

Research Training Group  
“Simply complex! A multimodal and interdisciplinary approach to examine linguistic complexity within Easy Language”

## “The validity of German Easy Language rules: First empirical evidence from ET, EEG and fMRI studies”

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# Hierarchies in lexical complexity:

Are there effects of word frequency, word length and repetition on the visual word processing of people with cognitive impairment?

Laura Schiff



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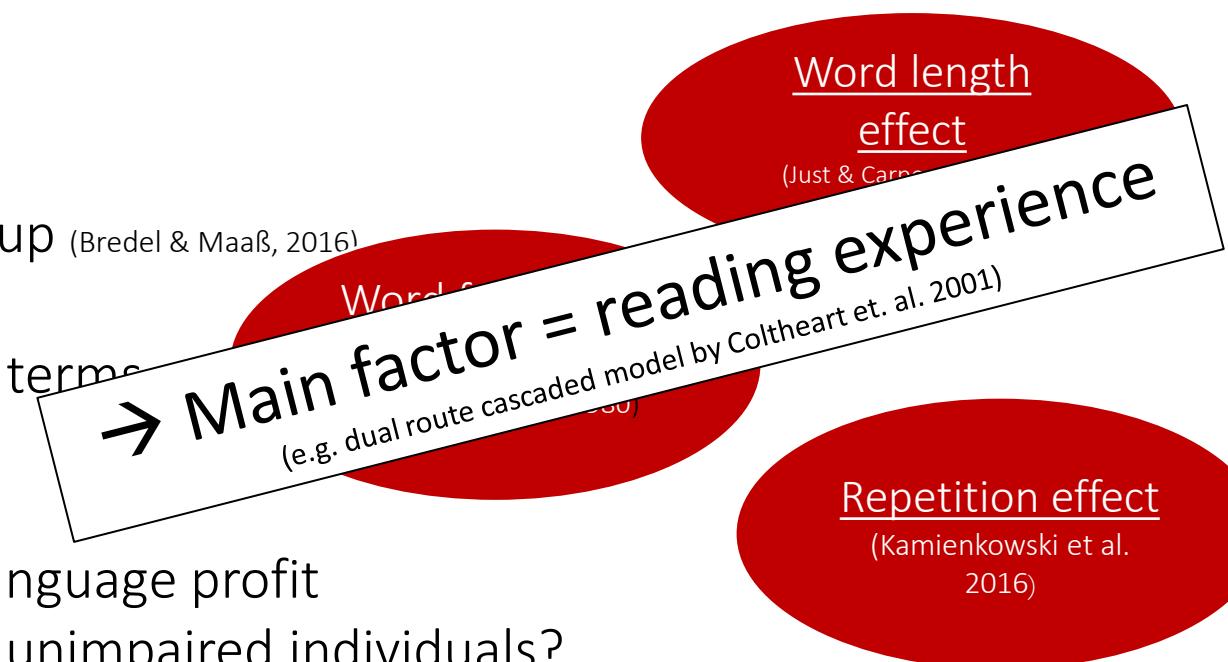


# The Current Project

## Guidelines on word use:

- ,simple' words\*
- ,short' words (and sentences)\*
- ,familiar' words \*
- prototypical representative of a word group (Bredel & Maaß, 2016)
- avoidance of foreign words and technical terms
- repetition of unfamiliar words\*

## Theoretical foundation



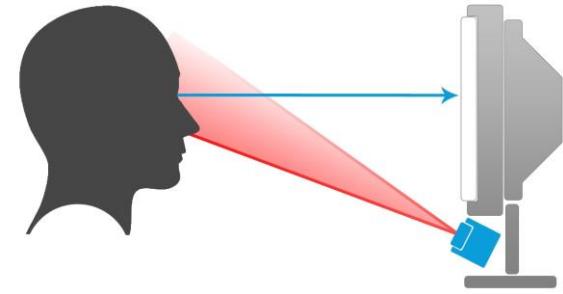
**Desiderata:** Does the target group of Easy Language profit from the same parameters on word level as unimpaired individuals?

\*early guidelines on German Easy Language: BITV 2.0 (2011), Inclusion Europe (2009), Netzwerk Leichte Sprache (2009/2013)

# Research Questions

- 1) Does the **frequency effect** for visual processing times of frequent and infrequent words appear in people with cognitive impairment in the same way as it does in cognitive unimpaired individuals?
- 2) Does the **length effect** for visual processing times of frequent and infrequent words appear in people with cognitive impairment in the same way as it does in cognitive unimpaired individuals?
- 3) How does the **repetition** of unfamiliar words influence the visual word processing speed in people with cognitive impairment?
- 4) Are there any **long-term learning effects** for frequently repeated unfamiliar words in people with cognitive impairment?

# Methods



## Eye-Tracking-Experiment

SMI 250Hz Eye Tracker

Examination	Target Group	Control Group	controlled
sentence	• V 40 people with cognitive impairment	40 people <u>without</u> cognitive impairment	
Singl	• varying etiologies • varying level of retardation		
Sacc	• S German first language speakers	German first language speakers	
	18-60 years of age	18-60 years of age	
	Sufficient reading abilities (pretests)		

## Additional

- Evaluation → Problem: both groups = very heterogeneous
- Think about protocols Approach: variance explanation through neuropsychological test battery & meta data
- Behavioral task for non-readers (Rating)

# Experimental Design



## Material:

Target words: (4 conditions)

8 words selected as **short & infrequent**

8 words selected as **short & frequent**

8 words selected as **long & infrequent**

8 words selected as **long & frequent**

→  $\frac{1}{2}$  of the infrequent words will be presented 3 times

Sentence length	5-8 words
Target word position	3 <sup>rd</sup> Position
Pretarget	adjective, matched for length and frequency
Posttarget	verb, matched for length and frequency
Syntax	SVO

→ All target words are **controlled** for: abstractness & familiarity

→ All target sentences are **controlled** for: naturelness & comprehensibility & sentence structure

# Procedure & Analysis

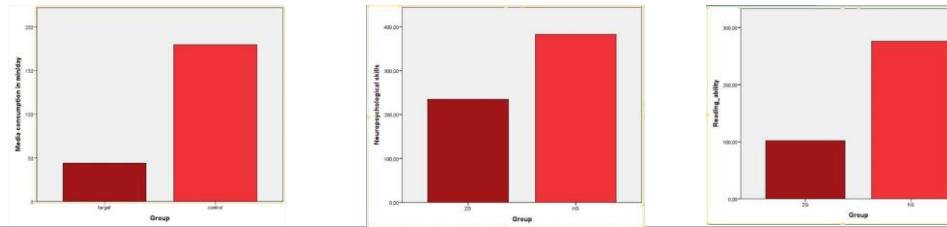
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## Collecting data from:

- 5 pretests on neuropsychological skills
- 2 pretests on reading abilities
- 1 eye-tracking-experiment (48 sentences + questions)
- 1 follow-up study (eye-tracking)

Dependant variables	Independant variables	
Eye Tracking	Within subject fixed effects:	<b>Between subject fixed effects:</b>
single fixation duration	word frequency	group (target vs. control)
first fixation duration	word length	reading skills
gaze duration	repetition	neuropsychological skills
total viewing time	Control variables	abstractness & familiarity

# First Results



## Media consumption

- Significant difference between control ( $m=179\text{min}/\text{per day}$ ) and target group ( $m=41\text{min}/\text{per day}$ )  
→ Less reading experience

## Neuropsychological overview

- Significant differences in all tests between both groups

## Reading abilities

- significant difference for *word reading* ( $m_{\text{target}}=41$ ,  $m_{\text{control}}=121$ ), *non-word reading* ( $m_{\text{target}}=23$ ,  $m_{\text{control}}=78$ ) & *sentence evaluation* ( $m_{\text{target}}=32$ ,  $m_{\text{control}}=76$ ) between both groups
- larger difference between *word reading* and *non-word reading* in control group than in target group

## Answer Accuracy

- huge individual differences

# Eye Tracking Study on the Visual Segmentation of Compounds in Easy Language

19th September 2019 Klaara 2019

Silvana Deilen

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# Hypothesis and Method

The insertion of a mediopoint facilitates processing of transparent compounds (1), but  
hinders processing of non-transparent compounds (2)

(1) Apfel·baum < Apfelbaum < Apfel-Baum

(2) Löwenzahn < Löwen·zahn < Löwen-Zahn

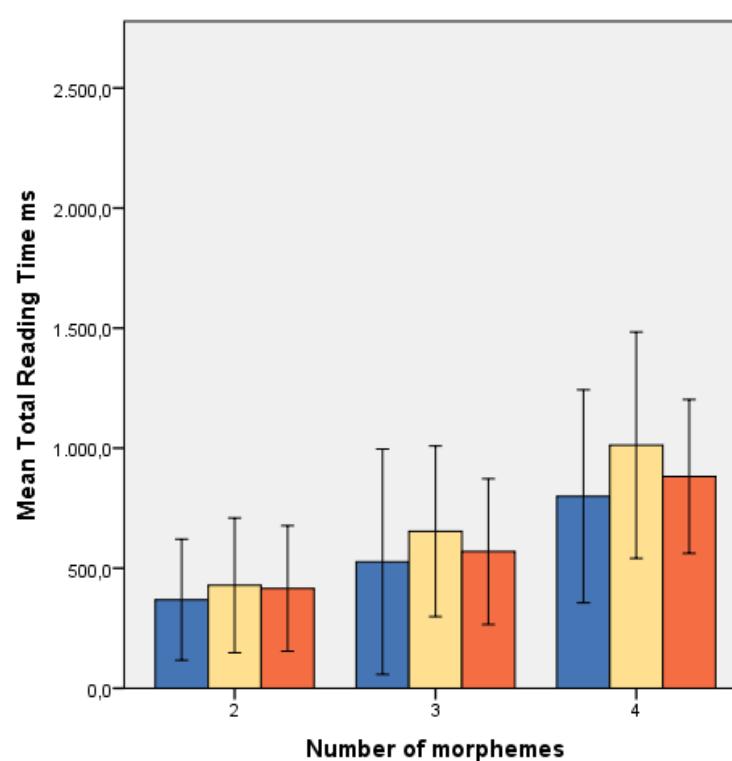
## Method

- Experiments on word level (word-picture-matching-test) and sentence level
- **Independent variables:**
  - Visual structuring sign
  - Number of morphemes
  - Semantic transparency
- **Recording of eye movements:**
  - Number of fixations
  - Total reading time
  - Regressions
- **Target group:** students with prelingual hearing impairments/deafness

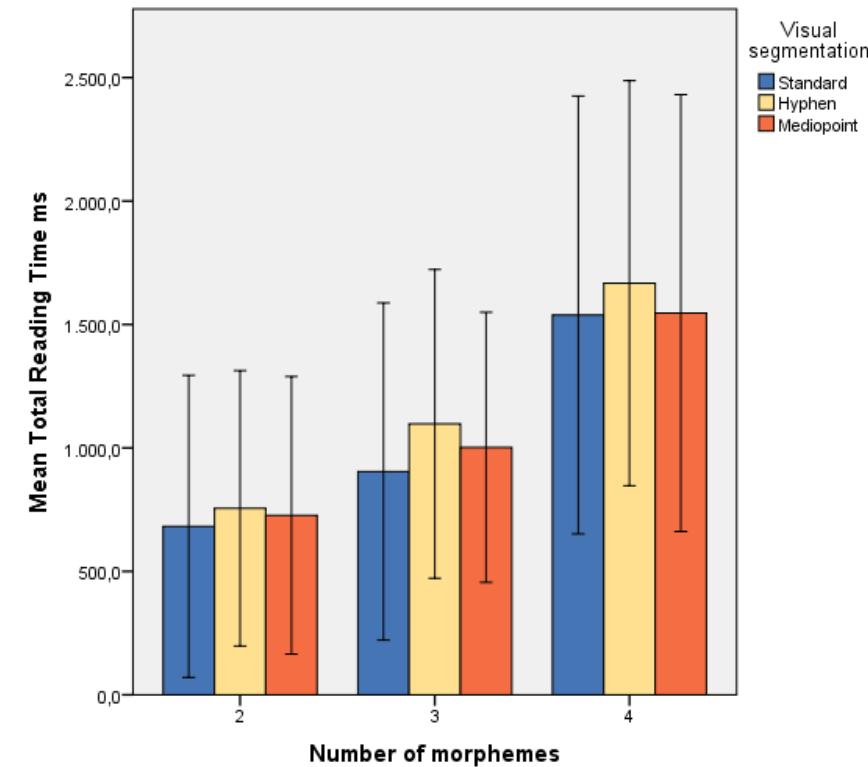
# Löwen-Zahn (*dandelion*)



# First Results: Number of morphemes

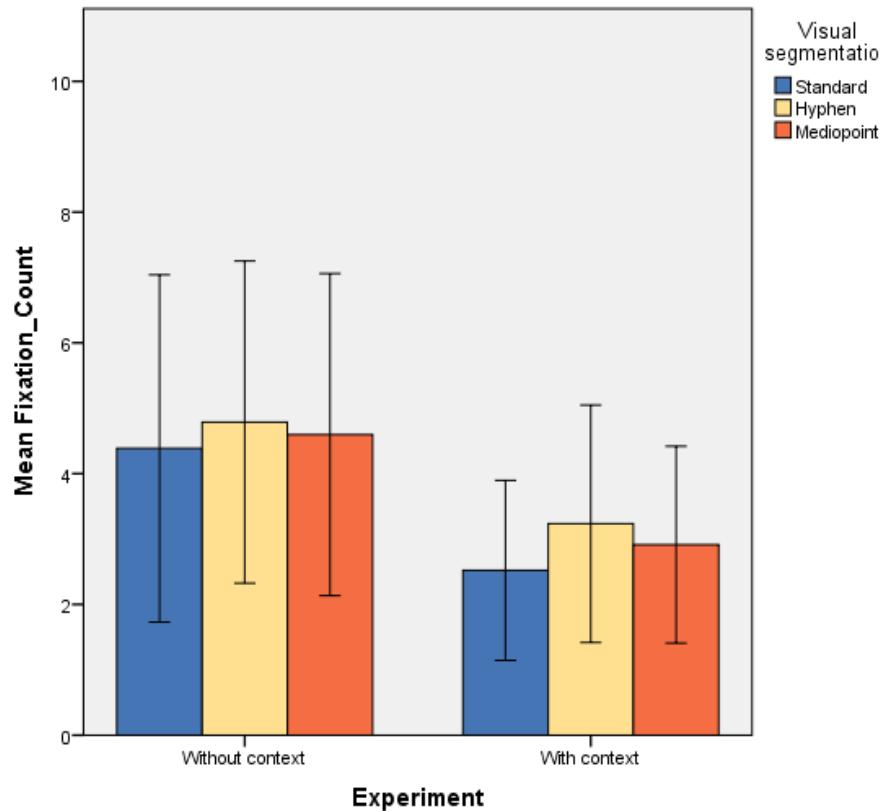


Unimpaired speakers

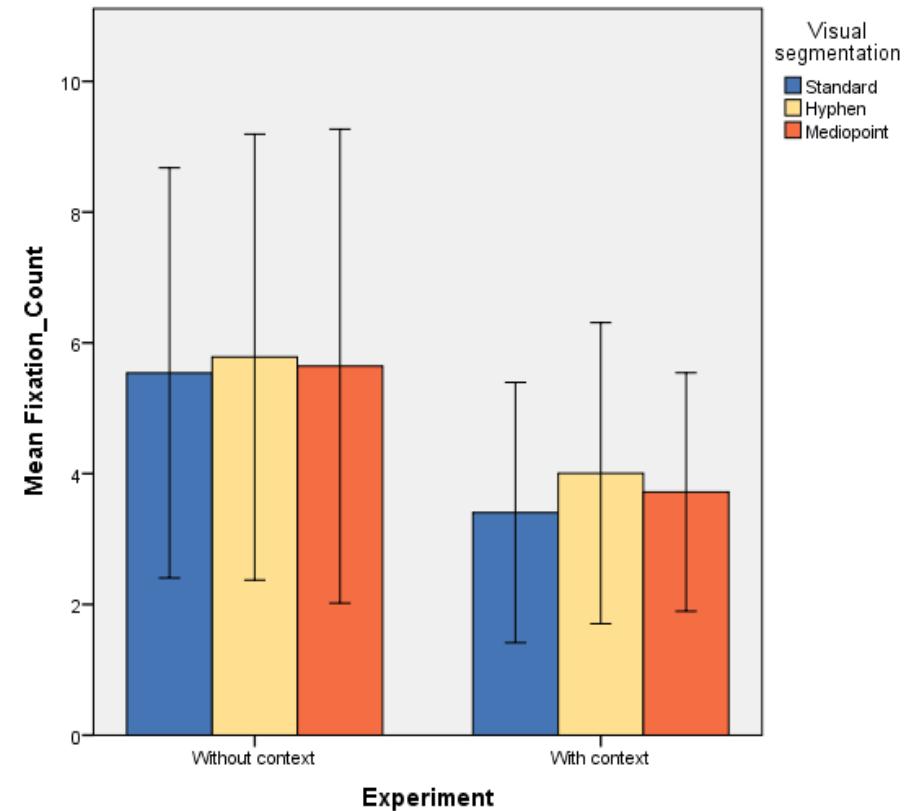


Target group

# First Results: Context

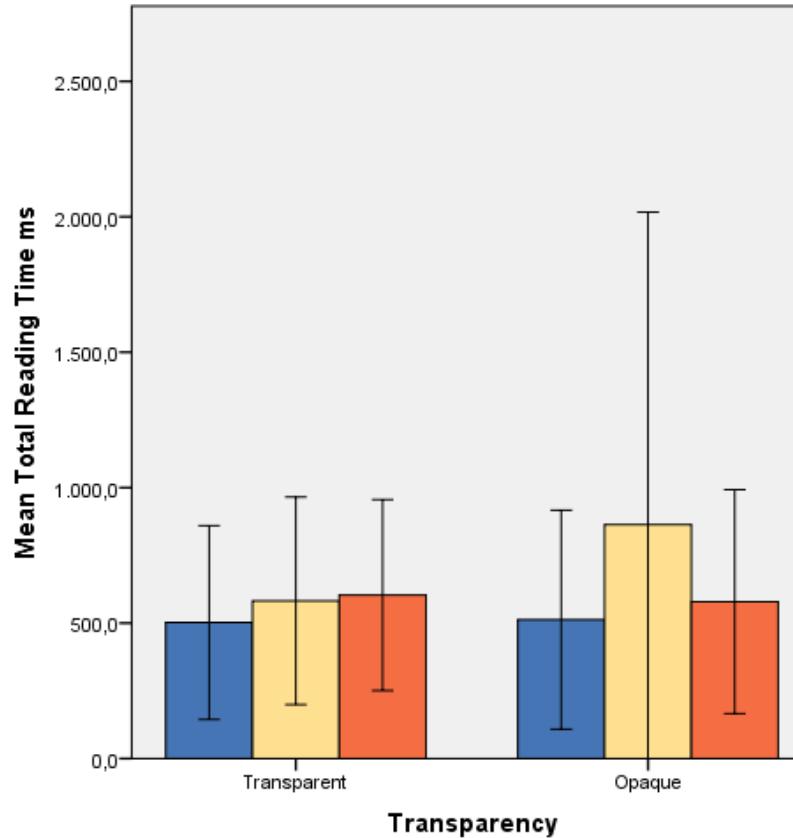


Unimpaired speakers

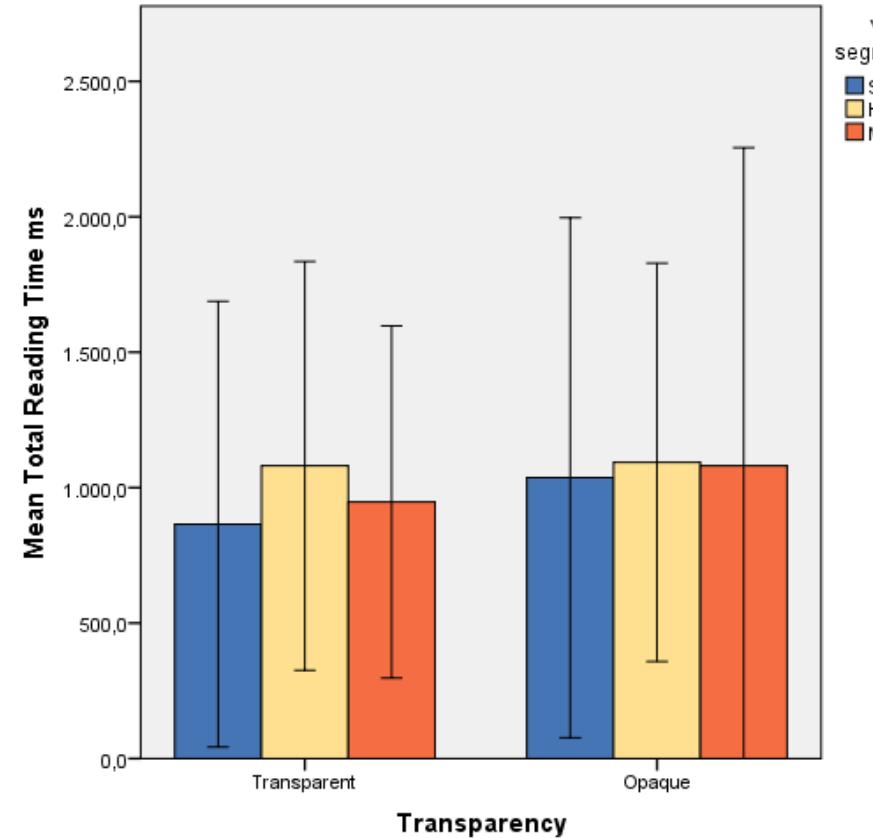


Target group

# First Results: Transparency

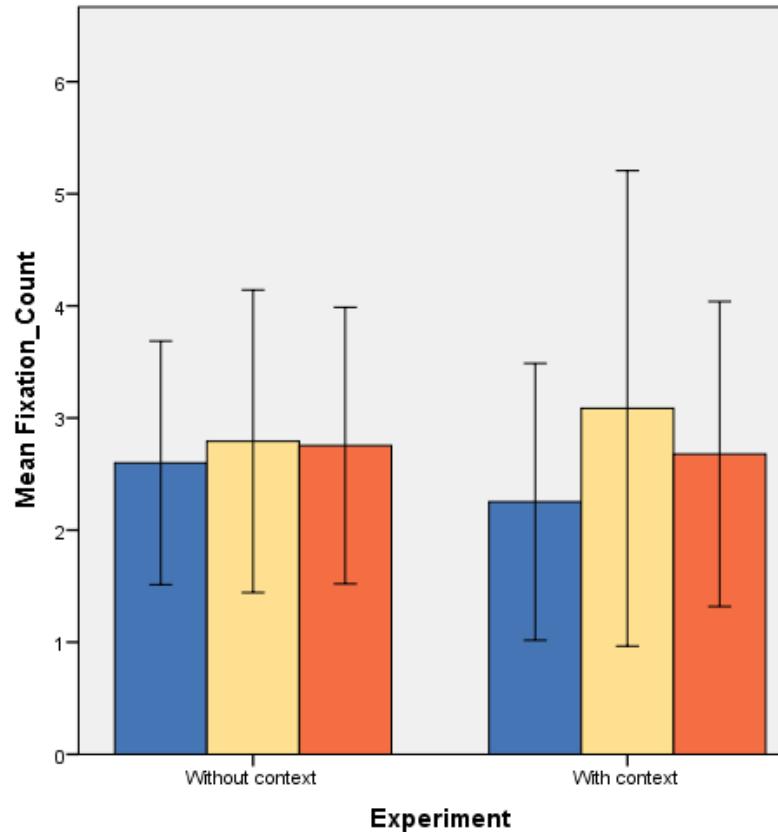


Unimpaired speakers

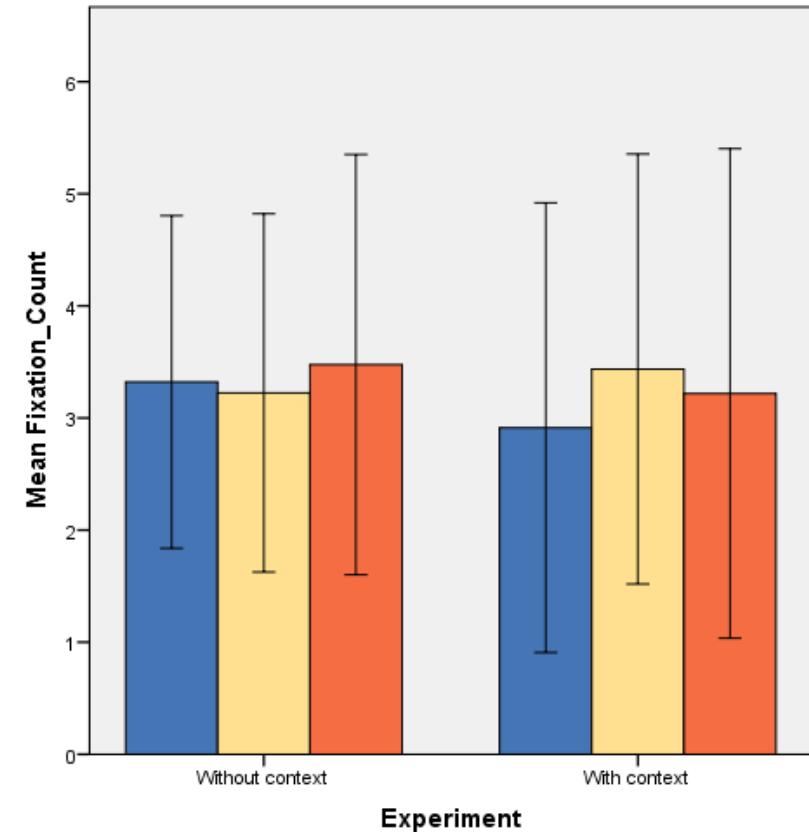


Target group

# First Results: Context



Unimpaired speakers



Target group

# NEGATION IN GERMAN EASY LANGUAGE

Does the typographic marking of negation words enhance  
negation comprehension?

19th September 2019 Klaara konferenssin Helsinki

Johanna Sommer



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# Rules and Recommendations for Negation Structures

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- Avoid negation, rather use affirmative structures
- If not possible: use „nicht“ („not“) negation rather than „kein“ („no“) negation
- Print negation words in bold typeface
- John is feeling well > John is **not** sick > John has **no** flu

# Research Questions + Hypotheses

1. Are there processing differences of negated sentences with typographically marked negation words compared to sentences with unmarked negation words? (Lotze et al. 2012)
2. Are these potential differences specific for certain forms of negation („*nicht*“ („not“) / „*kein*“ („no“) / noun negation / verb negation)? (Bredel & Maaß 2016)

1. Behavioral: Faster reading times, higher accuracy rates, faster RTs in probe task  
EEG: higher accuracy rates, faster RTs in a truth value-evaluation task  
ERPs in EEG: negativity (N400) after negated words attenuated after typographically marked negation words (emphasis effect) (Lotze et al. 2012, Fischler et al. 1983, Lüdtke et al. 2005, 2008; Scappini et al. 2015, Nieuwland & Kuperberg, 2008 a.o.)
2. Up to date no empirical finding for comparison of different negation forms

# Procedure

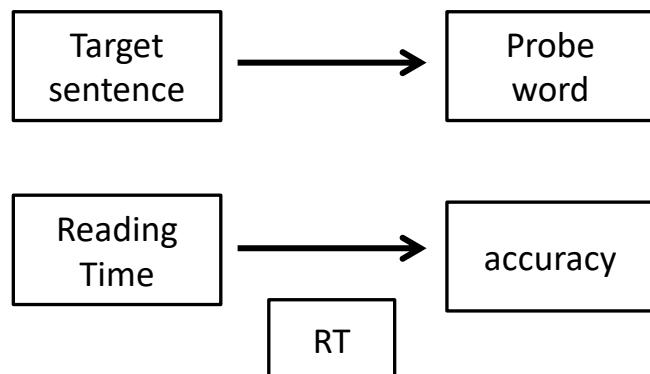
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- Subjects:  $M=24,0$  years old (range from 19-37 years), right handed, monolingual German, no visual, neurological, psychological or communicational disorder
- 0) Neuropsychological Pretests: TMT-1 & 2, verbal fluency, MWT-B, number recall
- 1) Self-paced reading + Probe task (n=28):
  - accuracy, RT for probe task
  - Reading time from first word to last button press before probe word
- 2) EEG + truth value evaluation (n=21):
  - accuracy, RTs for truth value evaluation
  - ERPs for time windows: - 200-1000ms before / after negated target object

# Design

## 1. Self-paced reading + Probe task

3 (typographic manipulation) x 2 (polarity) x 2 (negation form)

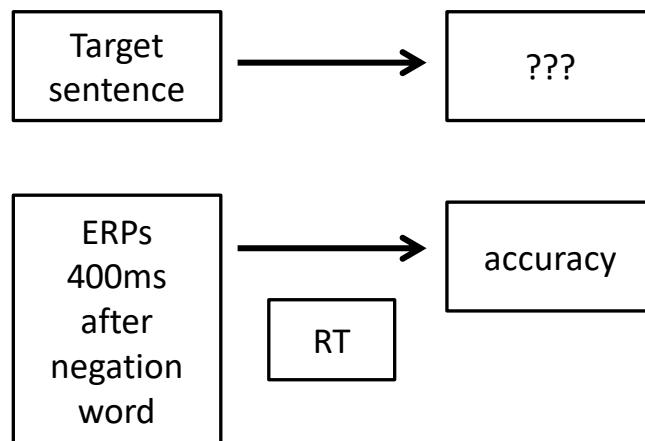


Bold Print	Uppercase	Normal Print
<b><u>Sentence negation</u></b> The woman is not reading the newspaper.  Die Frau liest <b>nicht</b> die Zeitung.	The woman is NOT reading the newspaper.	The woman is not reading the newspaper.
<b><u>Phrase negation</u></b> The woman is reading <b>no</b> newspaper.  Die Frau liest <b>keine</b> Zeitung.	The woman is reading NO newspaper.	The woman is reading no newspaper.
<b><u>Affirmation with adverb</u></b> Today, the woman is reading the newspaper.  Die Frau liest <b>heute</b> die Zeitung.	TODAY, the woman is reading the newspaper.	Today, the woman is reading the newspaper.
<b><u>Affirmation without adverb</u></b> The woman is reading a newspaper.  Die Frau liest <b>eine</b> Zeitung.	The woman is reading A newspaper.	The woman is reading a newspaper.

# Design

## 2. EEG: truth value evaluation

3 (typographic manipulation) x 2 (polarity) x 2 (truth value)

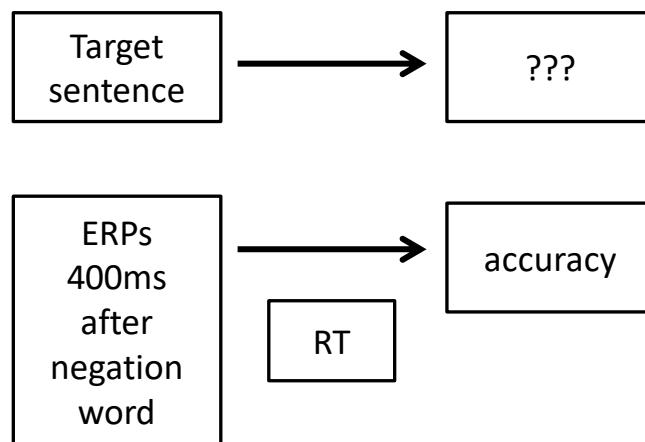


Bold Print	Uppercase	Normal Print
<b><u>Affirmation true</u></b> A trout is <b>a</b> fish.  Eine Forelle ist <b>ein</b> Fisch.	A trout is A fish.	A trout is a fish.
<b><u>Affirmation false</u></b> A trout is <b>a</b> tool.  Eine Forelle ist <b>ein</b> Werkzeug.	A trout is A tool.	A trout is a tool.
<b><u>Negation true</u></b> A trout is <b>no</b> tool.  Eine Forelle ist <b>kein</b> Werkzeug.	A trout is NO tool.	A trout is no tool.
<b><u>Negation false</u></b> A trout is <b>no</b> fish.  Eine Forelle ist <b>kein</b> Fisch.	A trout is NO fish.	A trout is no fish.

# Design

## 2. EEG: truth value evaluation

3 (typographic manipulation) x 2 (polarity) x 2 (congruency)



Bold Print	Uppercase	Normal Print
<b><u>Affirmation congruent</u></b> The woman is reading a newspaper.  Die Frau liest <b>eine</b> Zeitung.	The woman is reading A newspaper.	The woman is reading a newspaper.
<b><u>Affirmation incongruent</u></b> The woman is reading a bicycle.  Die Frau liest <b>ein</b> Fahrrad.	The woman is reading A bicycle.	The woman is reading a bicycle.
<b><u>Negation congruent</u></b> The woman is reading no newspaper.  Die Frau liest <b>keine</b> Zeitung.	The woman is reading NO newspaper.	The woman is reading no newspaper.
<b><u>Negation incongruent</u></b> The woman is reading no bicycle.  Die Frau liest <b>kein</b> Fahrrad.	The woman is reading NO bicycle.	The woman is reading no bicycle.

# Preliminary results

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# Reading Times SPR

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Condition	Example	Minimum	Maximum	MEAN (msec)	STAB
NOF	Die Frau liest <b>keine</b> Zeitung.	674,2	4842,0	2196,821	961,9427
AOF	Die Frau liest <b>eine</b> Zeitung.	787,1	5099,9	2237,876	955,1030
AON	Die Frau liest eine Zeitung.	864,5	5275,4	2275,617	972,4570
NOU	Die Frau liest KEINE Zeitung.	839,2	5128,2	2296,972	989,3466
NON	Die Frau liest keine Zeitung.	777,7	5515,7	2329,426	1075,1732
AOU	Die Frau liest EINE Zeitung.	892,1	4985,9	2333,040	1010,1602
NWN	Die Frau liest nicht die Zeitung.	1141,9	5991,0	2712,737	1172,4388
AWN	Die Frau liest heute die Zeitung.	1122,7	6166,8	2718,829	1152,1269
AWF	Die Frau liest <b>heute</b> die Zeitung.	1043,6	5936,6	2744,129	1111,9950
AWU	Die Frau liest HEUTE die Zeitung.	1189,8	6225,8	2790,940	1173,6266
NWF	Die Frau liest <b>nicht</b> die Zeitung.	1236,5	6581,1	2822,482	1213,0125
NWU	Die Frau liest NICHT die Zeitung.	1223,5	9768,2	2954,231	1358,1135

\*NON-NOF ( $T=2,261(193); p=0,025$ )

But not NON-NOU

\*NWN-NWU ( $T=-3,213 (193); p=0,002$ )

But not NWN-NWF

\*NOF-NOU ( $T=-2,349 (193); p=0,02$ )

But not NWF-NWU

Affirmative Sentences: 93,5%

Negative Sentences: 86,6%

# Accuracy Probe Task

Polarity	Sentence type	Typography	Example	Absolute	Relative
Affirmative	with adverb (W)	Bold print (F)	Die Frau liest <b>heute</b> die Zeitung.	193	0.951
Affirmative	without adverb (O)	Upper case(U)	Die Frau liest EINE Zeitung.	192	0.946
Affirmative	W	Normal (N)	Die Frau liest heute die Zeitung.	190	0.936
Affirmative	W	U	Die Frau liest HEUTE die Zeitung.	190	0.936
Affirmative	O	N	Die Frau liest eine Zeitung.	187	0.921
Affirmative	O	F	Die Frau liest <b>eine</b> Zeitung.	187	0.921
Negative	W	N	Die Frau liest nicht die Zeitung.	181	0.892
Negative	W	F	Die Frau liest <b>nicht</b> die Zeitung.	180	0.887
Negative	O	F	Die Frau liest <b>keine</b> Zeitung.	180	0.887
Negative	W	U	Die Frau liest NICHT die Zeitung.	177	0.872
Negative	O	U	Die Frau liest KEINE Zeitung.	177	0.872
Negative	O	N	Die Frau liest keine Zeitung.	160	0.788

# Reaction Times to Probe Task

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Condition	Example	Minimum	Maximum	MEAN (msec)	STAB
AWF	Die Frau liest <b>heute</b> die Zeitung.	381,0	1999,1	818,319	284,8415
AWU	Die Frau liest <b>HEUTE</b> die Zeitung.	369,7	1617,5	825,599	271,0356
NWU	Die Frau liest <b>NICHT</b> die Zeitung.	405,3	1761,5	827,326	264,1468
NOU	Die Frau liest <b>KEINE</b> Zeitung.	336,2	1639,6	828,248	272,9762
AWN	Die Frau liest <b>heute</b> die Zeitung.	411,1	1660,1	840,808	290,3100
NOF	Die Frau liest <b>keine</b> Zeitung.	370,3	1919,4	845,247	337,1391
NWN	Die Frau liest <b>nicht</b> die Zeitung.	371,5	1966,9	869,936	321,8547
AOU	Die Frau liest <b>EINE</b> Zeitung.	425,9	2580,5	882,083	324,6433
AOF	Die Frau liest <b>eine</b> Zeitung.	448,5	2026,3	885,896	338,7134
AON	Die Frau liest <b>eine</b> Zeitung.	402,9	1685,6	888,001	298,4035
NWF	Die Frau liest <b>nicht</b> die Zeitung.	387,0	1765,3	890,160	314,2340
NON	Die Frau liest <b>keine</b> Zeitung.	379,7	1993,7	903,202	335,1485

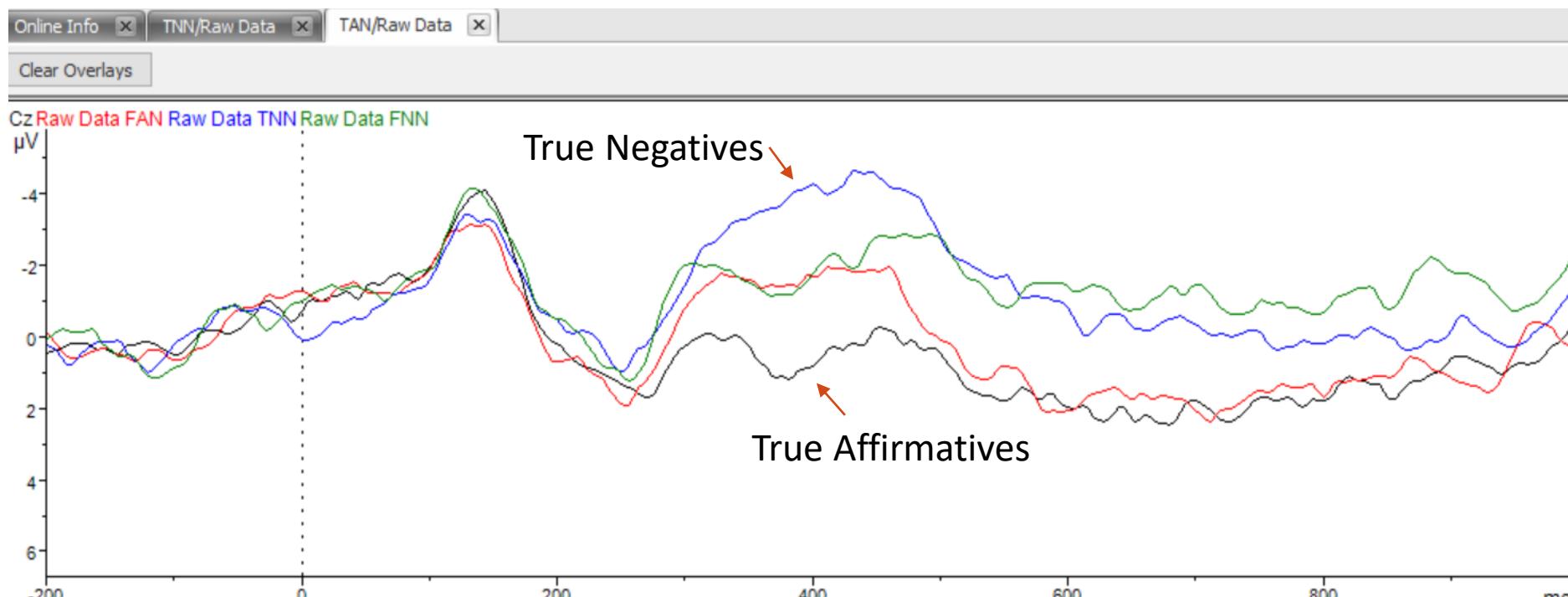
\*A-N ( $T=-4,065$  (893)  $p=,00$ )

\*NOU-NON ( $T=-2,494$  (151)  $p=,014$ )

\*NOF-NWF ( $T=-2,455$  (160)  $p=,015$ )

# ERPs after negated objects

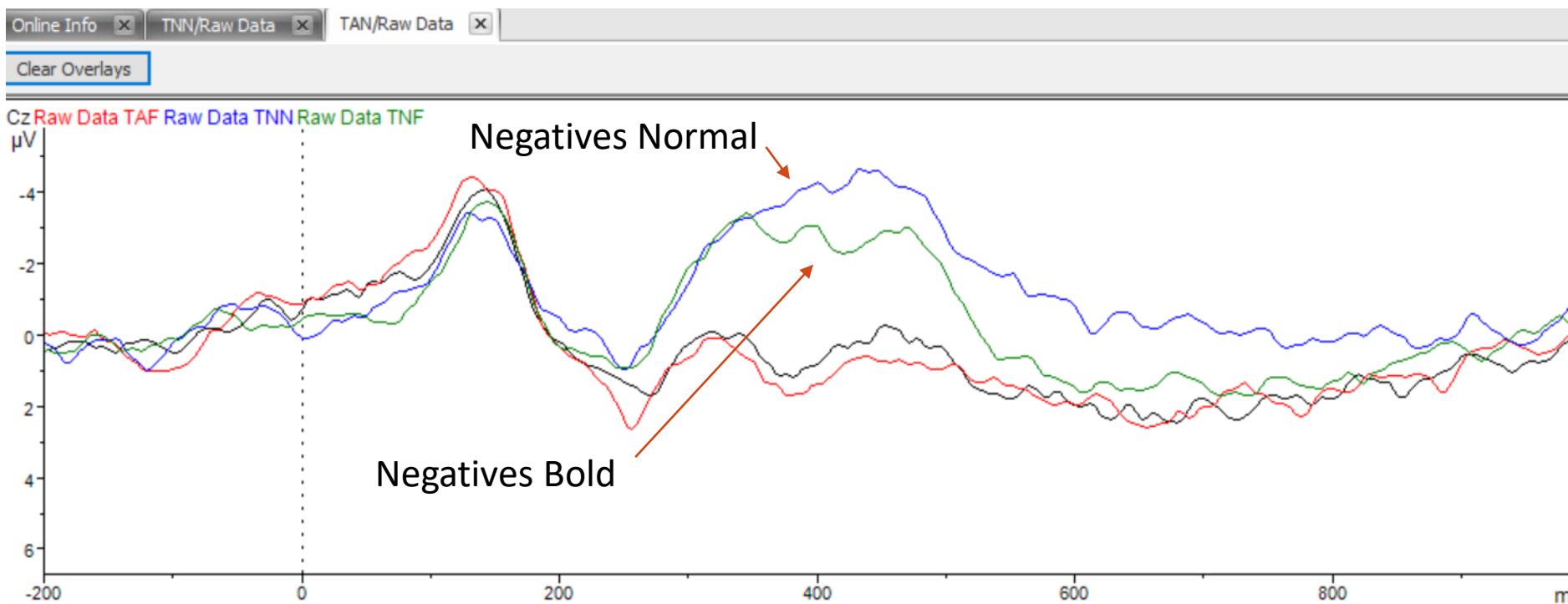
True Affirmatives – False Affirmatives – True Negatives – False Negatives



Graphic 1: Enhanced negativity after negated objects

# ERPs after negated objects

True Affirmatives Normal Print – True Affirmatives Bold Print – True Negatives Normal Print – True Negatives Bold Print



Graphic 2: Enhanced negativity attenuated after bold printed negation word

# Perspectives

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- ... Statistical Analysis of both experiments
- ... Interpretation
- ... Negation in context

# FMRI STUDY ON THE PROCESSING OF CAUSAL CLAUSES IN EASY LANGUAGE

Does the postulated transformation into autonomous sentences  
really simplify the processing?

Liv Borghardt

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# Rules and Recommendations for subordinated clauses

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- Prohibition of multi-part sentences
  - Restructuring into autonomous sentences
- Less demand on the working memory

„John put on more clothes, because it was cold yesterday“



„It was cold yesterday. Therefore John put on more clothes.“

# Empirical Study: Hypotheses

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- a) The contained causal information isn't conveyed correctly after the restructuring.
- b) The restructuring into autonomous sentences doesn't simplify the processing.
- c) The information-structural perspective is easier to process than the chronological perspective.

# Empirical Study: Hypotheses

---

- a) The contained causal information isn't conveyed correctly after the restructuring.
- b) The restructuring into autonomous sentences doesn't simplify the processing.
- c) The information-structural perspective is easier to process than the chronological perspective.



„John put on more clothes,  
because it was cold yesterday“



„It was cold yesterday.  
Therefore John put on more clothes.“

# Empirical Study: Method

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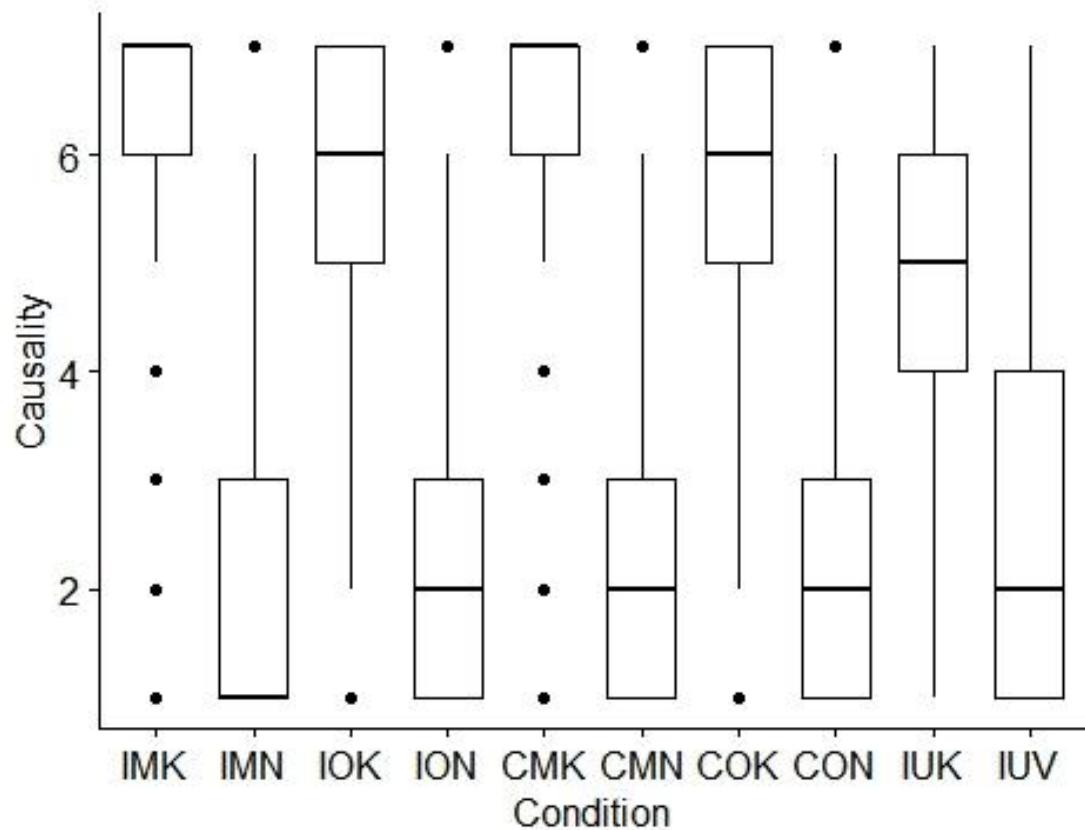
- stimuli with 3 factors:
  - 1) perspective: information-structural (I) vs. chronological (C)
  - 2) with (M) vs. without (O) connector,
  - 3) semantic congruence (K) vs. incongruence (V)
- behavioural test: rating of causality and naturalness of the stimuli (incl. response time measurement)
- fMRI study

# Empirical Study: Method

---

- stimuli with 3 factors:
  - 1) perspective: information-structural (I) vs. chronological (C)
  - 2) with (M) vs. without (O) connector,
  - 3) semantic congruence (K) vs. incongruence (N)
- **behavioural test: rating of causality and naturalness of the stimuli (incl. response time measurement)**
- fMRI study

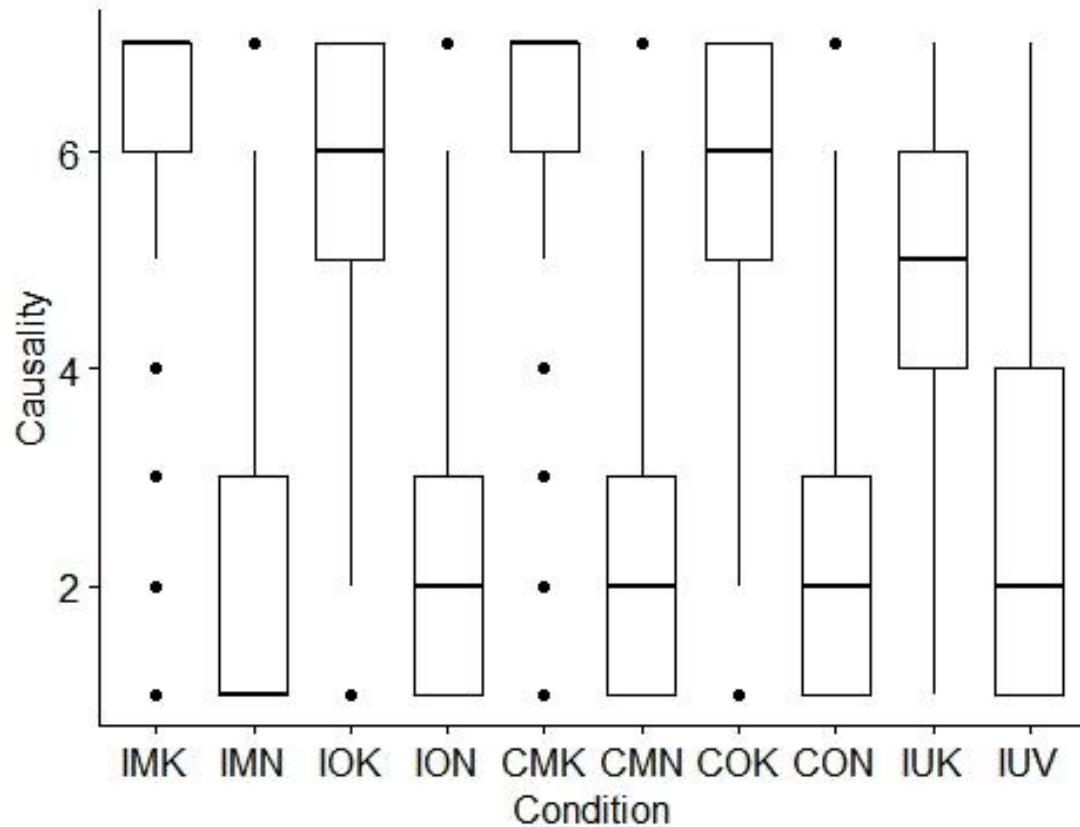
# First evidence: Rating



Stimuli with 3 factors:

- 1) perspective: information-structural (I)  
vs. chronological (C)
- 2) with (M) vs. without (O) connector,
- 3) semantic congruence (K) vs.  
incongruence (N)

# First evidence: Rating



- No significant difference between scenarios like:  
„John put on more clothes, because it was cold yesterday“  
„It was cold yesterday. Therefore John put on more clothes.“

# First evidence: Rating

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- no significant difference between scenarios like:

„John put on more clothes, because it was cold yesterday“ <-> „It was cold yesterday. Therefore John put on more clothes.“

- Very first results concerning these hypotheses:

- The contained causal information isn't conveyed correctly after the restructuring.**
- The restructuring into autonomous sentences doesn't simplify the processing.**
- The information-structural perspective is easier to process than the chronological perspective**

# Literature

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# Thank you for your attention!

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