



Experimental Humanities II

Eye-Tracking Methodology

First things first ...

- Great job, team Anestis + Jiří Č. + Kamila Č.! 😊
 - *Very nice comments on experimental design!*
- 25th April, A21, 18:00 „Data Quality Study“ – Kenneth Holmqvist
- 3 volunteers for presenting on Tue 26th April?
 - *To all of you, be on time!*
- Grading – I’ll find out if I need to create some exam time slot for which you need to sign up, otherwise will happen about 1 week since 26th April
- Informal meeting? [Doodle poll](#)

Browsing CH9-14

- Questions?:)

First drafts - do's and don'ts

Do's

- Go small and neat with the experiment
- Explain the terminology you are using and always define the terms (especially field-specific)
- Structure your drafts (title, importance, literature overview, project description – research questions and hypotheses, proposed eye-tracker, experiment, task, cover story, participants, groups, description of relevant measures and oculomotor events, expected outcomes, suggested analysis, references)
- Show how your stimulus + predictions look!
- Reflect your hypothesis and predictions in the analysis (be specific)
- Match stimuli – e.g. Pictures on size, colours, objects, luminosity...
- Turn on automatic spelling check in MS Word

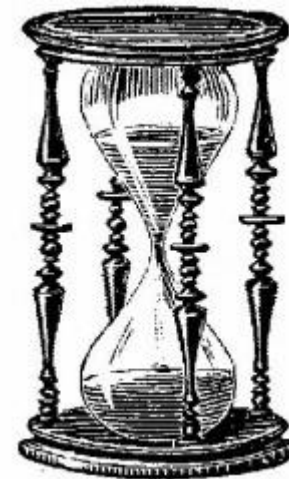
First drafts - do's and don'ts

Don'ts

- Don't try to save the world and/or evaluate the eye-tracking methodology
- Don't complain about the lack of space
- Don't include emotional statements (phrases such as: the biggest weakness of experiment, good overview, I feel, I'm afraid, in my opinion)

Final project - deadlines

- **23.4. 23:00** DDL final project



Final drafts

- 8-10 A4 pages (1.5 line spacing, 12pt font)
- All sections well written up, no „to-do“ left
- Use comments from your peers and me, decide if you are going to accept them or not

Lecture 5: Measures

- When to choose the eye-tracking measures?
- How to choose the eye-tracking measures?
- What to choose from?
- Complexity of measures
- Validity and reliability of measures
- Pilot study

When to choose the eye-tracking measures?

- Always **before** you start recording your study, so already during the experimental design planning phase
- Beware of fishing trips and post-hoc hypotheses

How to choose the eye-tracking measures?

- Based on the hypothesis and task, draw the expected eye movement behaviour onto the intended stimulus
- Run the pilot
- Recording what you expected?
 - Yes – run the study
 - No - redesign
- Within paradigms
 - If your study is very similar to an already published study, reuse the measures! 😊
 - When you deviate in design, you have to think for yourself

What to choose from?

- Previous studies, paradigms
- Experimental design operationalization to search between
 - Movement measures
 - Position measures
 - Count measures
 - Latency measures
 - Distance measures
 - All these described in the Book 😊

Movement measures

- Simple

Movement measure group	Uses	Page
Movement direction measures	<i>In what direction did the eye move?</i>	301
Movement amplitude measures	<i>How far did the eye move?</i>	311
Movement duration measures	<i>For how long did the eye move?</i>	321
Movement velocity measures	<i>How fast did the eye move?</i>	326
Movement acceleration measures	<i>How fast did the eye accelerate?</i>	332
Movement shape measures	<i>What is the shape of the eye movement?</i>	336
AOI order and transition measures	<i>How similar are movements in AOIs?</i>	339
Scanpath comparison measures	<i>How similar are two or more scan-paths?</i>	346

- Complex

Position measures

Position measure group	Uses	Page
Basic position measures	<i>Where did the participant look?</i>	357
Position dispersion measures	<i>How focused versus distributed is the gaze data?</i>	359
Position similarity measures	<i>How similar are the positions of two groups of gaze data?</i>	370
Position duration measures	<i>For how long did gaze stay in the position?</i>	376
Position dilation measures	<i>What is the pupil dilation at the position?</i>	391

Count measures

- Number is simply the number
- Proportion 0-1%
- Rate – number / extension by temporal range

Countable entities	How researchers count them	Page
Saccades	<i>Number, proportion and rate</i>	403
Glissades	<i>Proportion</i>	405
Microsaccades	<i>Rate</i>	406
Square-wave jerks	<i>Rate</i>	407
Smooth pursuits	<i>Rate</i>	408
Blinks	<i>Rate</i>	410
Fixations	<i>Number, proportion and rate</i>	412
Dwells	<i>Number, proportion and rate</i>	417
Participants, areas of interest and trials	<i>Number and proportion</i>	419
Transitions	<i>Number, proportion and rate</i>	422
Regressions, backtracks, look-backs, and look-aheads	<i>Number and rate</i>	425

Latency measures

Latency measure	Target question	Page
Saccadic latency	<i>How soon after target onset does the saccade start?</i>	430
Smooth pursuit latency	<i>How soon after target motion onset does smooth pursuit start?</i>	432
Latency of the reflex blink	<i>How soon after onset of an event which causes blink does the blink commence?</i>	434
Pupil dilation latency	<i>How soon after onset of an event which causes dilation does the pupil start to dilate?</i>	434
Eye fixation related potential (EFRP)	<i>How soon after the eye started looking at X does the ERP component show?</i>	436
Entry time	<i>How soon after onset is the AOI entered?</i>	437
TX: Thresholded entry time	<i>How soon after onset have X % of participants visited the AOI?</i>	438
Proportion of participants over time	<i>What proportion of the participants look or have looked at an AOI at a specific point in time?</i>	440
Eye–voice latency	<i>How soon after the eye started looking at X does the participant verbalize X?</i>	442
Eye–hand span	<i>How soon after the eye looked at X does the hand perform the corresponding action?</i>	445
The eye–eye span (cross-recurrence analysis)	<i>How soon, on average, does a listener look where the speaker looks?</i>	447

Distance measures

Distance measure	Target question	Page
Eye–mouse distance	<i>What is the distance between the point of gaze and the mouse position?</i>	448
Disparity	<i>What is the distance between the points of gaze of left and right eye?</i>	449
Smooth pursuit gain	<i>What is the velocity ratio between point of gaze and the target?</i>	450
Smooth pursuit phase	<i>How far behind or ahead is the eye with respect to the target?</i>	451
Saccadic gain	<i>What is the distance between saccadic ending point and target?</i>	452

Complexity of measures - simple measure

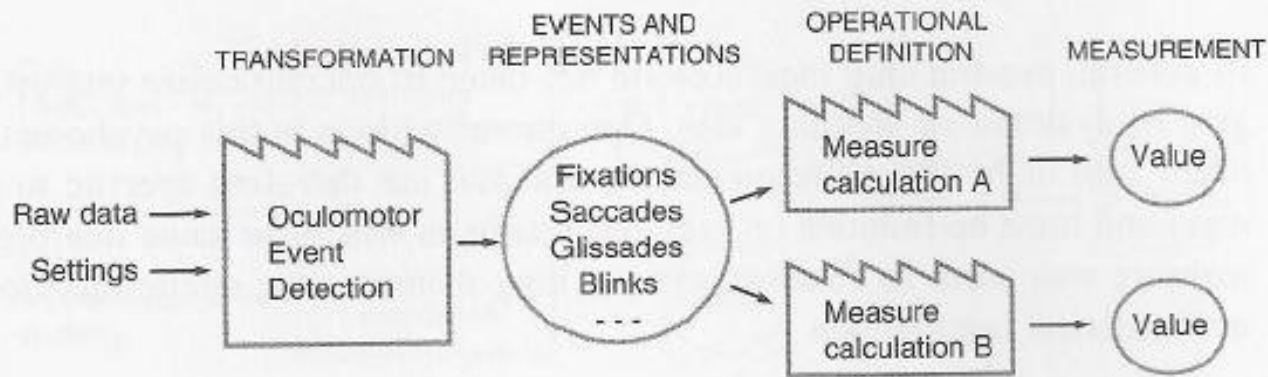


Fig. 14.3 How a measurement value for saccadic amplitude is produced from raw data and settings. The operational definition presumes a transformation of data that we know as oculomotor event detection, and which is performed using one from a variety of algorithms, using appropriate settings as secondary input (not shown). The transformation produces events and representations. The second set of algorithms (factories) are the operational definitions belonging to the measure itself, in our case the two ways of calculating saccadic amplitude, each producing its own measurement value.

Complexity of measures - complex measure

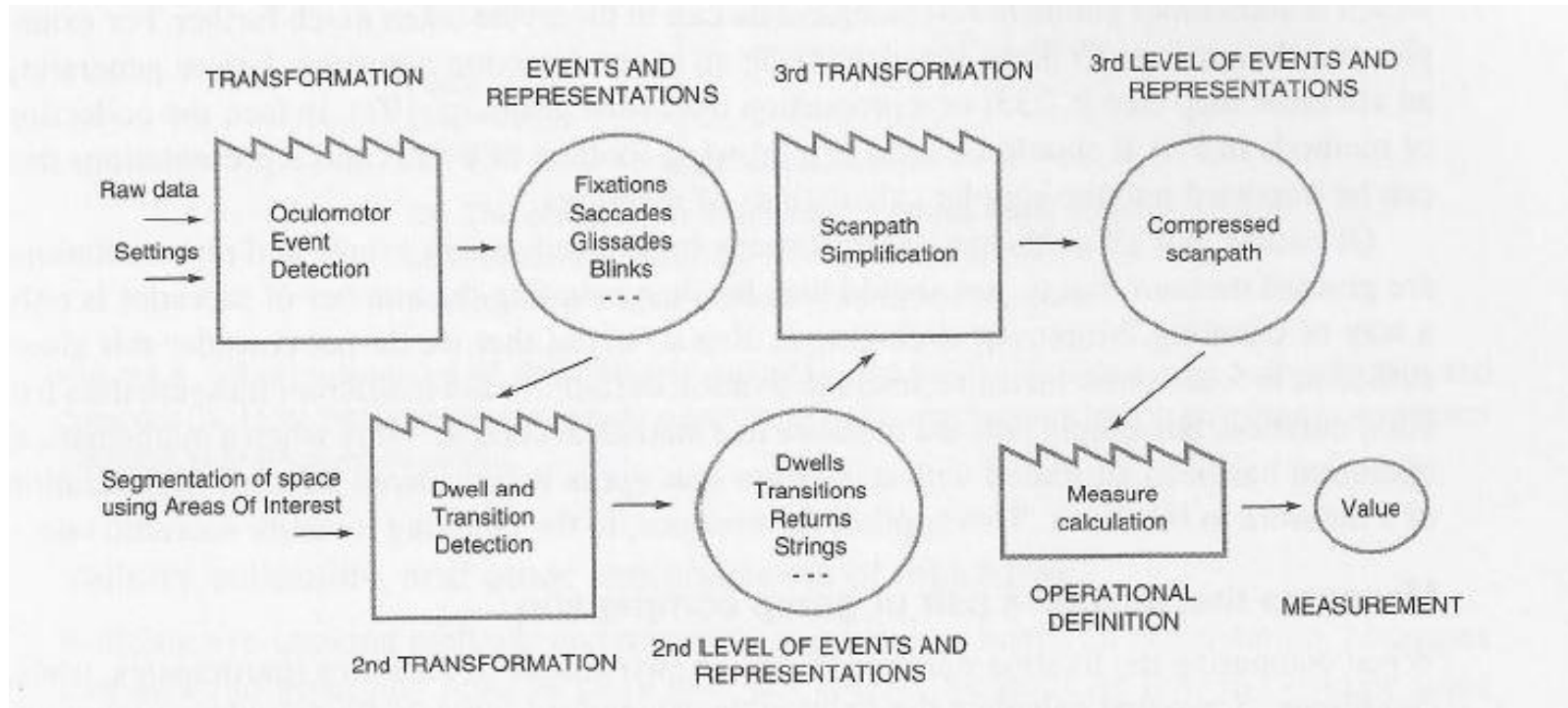


Fig. 14.4 Several of the scanpath comparison measures use repeated transformations of data before reaching the level of actual measure calculation.

Validity and reliability of measures

- Measures are not all equal
- Some are more verified than others
- Reliability: e.g. Fixation duration is not a reliable measure of the level of processing, since there are many other causes of long fixation durations that could appear in almost any experiment
- Validity: It measures what it is intended to measure. E.g., does the duration of a fixation on a text unit actually reflect the processing difficulty of the reader?

Pilot your measures! 😊

- Your participants may not behave as you thought they would when you were drawing your expectations on the stimulus
- Statistical methods cannot be adapted to just any measures and experimental designs that you happen to use

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- Minimizing the risk of recording lots of data and being unable to use it



What have we learned so far?

- Choose your measures before you start recording the experiment
- Always draw the expected eye movements on the stimulus
- Keep in mind that whenever you are using complex measures, a part of the information can be lost through the transformations
- Reuse measures from paradigms or similar studies
- Prefer such measures which have been tested in many studies before
- Pilot your measures

- Questions?:)

Collecting questions left unanswered

- Unanswered questions on eye-tracking?

For the next lecture...



- Kenneth Holmqvist as a guest
- Your projects presentation
- Q&A session
- I'll collect feedback on the course
 - What do you think about the course?
 - Did it give you what you expected from it?
 - What was good, what was less optimal?
 - Something that you were missing?
 - Personal message? 😊
- Prepare
 - Send the final projects on my email address until 23rd April, 23:00