



Testing linguistic theory with visual world eye-tracking evidence

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IZ D2MCM Cookie Talk
12.12.2024

Eye-tracking: Recording eye movements

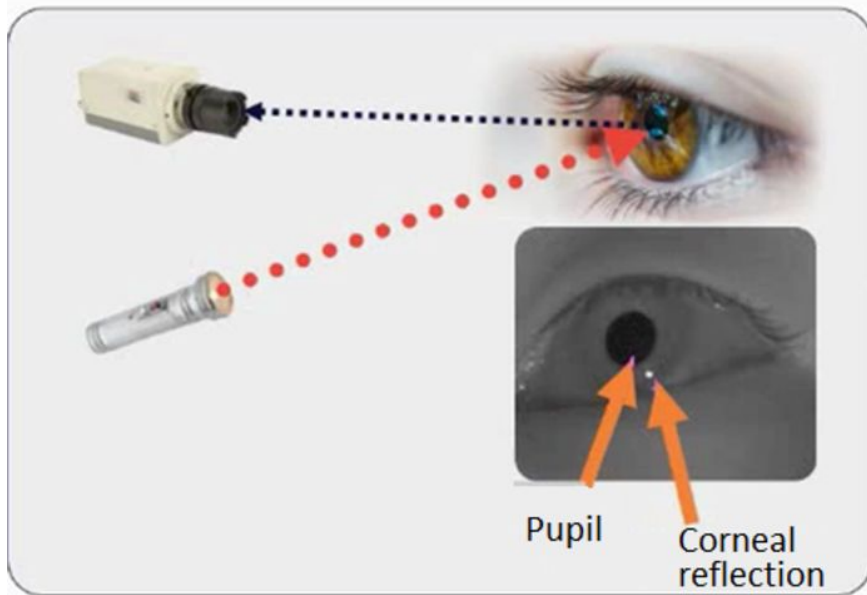
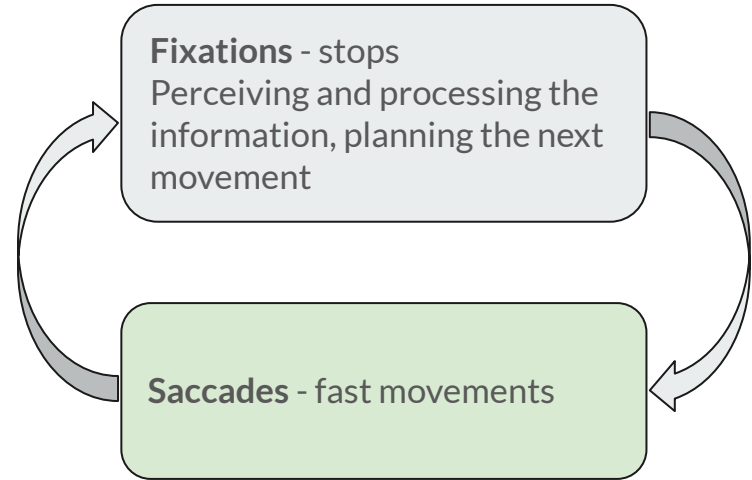


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(Scheme based on Conklin et al. (2018))

Reading vs. visual world

DANS, KÖN OCH JAGPROJEKT

På jakt efter ungdomars kroppsspråk och den "synkretiska dansen", en sammansmältning av olika kulturers dans, har jag i mitt fältarbete under hösten rört mig på olika arenor inom skolans värld. Nordiska, afrikanska, syd- och östeuropeiska ungdomar gör sina röster hörda genom sång, musik, skrik, skraff och gestaltar känslor och uttryck med hjälp av kroppsspråk och dans.

Den individuella estetiken framträder i kläder, frisyrer och symboliska tecken som förstärker ungdomarnas "jagprojekt" där också den egna stilen i kroppsrörelserna spelar en betydande roll i identitetsprövningen. Upphållsrummet fungerar som offentlig arena där ungdomarna spelar upp sina performance-liknande kroppsspråk.

Image by [Lucs-kho](https://upload.wikimedia.org/wikipedia/commons/e/ef/Reading_Fixations_Saccades.jpg) at [English Wikipedia](https://upload.wikimedia.org/wikipedia/commons/e/ef/Reading_Fixations_Saccades.jpg):
https://upload.wikimedia.org/wikipedia/commons/e/ef/Reading_Fixations_Saccades.jpg



(Razguliaeva et al. 2024)



Eye-tracking in linguistics

(Conklin et al. 2018; Ito and Knoeferle 2022 and references therein)

- Motivation: Locus of fixation indicates attention and information processing
- Eye-mind assumption
- Visual world: Adding temporal information - when participants look at certain objects
- Advantages:
 - fine-grained online measurement
 - direct, no conscious decision-making
 - relatively natural setting
- Considerations:
 - control for various factors
 - choice of measurement



Modelling the question-statement opposition in Slavic languages (QueSlav)

- DFG and GAČR
- Humboldt University in Berlin and Charles University in Prague
- A combination of a theoretical and a data-driven approach
- Strategies of expressing questions in Slavic languages
 - Fine meaning distinctions and context restrictions
- Eye-tracking: Processing of yes/no questions in Czech and Russian
 - Positive vs. negative alternative (Tian et al. 2016; 2021)



Pipeline

Preparation

- Experiment design
- Preregistration
- Creating the stimuli
- Programming the experiment
- Looking for participants

Experiment in the lab

- Consent forms and questionnaires
- Calibration
- Experiment itself
- Securing the data

Data analysis

- Preprocessing
- Descriptive statistics
- Inferential statistics



Experiment design and stimuli

- **Theoretical background:** Formal approaches to yes/no-questions: 1) Both alternatives are present in the meaning; 2) Only the pronounced alternative is crucial
- What to compare (**predictors**)? - Negation, word order.
- How to compare them (**experimental setup**)? - Audio of questions + images depicting the positive and the negative alternative
- Experimental **stimuli** should differ only in the features we compare

(13) Czech

- | | | | |
|----|--|----------------------|----|
| a. | { Umyla / Neumyla } | Dita včera holínky? | V1 |
| | washed not-washed | Dita yesterday boots | |
| b. | Dita { umyla / neumyla } | včera holínky? | V2 |
| | Dita washed not-washed | yesterday boots | |
| | 'Did Dita (not) wash the boots yesterday?' | | |

Participants and experimental setup

- Around 50 participants pro language
- Looking for participants: university resources, social networks
- Communication of the procedure (oral and written instructions)
- Camera calibration
- Additional task: choose a picture

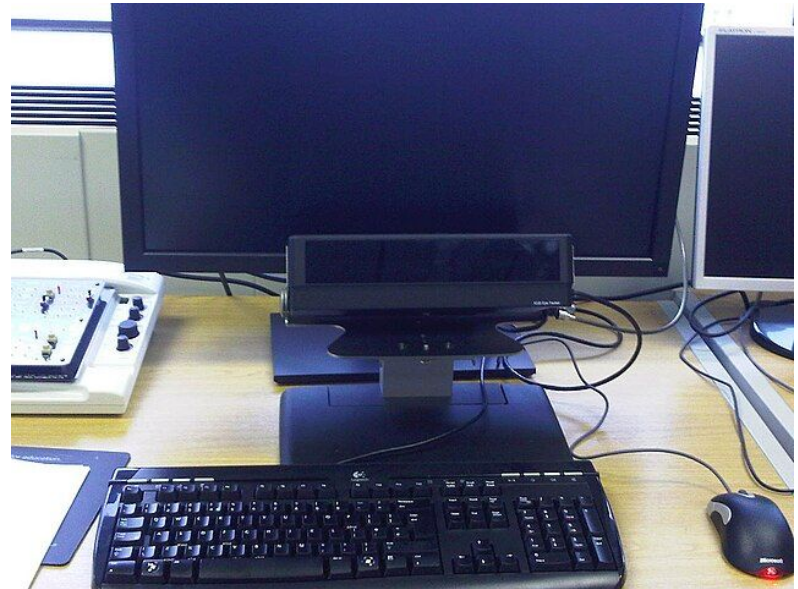
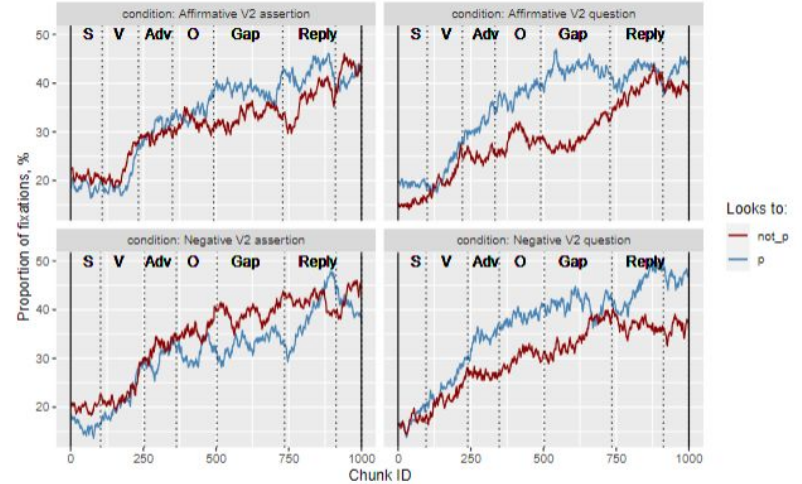


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Data analysis

- Interest area vs. interest period
- Dependent variable - a variety of measures
- Choice of software
- Statistical method: linear mixed models
- Visualization



(Razguliaeva et al. 2024)



Conclusion

- Eye-tracking is a fine-grained and precise method
- Controlled lab setting, but relatively natural behaviour
- Link between eye movements and language processing is based on certain assumptions
- A lot of choices to make as a researcher

Thank you to Maria Onoeva, Roland Meyer, Radek Šimík and Kateřina Hrdinková!



References

- Conklin, Kathy, Ana Pellicer-Sánchez und Gareth Carrol. 2018. *Eye-Tracking: A Guide for Applied Linguistics Research*. 1. Aufl. Cambridge University Press. doi:[10.1017/9781108233279](https://doi.org/10.1017/9781108233279), <https://www.cambridge.org/core/product/identifier/9781108233279/type/book> (zugegriffen: 11. Dezember 2024).
- Ito, Aine und Pia Knoeferle. 2022. Analysing data from the psycholinguistic visual-world paradigm: Comparison of different analysis methods. *Behavior Research Methods*. doi:[10.3758/s13428-022-01969-3](https://doi.org/10.3758/s13428-022-01969-3), <https://link.springer.com/10.3758/s13428-022-01969-3> (zugegriffen: 11. Januar 2023).
- Marconi, Mathieu, Noélia Do Carmo Blanco, Christophe Zimmer und Alice Guyon. 2023. Eye movements in response to different cognitive activities measured by eyetracking: a prospective study on some of the neurolinguistics programming theories. *Journal of Eye Movement Research* 16, Nr. 2 (16. Mai). doi:[10.16910/jemr.16.2.2](https://doi.org/10.16910/jemr.16.2.2), <https://bop.unibe.ch/JEMR/article/view/8877> (zugegriffen: 11. Dezember 2024).
- Razguliaeva, Mariia, Maria Onoeva, Kateřina Hrdinková, Radek Šimík und Roland Meyer. 2024. Polar question meaning in Slavic. Visual world eye-tracking evidence. Presentation. Gehalten auf: Psycholinguistics of Slavic Languages, University of Wrocław.
- Tian, Ye, Heather Ferguson und Richard Breheny. 2016. Processing negation without context – why and when we represent the positive argument. *Language, Cognition and Neuroscience* 31, Nr. 5: 683–698. doi:[10.1080/23273798.2016.1140214](https://doi.org/10.1080/23273798.2016.1140214), .
- Tian, Ye, Bob van Tiel, Élise Clin und Richard Breheny. 2021. Representing Polar Questions. *Journal of Psycholinguistic Research* 50, Nr. 6: 1535–1555. doi:[10.1007/s10936-021-09814-y](https://doi.org/10.1007/s10936-021-09814-y), .