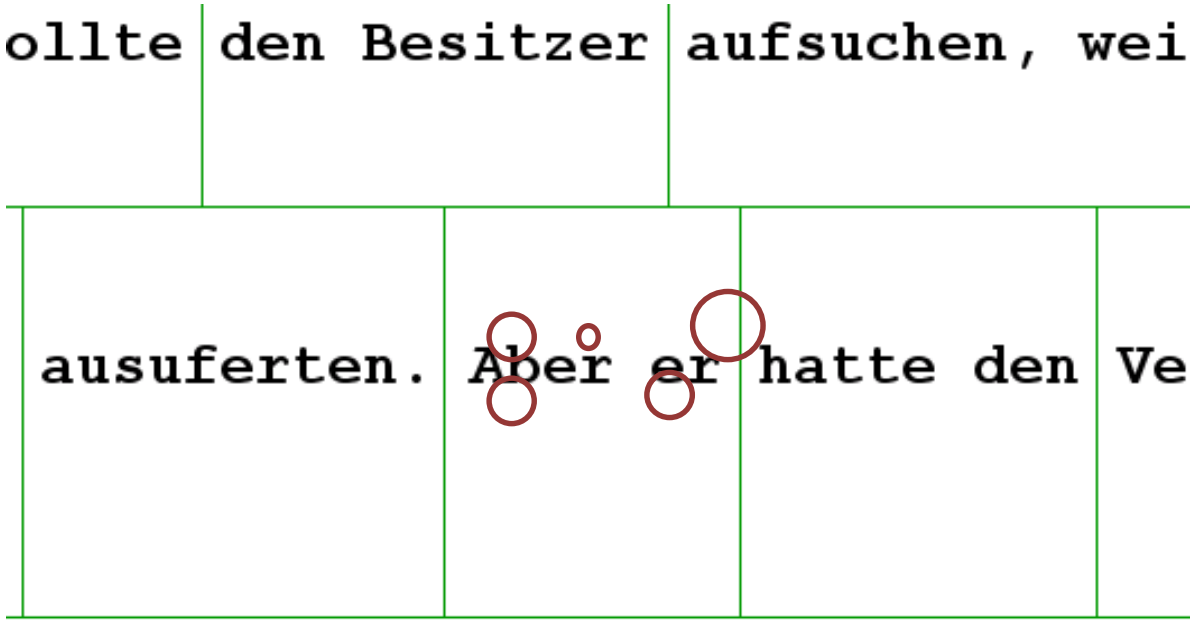
COMMON MEASURES IN EYE-TRACKING DURING READING

Measures

Die Pächterin	wollte	den Besitzer	aufsuchen, weil	
die Nebenkosten	ausuferten.	Aber er	hatte den	Vertrag vergessen.

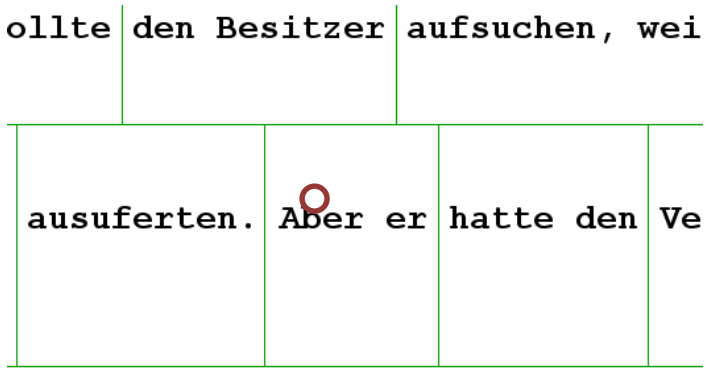
Measures


ollte
den Besitzer
aufsuchen, wei
ausuferten.
Aber er hatte den
Ve

Standard measures

First fixation duration

- Duration (in ms) of the *first* fixation in an interest area

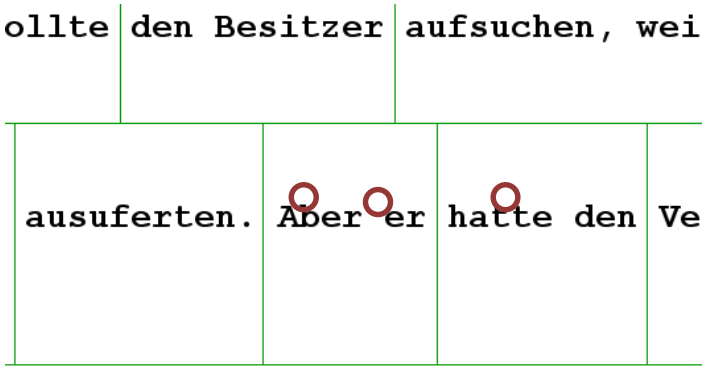


Early measure: usually related to word-level factors (e.g. length, frequency)

Standard measures

First-pass time / first-run dwell time / (gaze duration)

- Sum of fixation durations in an interest area during the first pass
  - From the first fixation in an IA until the eye exits the IA for the first time, in any direction

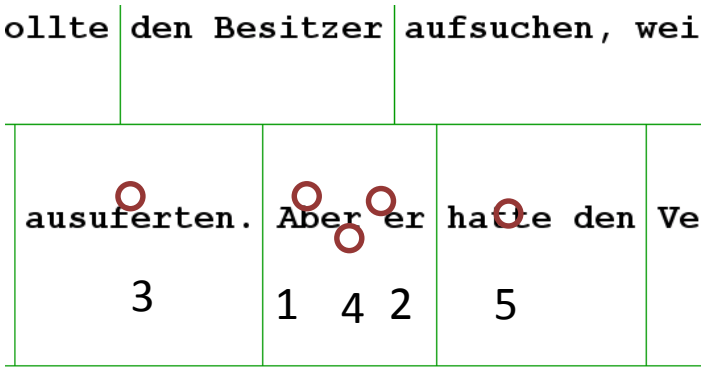


Also early measure related to word recognition (but can pick up integration difficulties)

Standard measures

Go-past time / regression-path duration

- Sum of fixation durations in an IA until an exit *to the right*
  - (If script reading direction is L–R)
  - Includes fixations in previous regions

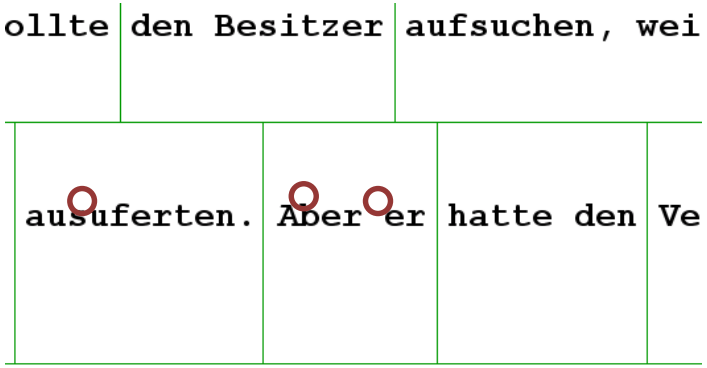


Later measure related to integration of a word/phrase: useful for sentence-level phenomena

Standard measures

(First-pass) regression-out probability

- Probability that there was a regression from the IA (during the first pass)
  - **Binary** measure, not ms duration

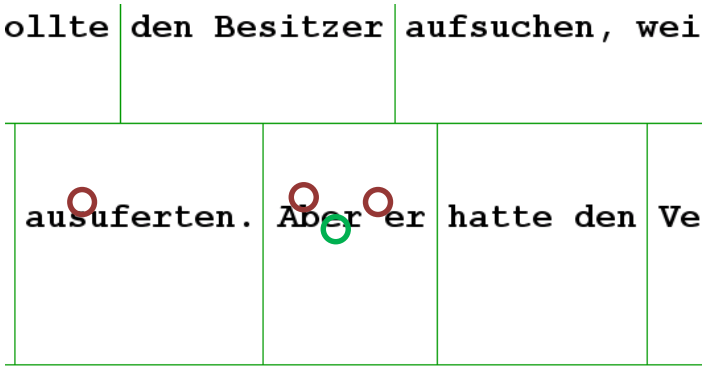


Early/late: can reflect word recognition difficulty or integration difficulty

Standard measures

Rereading time / second-pass time

- Sum of fixation durations in an IA during the second pass
  - After IA has been exited once (after first-pass time), all remaining fixations in IA count
  - Controversy over including 0 when no rereading

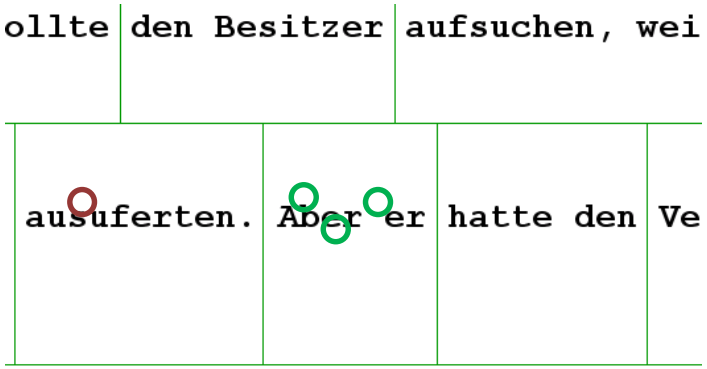


Later measure of integration at sentence level

Standard measures

Total reading time / dwell time

- Sum of all fixations in an IA
  - Aggregate measure, combining earlier and later measures
  - Can be heavily influenced by first-pass time, rereading time or both



Effects in this measure are usually also seen in other measures

Eyetracking measures: beware!

- Many other measures possible
- Unwise to look at large number of measures
  - Too much data, difficult to interpret!
- Possibility of Type I error is high
  - Need to make **precise** predictions relating to **specific measures** and **specific regions**
- ‘Early’ versus ‘late’ does not map precisely to processing models - be careful with labels

WHAT DO I DO WITH THE DATA?

Data workflow

- Experimental data is saved in edf format
- Data Viewer Software
  - .edf data is uploaded
  - Data is checked
  - Automatic cleaning process
  - Generate output reports
- Output saved in .txt or .csv format, which can be uploaded to analysis software

Plan for the current session

Four steps

- Read in .edf files to DV

- Check data in DV session

- Data cleaning in DV session

- Run an output report from DV

Step 1

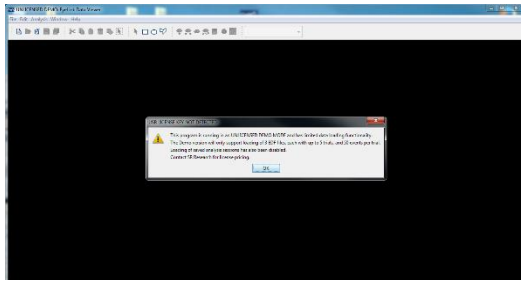
Read in .edf files

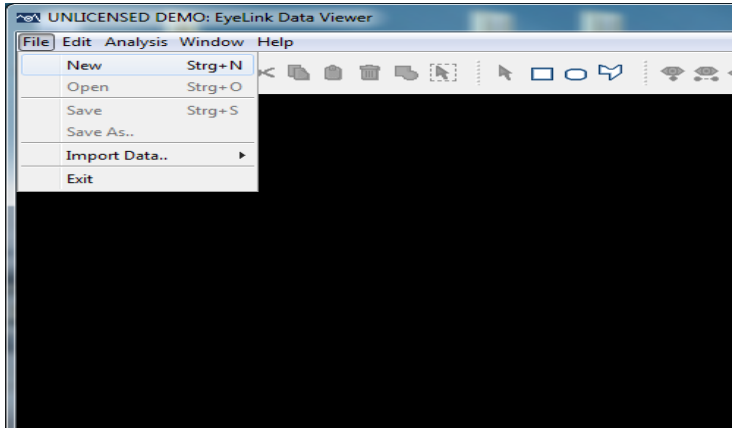
Data Viewer

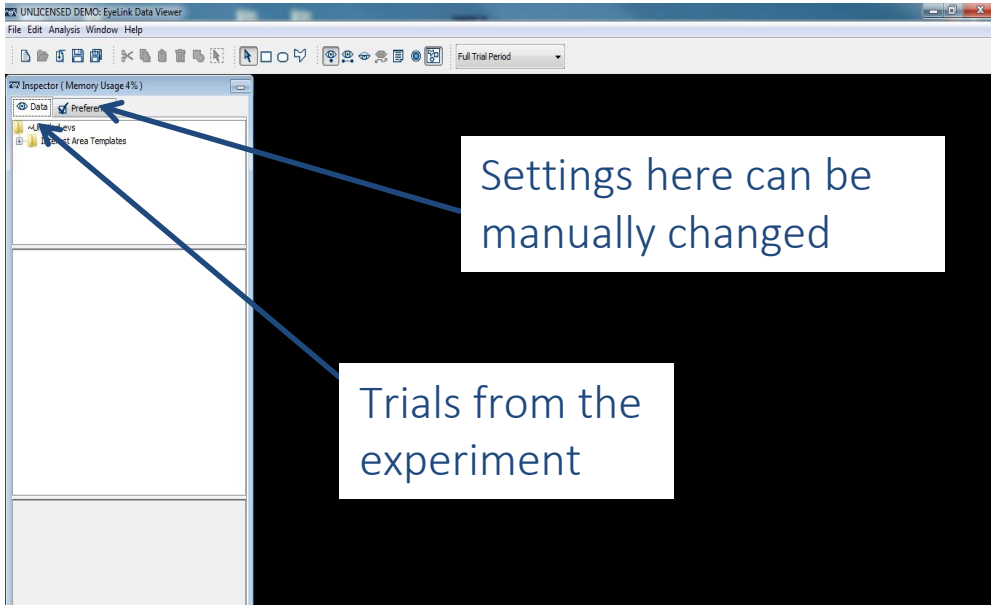
- Shortcut on the desktop
- Test version!
  - Limited functions

Data Viewer

- Open DV

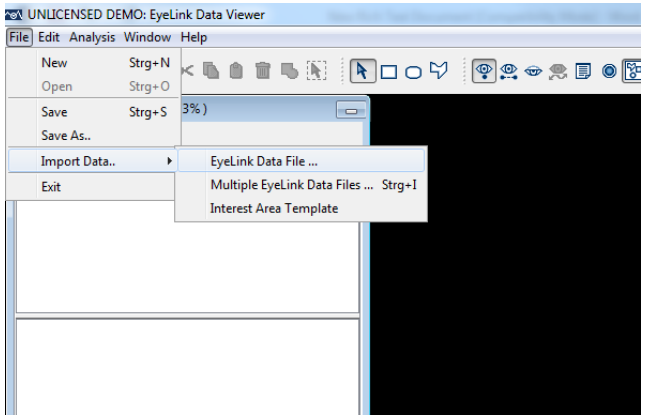


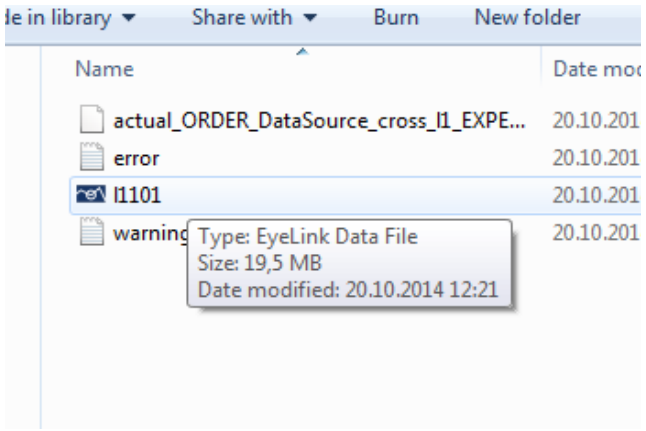




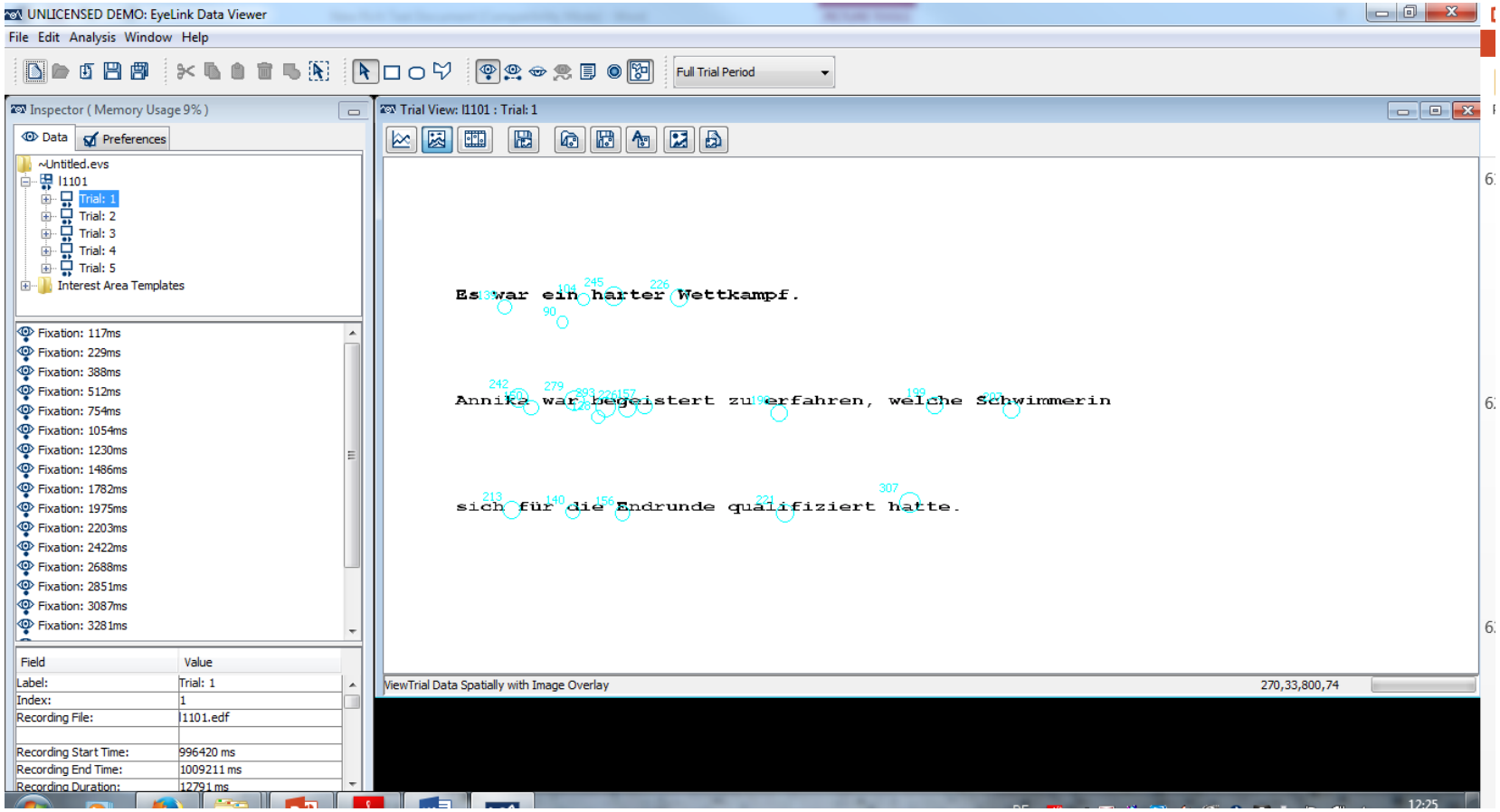
Data viewer

- Import one .edf file
  - Disk D
  - *Eyetracking 2016* folder
  - *Methodenworkshop_depl*
  - *results* folder
  - *Subj01* folder



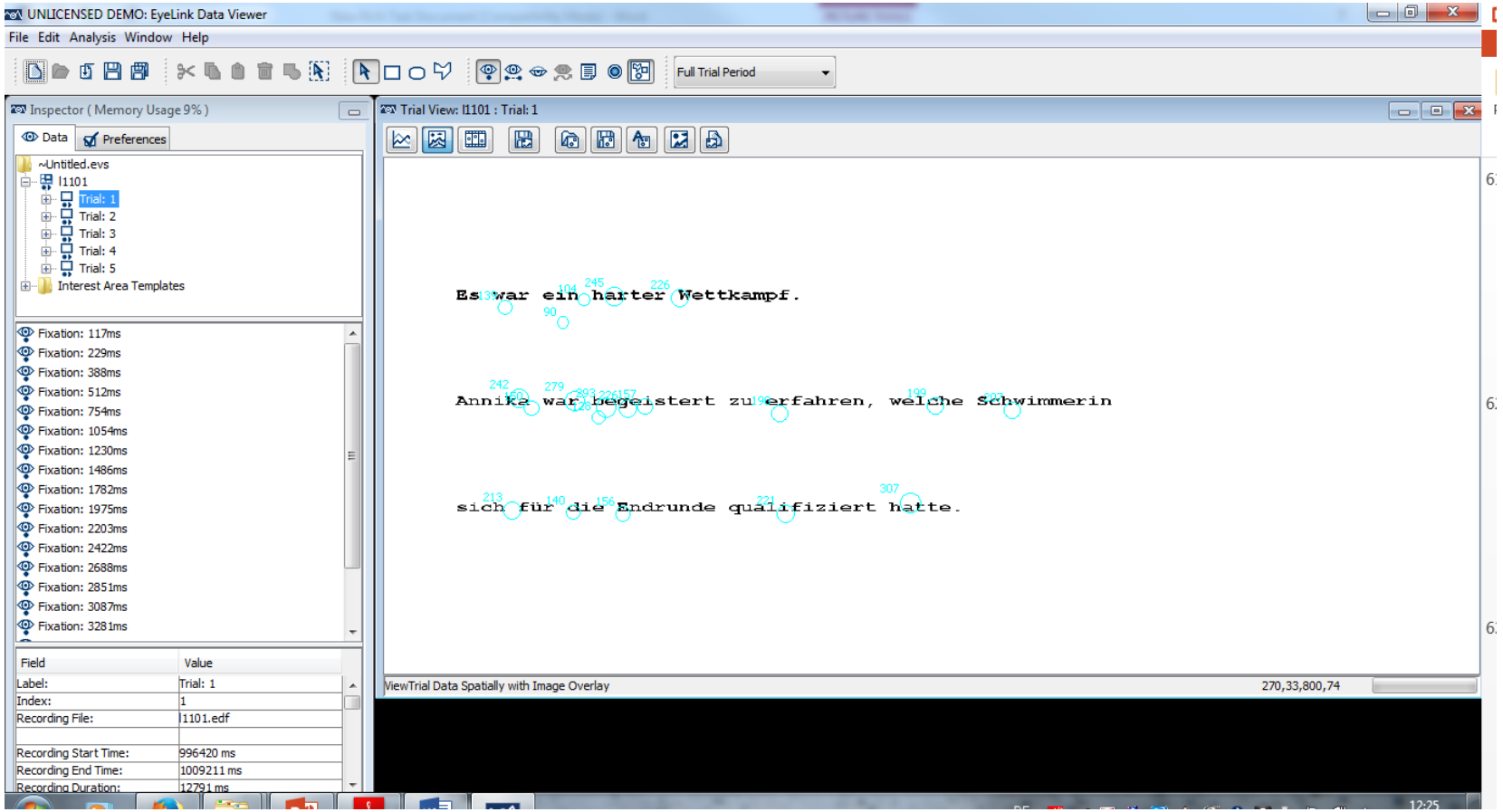


Data Viewer


UNLICENSED DEMO: EyeLink Data Viewer
File Edit Analysis Window Help
Full Trial Period
Inspector (Memory Usage 9%)
Data
Preferences
~Untitled.evs
l1101
Trial: 1
Trial: 2
Trial: 3
Trial: 4
Trial: 5
Interest Area Templates
Fixation: 117ms
Fixation: 229ms
Fixation: 388ms
Fixation: 512ms
Fixation: 754ms
Fixation: 1054ms
Fixation: 1230ms
Fixation: 1486ms
Fixation: 1782ms
Fixation: 1975ms
Fixation: 2203ms
Fixation: 2422ms
Fixation: 2688ms
Fixation: 2851ms
Fixation: 3087ms
Fixation: 3281ms
Field
Value
Label:
Trial: 1
Index:
1
Recording File:
l1101.edf
Recording Start Time:
996420 ms
Recording End Time:
1009211 ms
Recording Duration:
12791 ms
Trial View: l1101 : Trial: 1
Es war ein harter Wettkampf.
Annika war begeistert zu erfahren, welche Schwimmerin
sich für die Endrunde qualifiziert hatte.
ViewTrial Data Spatially with Image Overlay
270,33,800,74

Data Viewer

- Reorder by trial/condition/item number

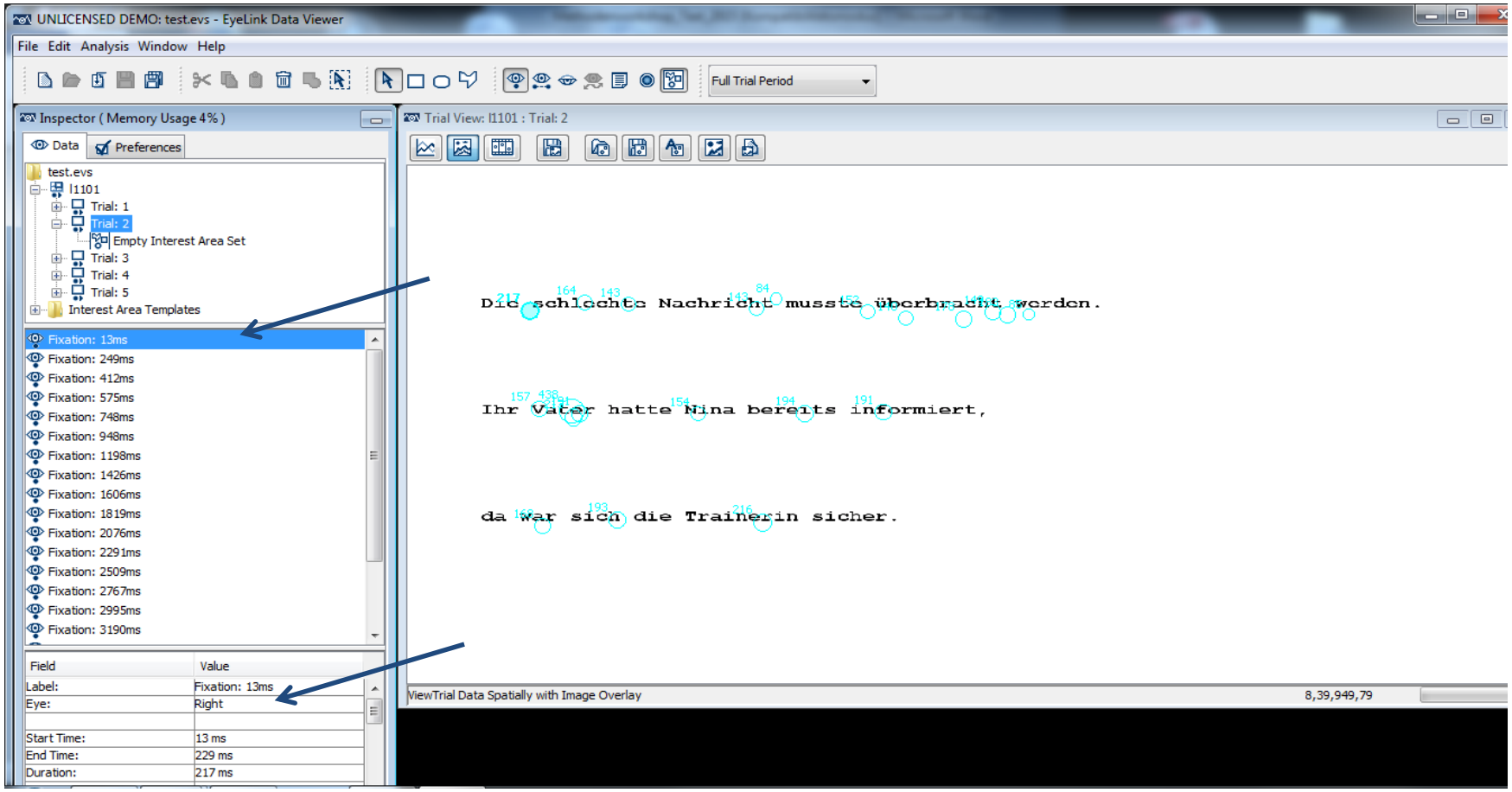


Data Viewer

Look at trial 1

- Fixation size/duration
- Order of fixations
- Other fixation information

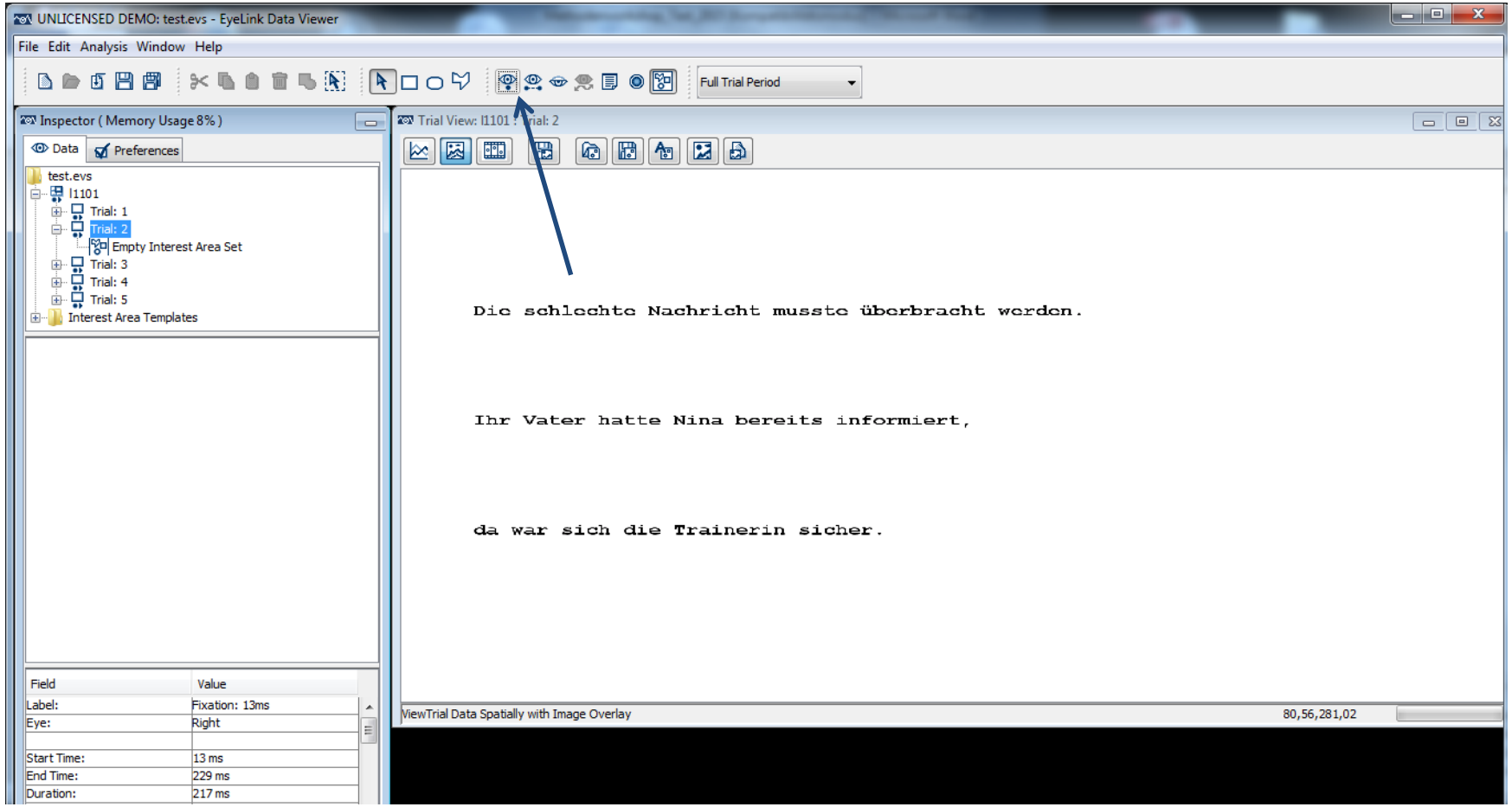
Data Viewer


UNLICENSED DEMO: test.evs - EyeLink Data Viewer
File Edit Analysis Window Help
Full Trial Period
Inspector (Memory Usage 4%)
Data
Preferences
test.evs
I1101
Trial: 1
Trial: 2
Empty Interest Area Set
Trial: 3
Trial: 4
Trial: 5
Interest Area Templates
Fixation: 13ms
Fixation: 249ms
Fixation: 412ms
Fixation: 575ms
Fixation: 748ms
Fixation: 948ms
Fixation: 1198ms
Fixation: 1426ms
Fixation: 1606ms
Fixation: 1819ms
Fixation: 2076ms
Fixation: 2291ms
Fixation: 2509ms
Fixation: 2767ms
Fixation: 2995ms
Fixation: 3190ms
Field
Value
Label:
Fixation: 13ms
Eye:
Right
Start Time:
13 ms
End Time:
229 ms
Duration:
217 ms
Trial View: I1101 : Trial: 2
Die schlechte Nachricht musste überbracht werden.
Ihr Vater hatte Nina bereits informiert,
da war sich die Trainerin sicher.
ViewTrial Data Spatially with Image Overlay
8,39,949,79

Quick DV tour

- Toggle fixations on and off
- Toggle saccades on and off
- Other views (graph, video)
- Interest area settings

Data Viewer


UNLICENSED DEMO: test.evs - EyeLink Data Viewer
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Full Trial Period
Inspector (Memory Usage 8%)
Data
Preferences
test.evs
I1101
Trial: 1
Trial: 2
Empty Interest Area Set
Trial: 3
Trial: 4
Trial: 5
Interest Area Templates
Field
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End Time:
229 ms
Duration:
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Trial View: I1101 : Trial: 2
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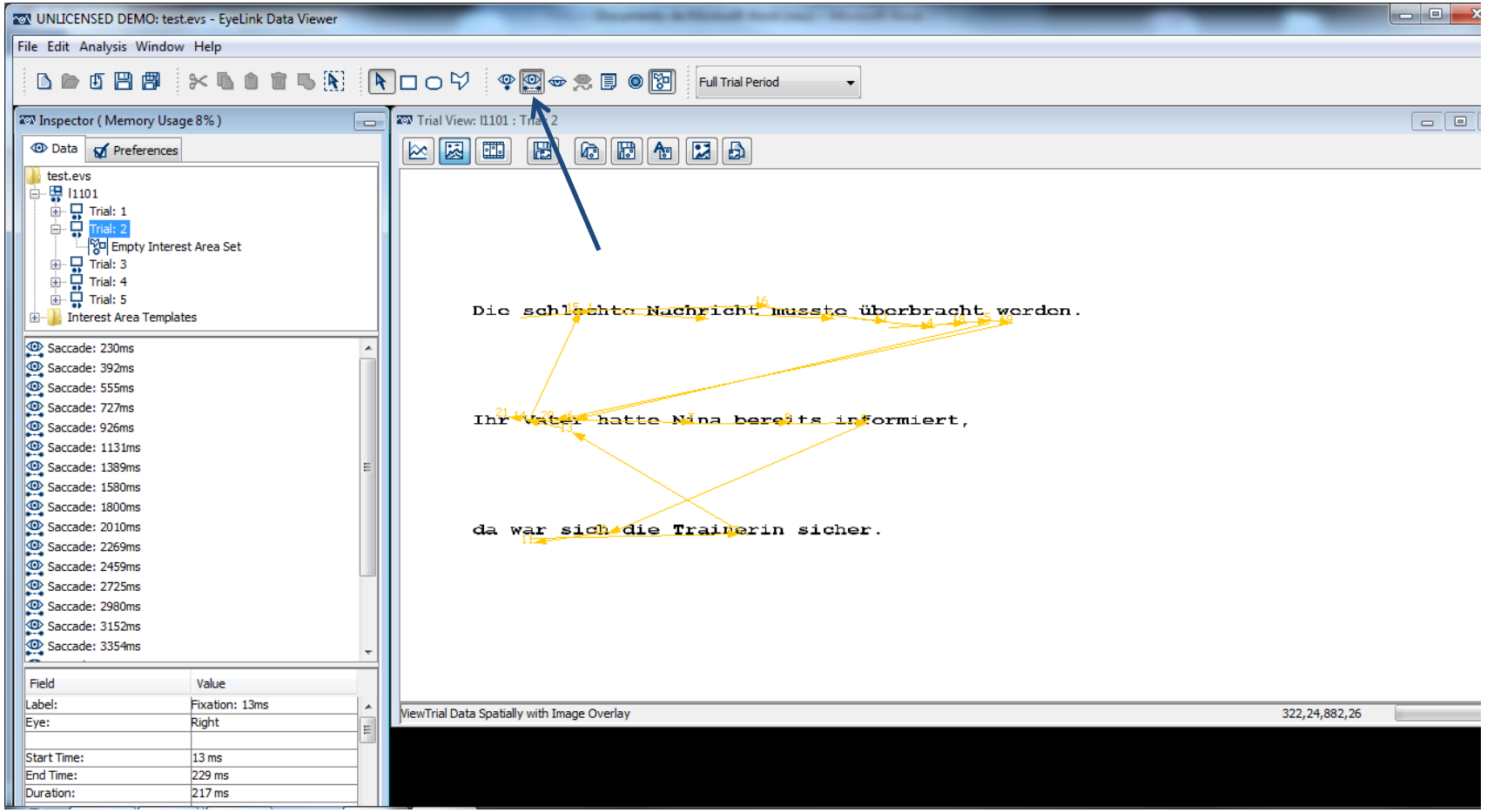
da war sich die Trainerin sicher.
ViewTrial Data Spatially with Image Overlay
80,56,281,02

Data Viewer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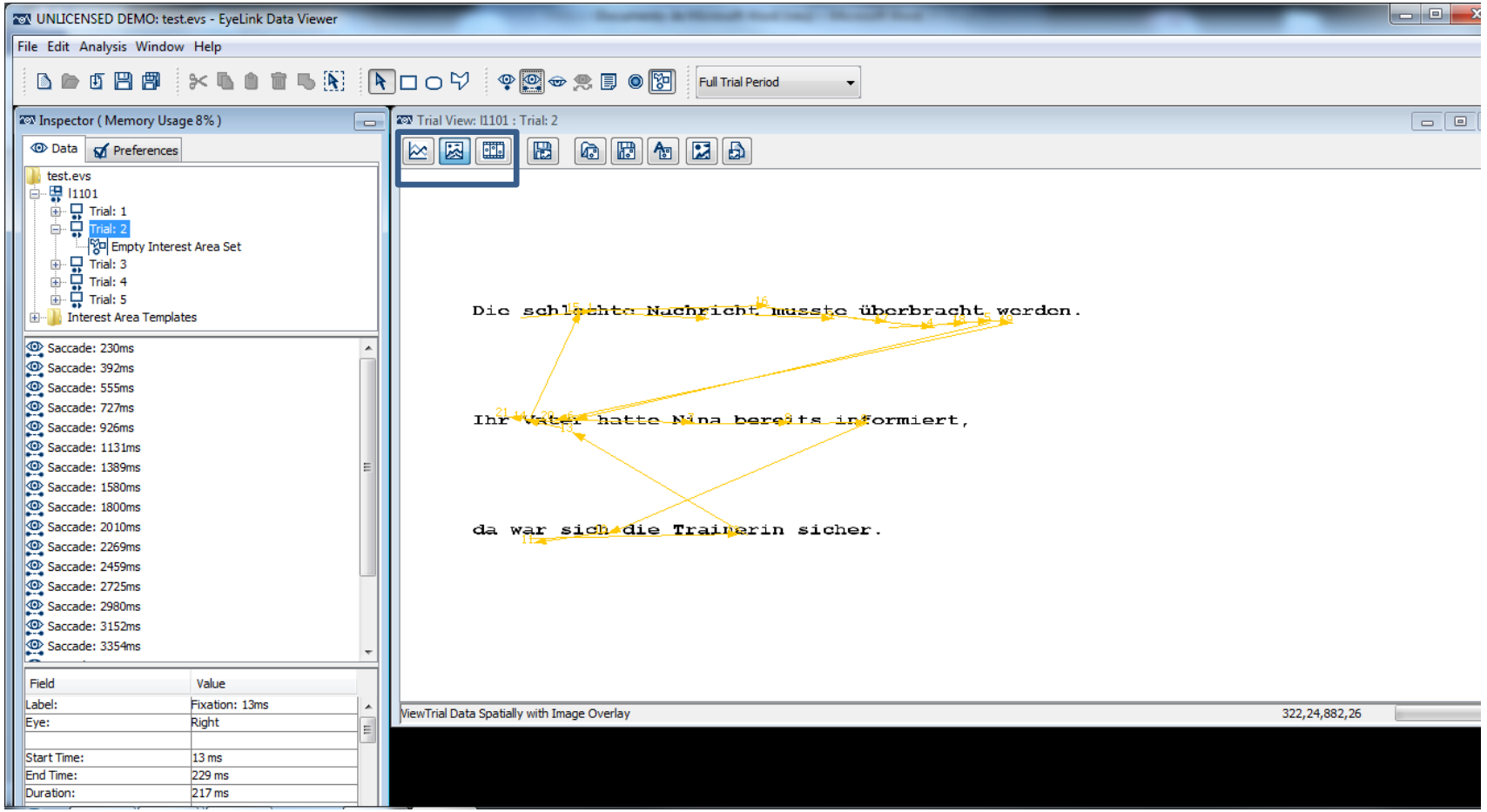
Full Trial Period
Inspector (Memory Usage 8%)
Data
Preferences
test.evs
I1101
Trial: 1
Trial: 2
Empty Interest Area Set
Trial: 3
Trial: 4
Trial: 5
Interest Area Templates
Saccade: 230ms
Saccade: 392ms
Saccade: 555ms
Saccade: 727ms
Saccade: 926ms
Saccade: 1131ms
Saccade: 1389ms
Saccade: 1580ms
Saccade: 1800ms
Saccade: 2010ms
Saccade: 2269ms
Saccade: 2459ms
Saccade: 2725ms
Saccade: 2980ms
Saccade: 3152ms
Saccade: 3354ms
Field
Value
Label:
Fixation: 13ms
Eye:
Right
Start Time:
13 ms
End Time:
229 ms
Duration:
217 ms
Trial View: I1101 : Trial: 2
Die schlechte Nachricht musste überbracht werden.
Ihr Vater hatte Nina bereits informiert,
da war sich die Trainerin sicher.
ViewTrial Data Spatially with Image Overlay
322,24,882,26

Data Viewer


UNLICENSED DEMO: test.evs - EyeLink Data Viewer
File Edit Analysis Window Help
Full Trial Period
Inspector (Memory Usage 8%)
Data
Preferences
test.evs
I1101
Trial: 1
Trial: 2
Empty Interest Area Set
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Trial: 5
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Saccade: 230ms
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Saccade: 727ms
Saccade: 926ms
Saccade: 1131ms
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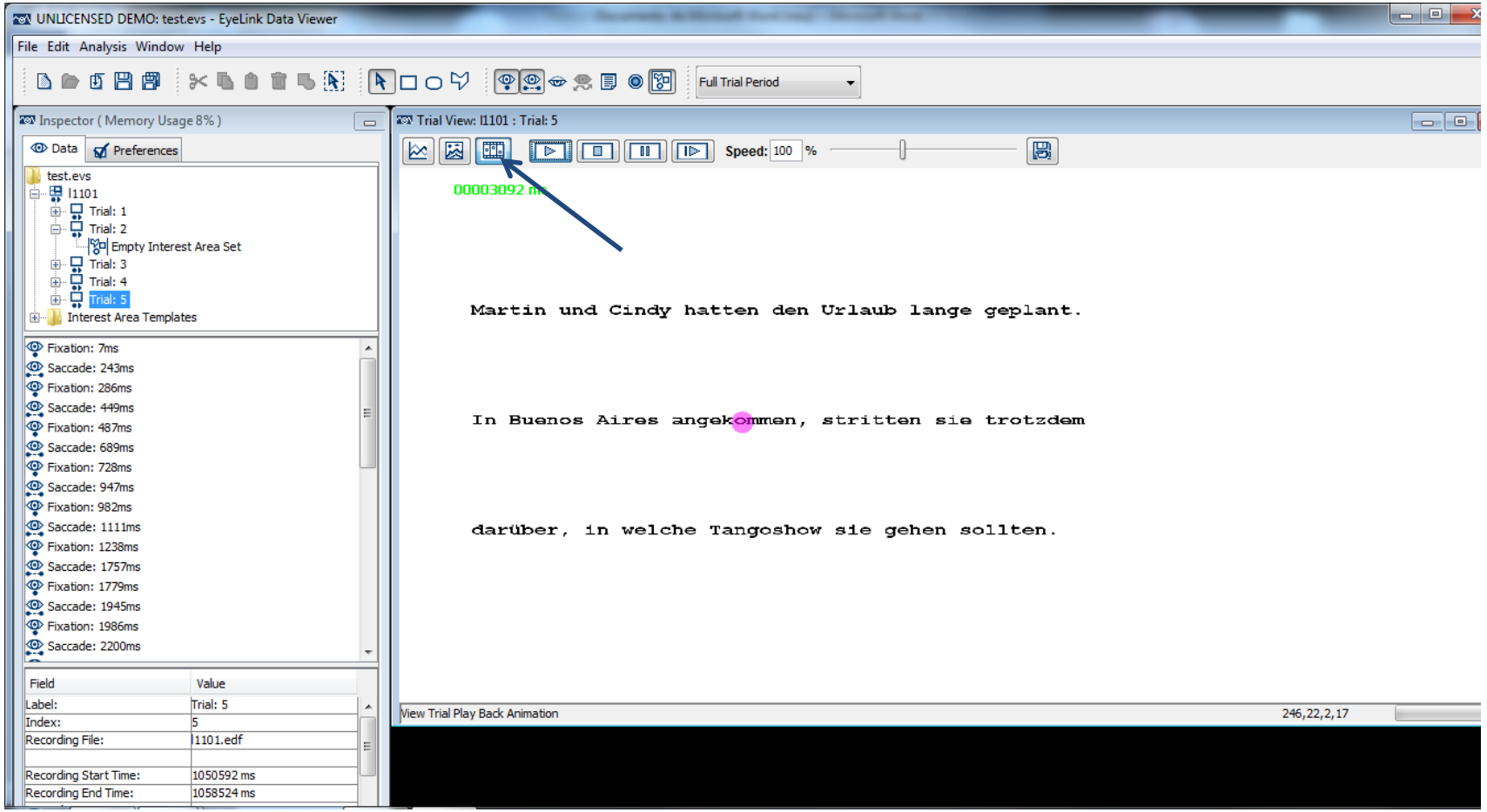
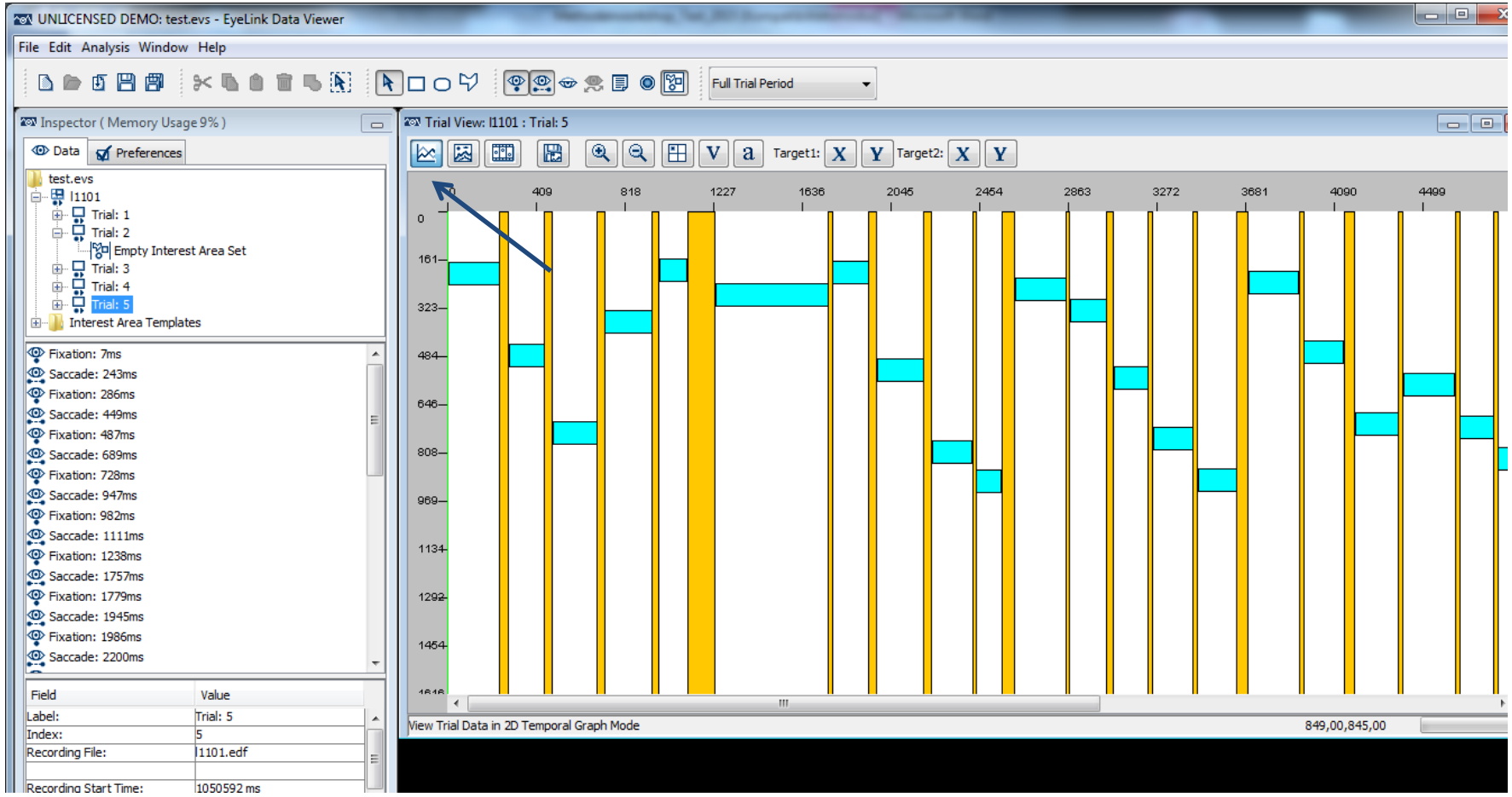
322,24,882,26

Data Viewer


UNLICENSED DEMO: test.evs - EyeLink Data Viewer
File Edit Analysis Window Help
Full Trial Period
Inspector (Memory Usage 8%)
Data
Preferences
test.evs
l1101
Trial: 1
Trial: 2
Empty Interest Area Set
Trial: 3
Trial: 4
Trial: 5
Interest Area Templates
Fixation: 7ms
Saccade: 243ms
Fixation: 286ms
Saccade: 449ms
Fixation: 487ms
Saccade: 689ms
Fixation: 728ms
Saccade: 947ms
Fixation: 982ms
Saccade: 1111ms
Fixation: 1238ms
Saccade: 1757ms
Fixation: 1779ms
Saccade: 1945ms
Fixation: 1986ms
Saccade: 2200ms
Field
Value
Label:
Trial: 5
Index:
5
Recording File:
1101.edf
Recording Start Time:
1050592 ms
Recording End Time:
1058524 ms
Trial View: l1101 : Trial: 5
Speed: 100 %
00003092 ms
Martin und Cindy hatten den Urlaub lange geplant.
In Buenos Aires angekommen, stritten sie trotzdem
darüber, in welche Tangoshow sie gehen sollten.
View Trial Play Back Animation
246,22,2,17

Data Viewer


UNLICENSED DEMO: test.evs - EyeLink Data Viewer
File Edit Analysis Window Help
Full Trial Period
Inspector (Memory Usage 9%)
Data
Preferences
test.evs
l1101
Trial: 1
Trial: 2
Empty Interest Area Set
Trial: 3
Trial: 4
Trial: 5
Interest Area Templates
Fixation: 7ms
Saccade: 243ms
Fixation: 286ms
Saccade: 449ms
Fixation: 487ms
Saccade: 689ms
Fixation: 728ms
Saccade: 947ms
Fixation: 982ms
Saccade: 1111ms
Fixation: 1238ms
Saccade: 1757ms
Fixation: 1779ms
Saccade: 1945ms
Fixation: 1986ms
Saccade: 2200ms
Field
Value
Label:
Trial: 5
Index:
5
Recording File:
l1101.edf
Recording Start Time:
1050592 ms
Trial View: l1101 : Trial: 5
Target1:
Target2:
409
818
1227
1636
2045
2454
2863
3272
3681
4090
4499
0
161
323
484
646
808
969
1134
1292
1454
View Trial Data in 2D Temporal Graph Mode
849,00,845,00

Step 2

Checking your data:

- Setting up Interest Areas
- Identifying and dealing with drift
- Indentifying trials that should be exluded

Setting up Interest Area sets

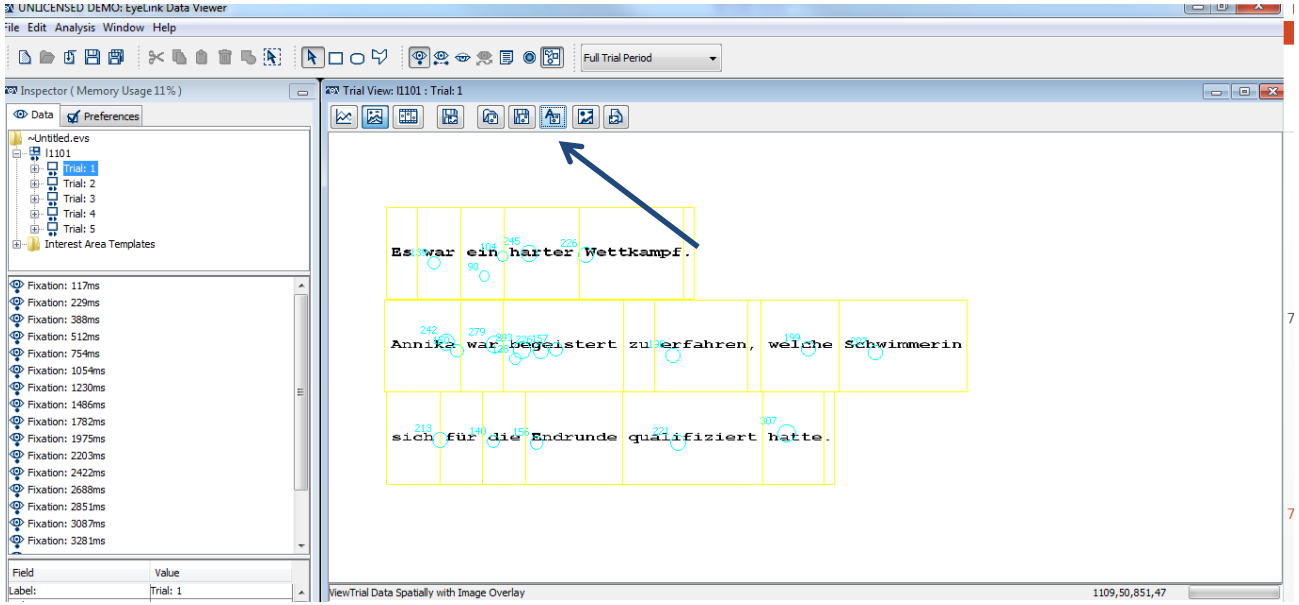
- IAs should be part of experimental design

In Data Viewer:

- Several methods exist
- We will show you manual method today
  - Alternative is pre-defining IAs via Experiment Builder
  - Or combining afterwards in external software

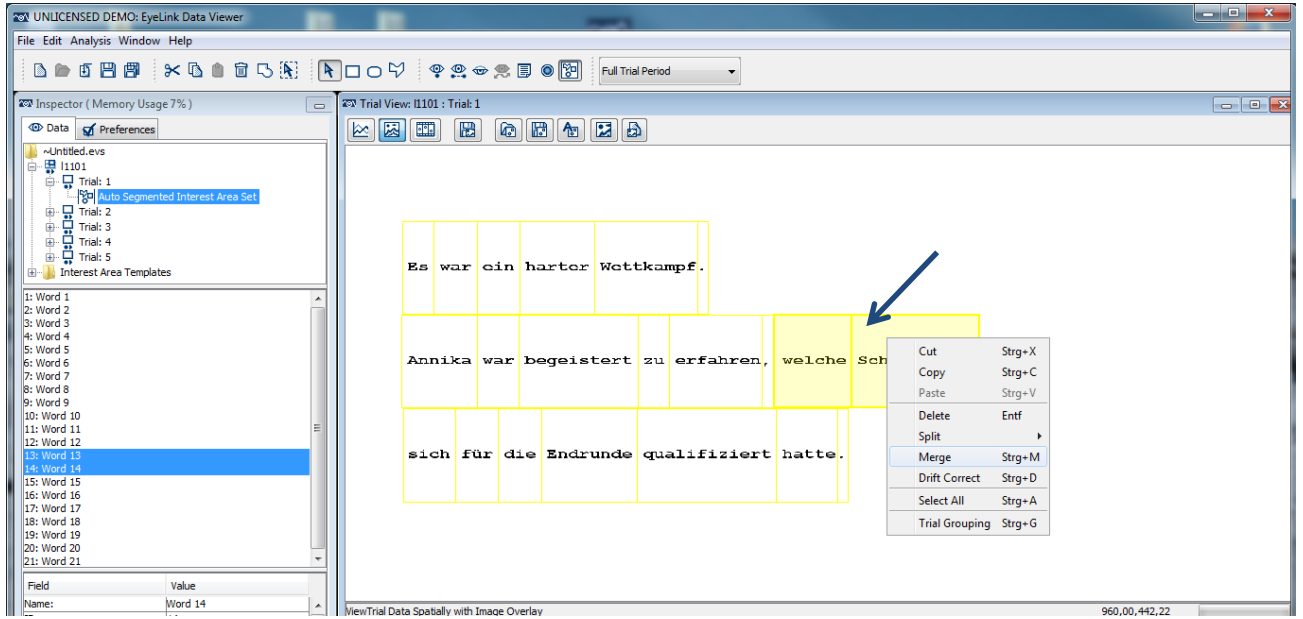
Setting up Interest Area sets

- Toggle off fixations
- Click automatic Interest Area segmentation



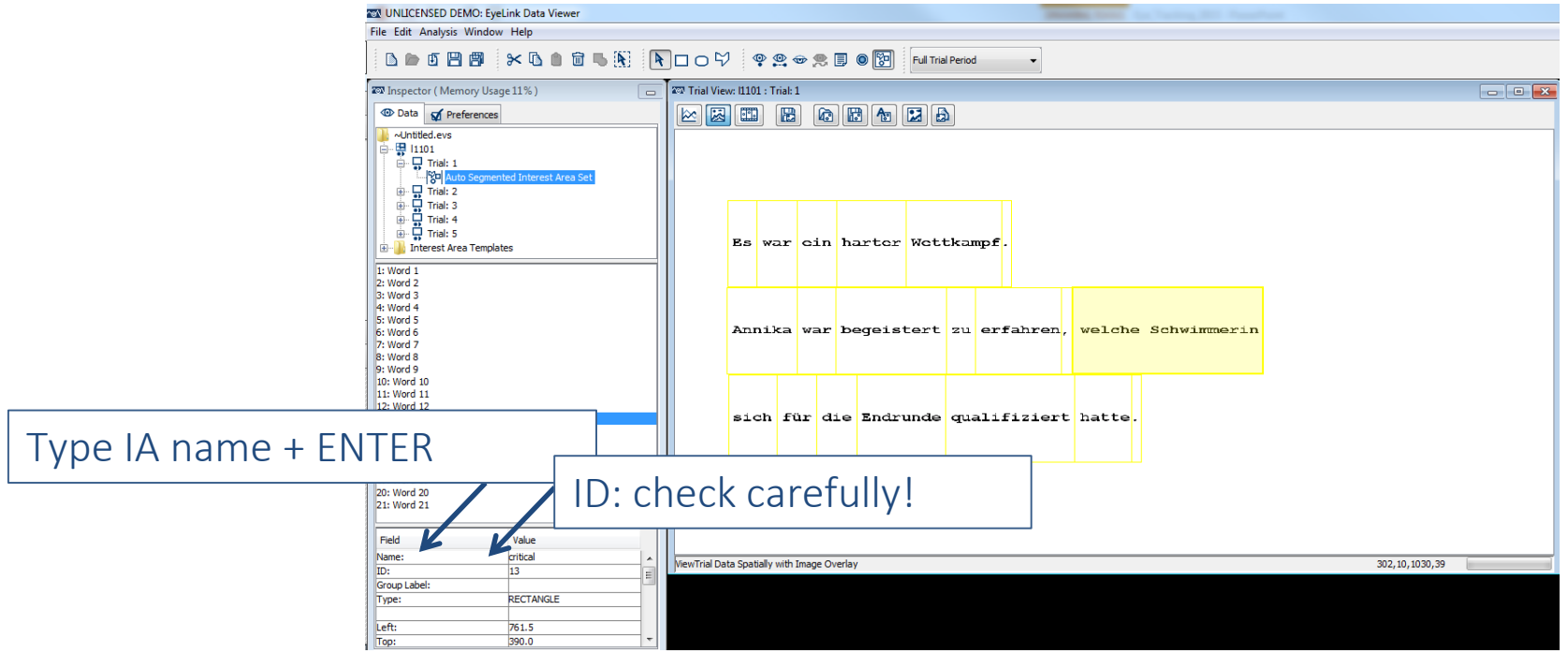
Setting up Interest Area sets

- Merging IAs
  - IMPORTANT: fixations should not be visible!



Setting up Interest Area sets

- Rename IA and check sequence



Setting up Interest Area sets

Exercise:

- Merge to create further IAs for Trial 1
- Don‘t forget to rename and check ID sequence

Saving Interest Area template

- On trial 1, where you have created IA set, click on „save IA set to disk“
- We are now going to look at data from subject 2
  - [Trial DV version bug]
  - New DV session and import as before

Applying Interest Area template

- Read in one .edf file (subject 2)
  - Disk D
  - *Eyetracking 2016* folder
  - *Methodenworkshop_depl*
  - *results* folder
  - *Subj02* folder

Applying Interest Area template

- Go to trial 1 for Subj 2
- Click on „apply IA template“
- Navigate to your saved template
- Choose and apply

Applying Interest Area template

- IA templates can be used for conditions within an item, so long as length has been controlled
- With multiple subjects and items, arranging by „condition“ allows you to apply IA set to multiple trials

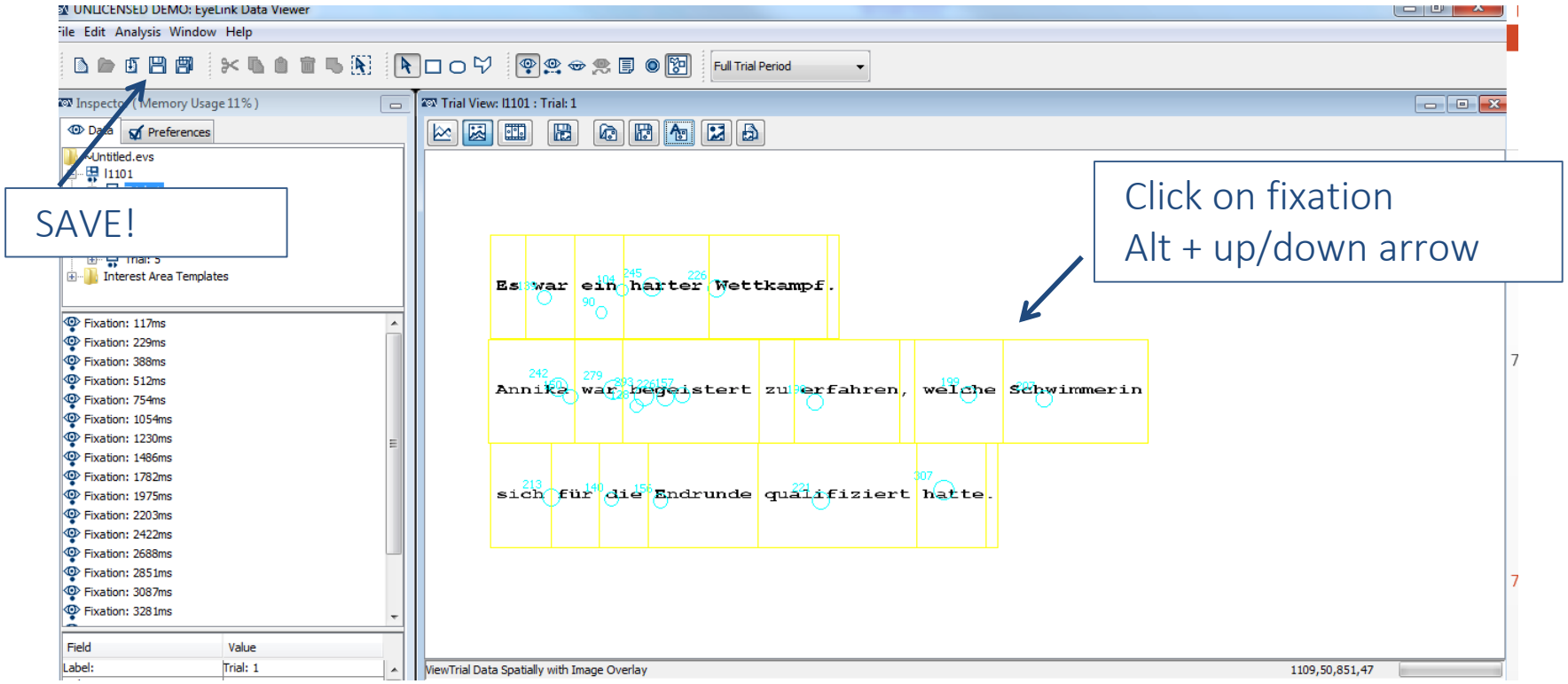
Identifying and dealing with drift

- Look at the data from subj 02
- Drift occurs when tracking becomes inaccurate, such that fixations are recorded at some distance from the text
- When drift can be **clearly** identified, fixations can be adjusted manually to avoid data loss

Identifying and dealing with drift

- Fixations should ONLY be moved vertically, NEVER horizontally
- If you are not sure whether a fixation pattern constitutes drift, do not adjust
- Adjustments are recorded by data viewer (as Y/N) and this information can be exported in the fixation report
  - Also keep notes
- It is good practice to report the percentage of adjusted trials
- Many adjusted trials for one subject – consider exlcuding subject

Identifying and dealing with drift



Excluding trials

- Read in one .edf file (subject 3)
  - Disk D
  - *Eyetracking 2016* folder
  - *Methodenworkshop_depl*
  - *results* folder
  - *Subj03* folder

- Apply IA template to trial 1

Excluding trials

- Look at all the trials for subj 03
  - Are there some that look odd to you?
- Trials should be excluded when:
  - Reading pattern is not clear
  - Very little data – trial not read properly
- Make a list of such trials (subj, item, condition, trial number) and exclude them during statistical analysis
- Can be deleted directly from DV, but this is less transparent
- Always report percentage of excluded trials

Step 3

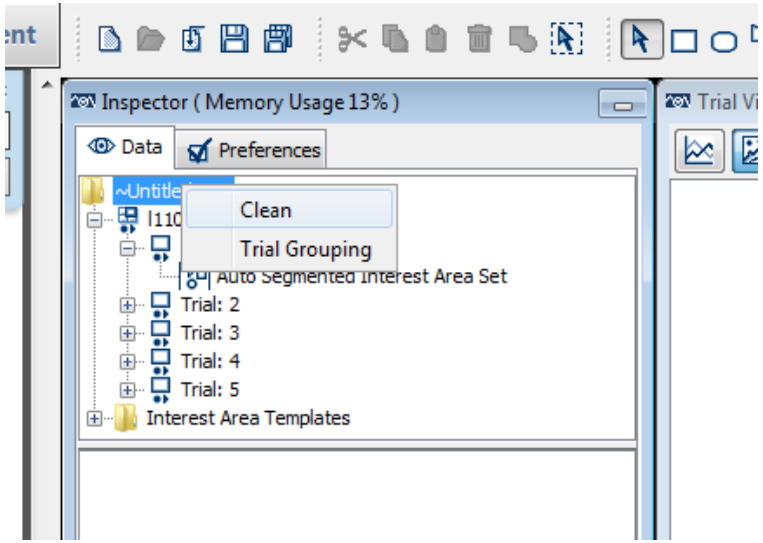
Data cleaning

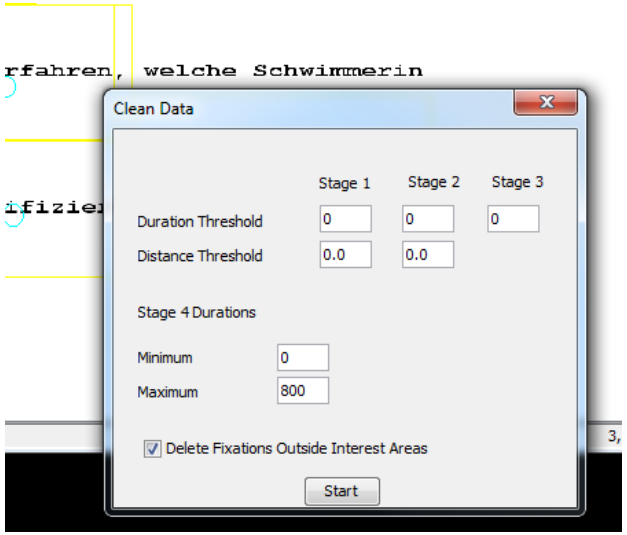
Data cleaning

- Automatic procedure
  - Removal of very short and very long fixations
  - Merging fixations where appropriate
  - Removal of fixations outside an interest area

Data cleaning

- Make sure this is FINAL STEP!
- Right click on experiment name and choose clean





Data cleaning

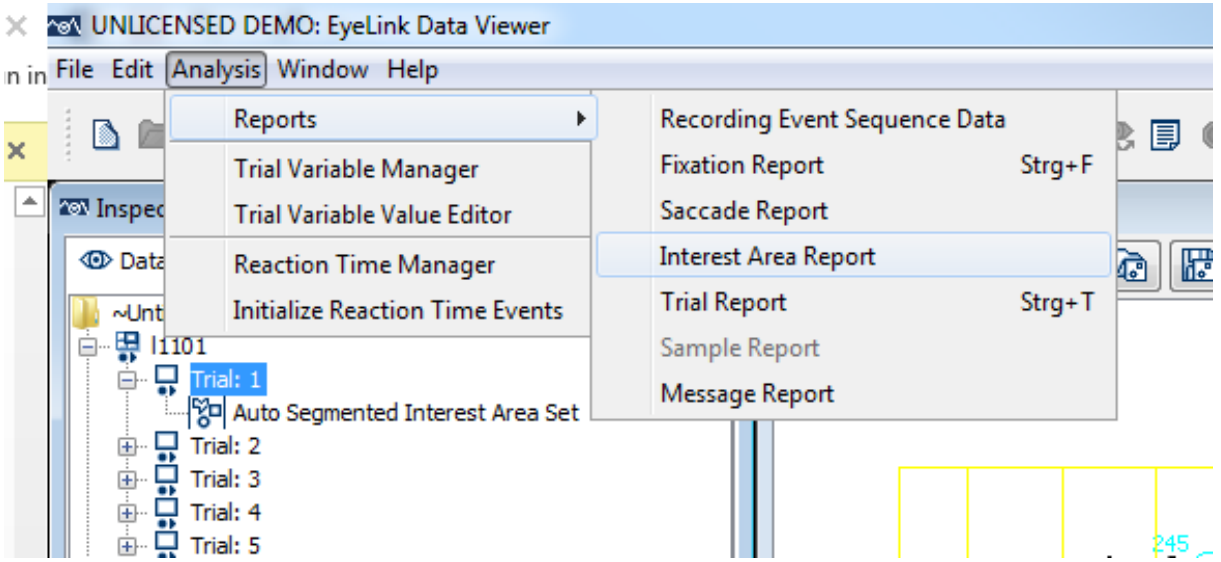
- Stage 1: set duration and distance threshold
  - Standard in linguistic reading experiments 80ms and 1 degree
- With these settings, data viewer will merge fixations shorter than 80ms to a nearby fixation (within 1 degree of visual angle)
- Stages 2 and 3: leave blank
- Stage 4: set min and max, e.g. 80 and 1000

Step 4

Generating output reports

Interest Area Report

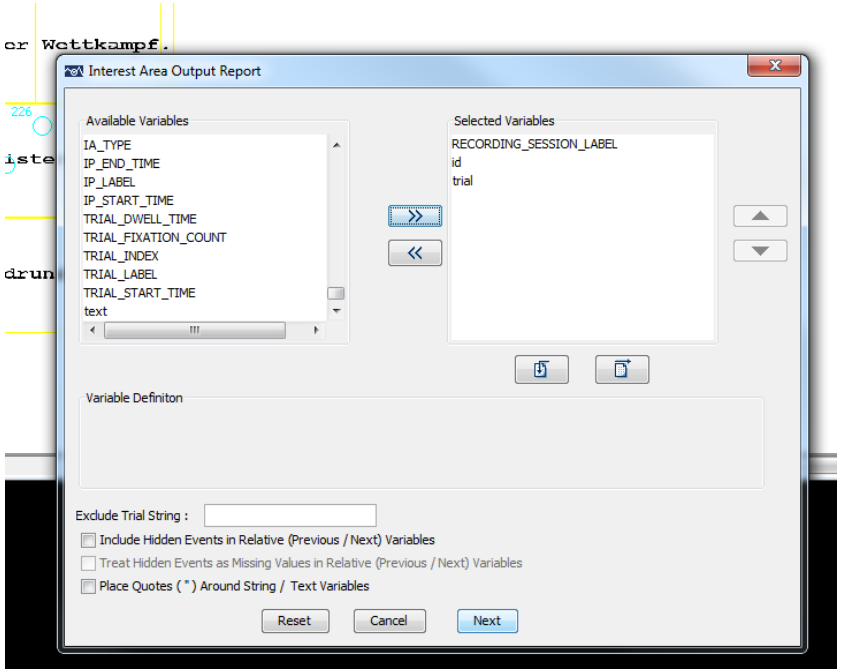
- Navigate to IA report



Interest Area Report

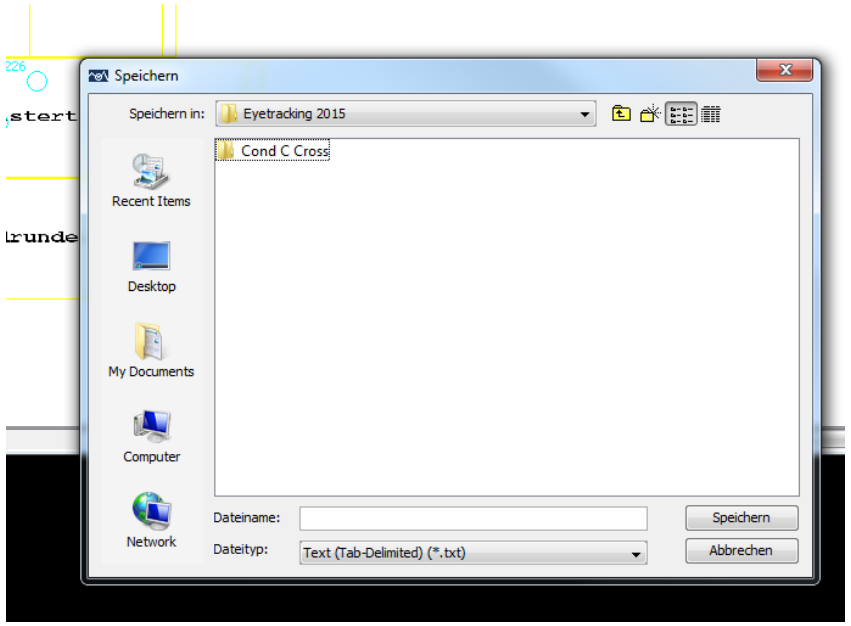
- Choose variables

- RECORDING_SESSION_LABEL (subj)
- id (item name – defined in EB)
- trial (trial number)
- IA_FIRST_FIXATION_DURATION
- IA_FIRST_RUN_DWELL_TIME
- IA_REGRESSION_PATH_DURATION
- IA_DWELL_TIME
- ….



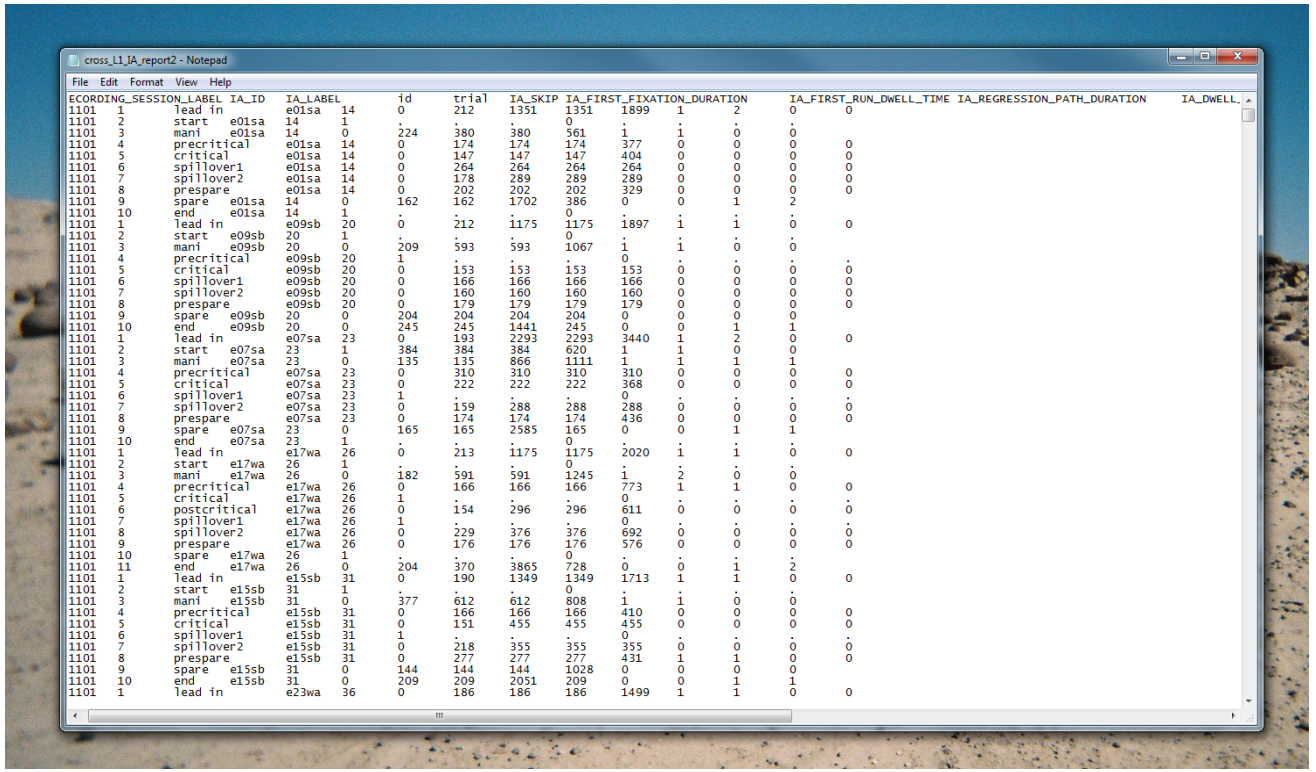
Interest Area Report

- Save in Eyetracking 2016 folder
- Save as .txt file



Interest Area Report

- Take a look

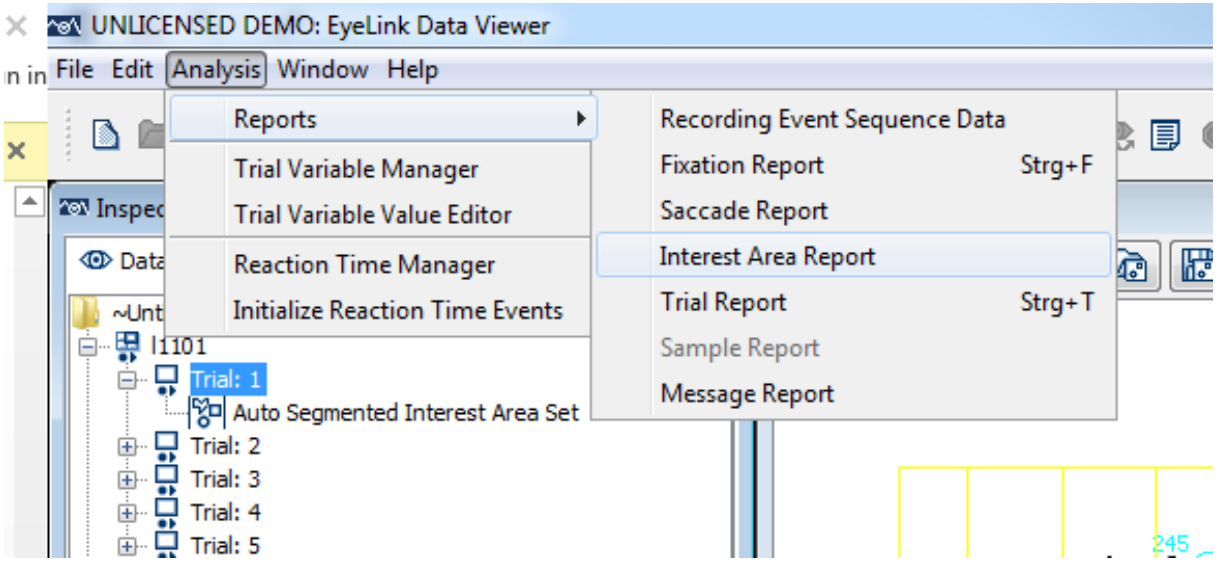


Fixation Report

- Can get information on whether fixation has been adjusted
- Also use this report if you want to generate measures and IAs with an external program, e.g. em2 in R

Fixation Report

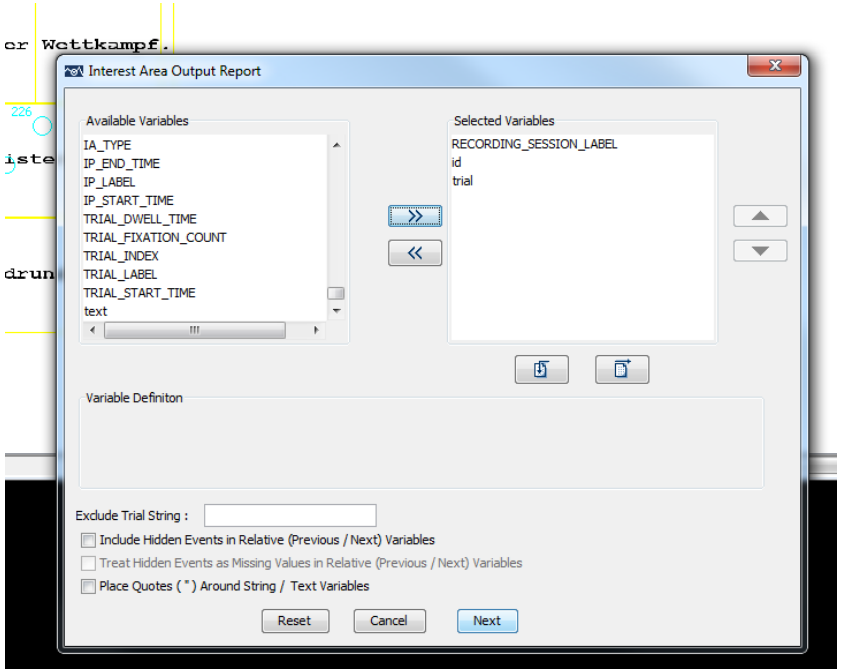
- Navigate to Fixation Report



Fixation Report

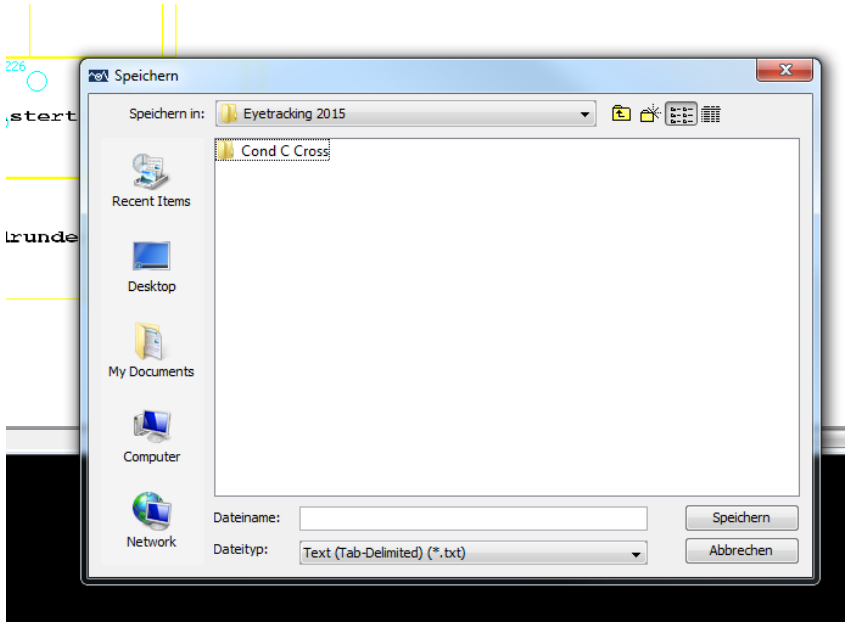
- Choose variables

- RECORDING_SESSION_LABEL (subj)
- id (item name – defined in EB)
- trial (trial number)
- CURRENT_FIX_ADJUSTED
- CURRENT_FIX_DURATION
- CURRENT_FIX_INDEX
- CURRENT_FIX_INTEREST_AREAS
- ….



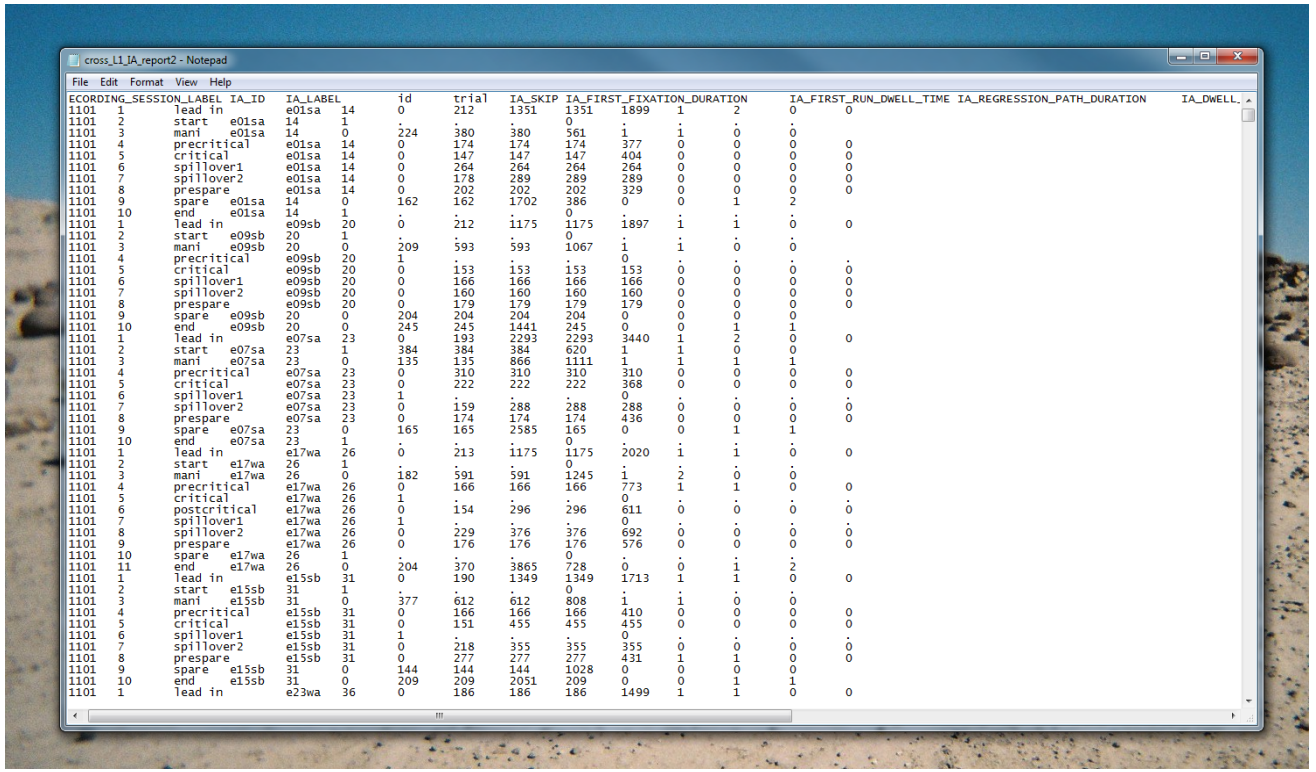
Fixation Report

- Save in Eyetracking 2016 folder
- Save as .txt file



Fixation Report

- Take a look



Finally…

- Thanks for taking part!
- Please send feedback!