Semantic Priming of Complex German Verbs: Effects of Transparency

STUTSGART 51

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Definitions

- Transparent words' meanings are **obvious** when considering their parts
  - hinfallen = hin + fallen
- Semantically opaque words' meanings are **not** immediately **derivable** from the meaning of their morphemes
  - auffallen != auf + fallen

Definitions

- Priming
  - Repeated exposure to a certain stimulus leads to faster responses to this or related stimuli

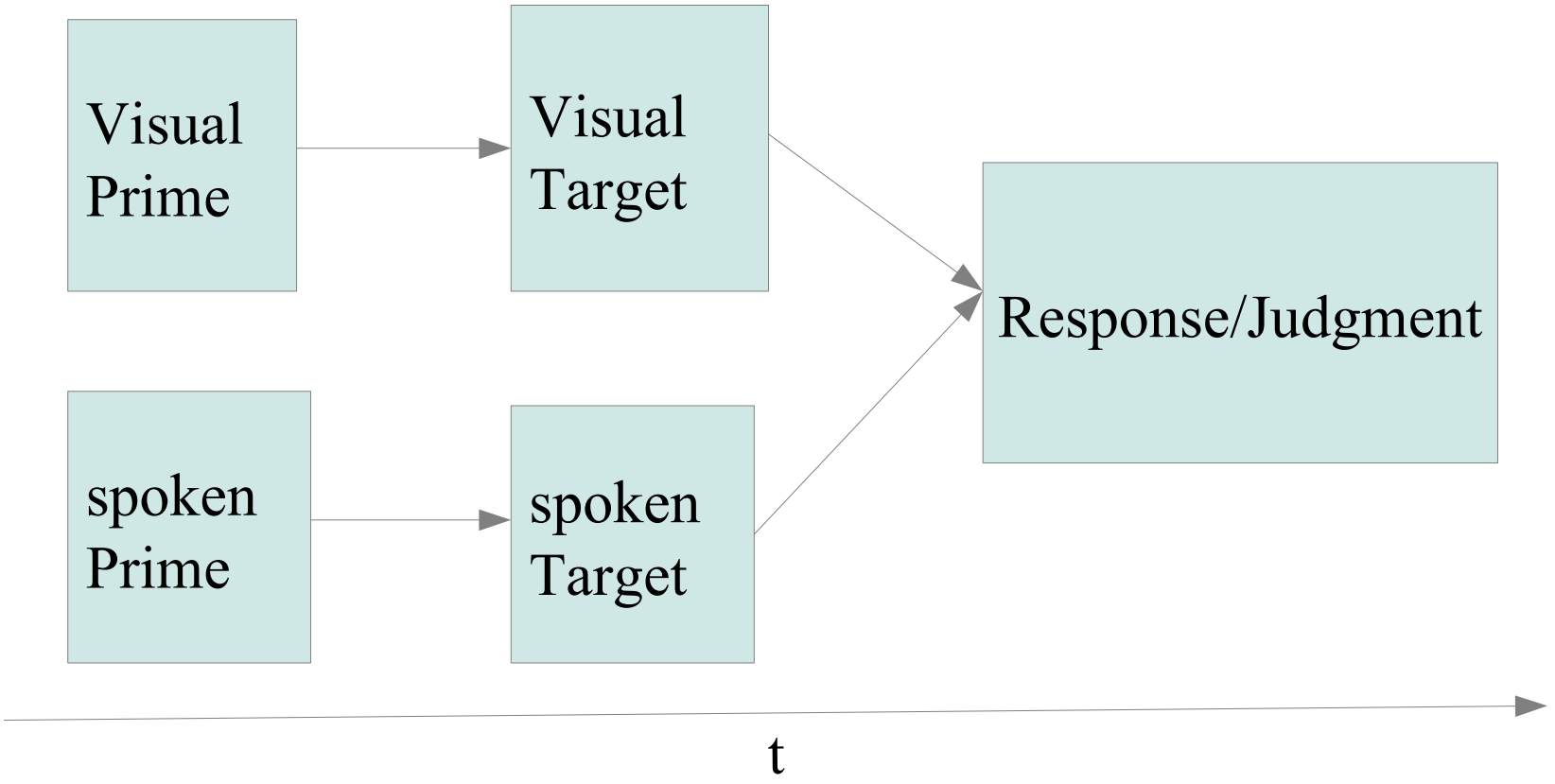
Definitions

- Lexical Decision Task:
  - Subjects were presented two stimuli in a row (**prime** and **target**)
  - Subjects have to **judge** whether the second stimulus (Target) is a word or not
  - Unimodal (usually visual) or

    crossmodal (usually visual prime followed by spoken target)
  - The dependent variables are **RT** and **correctness**

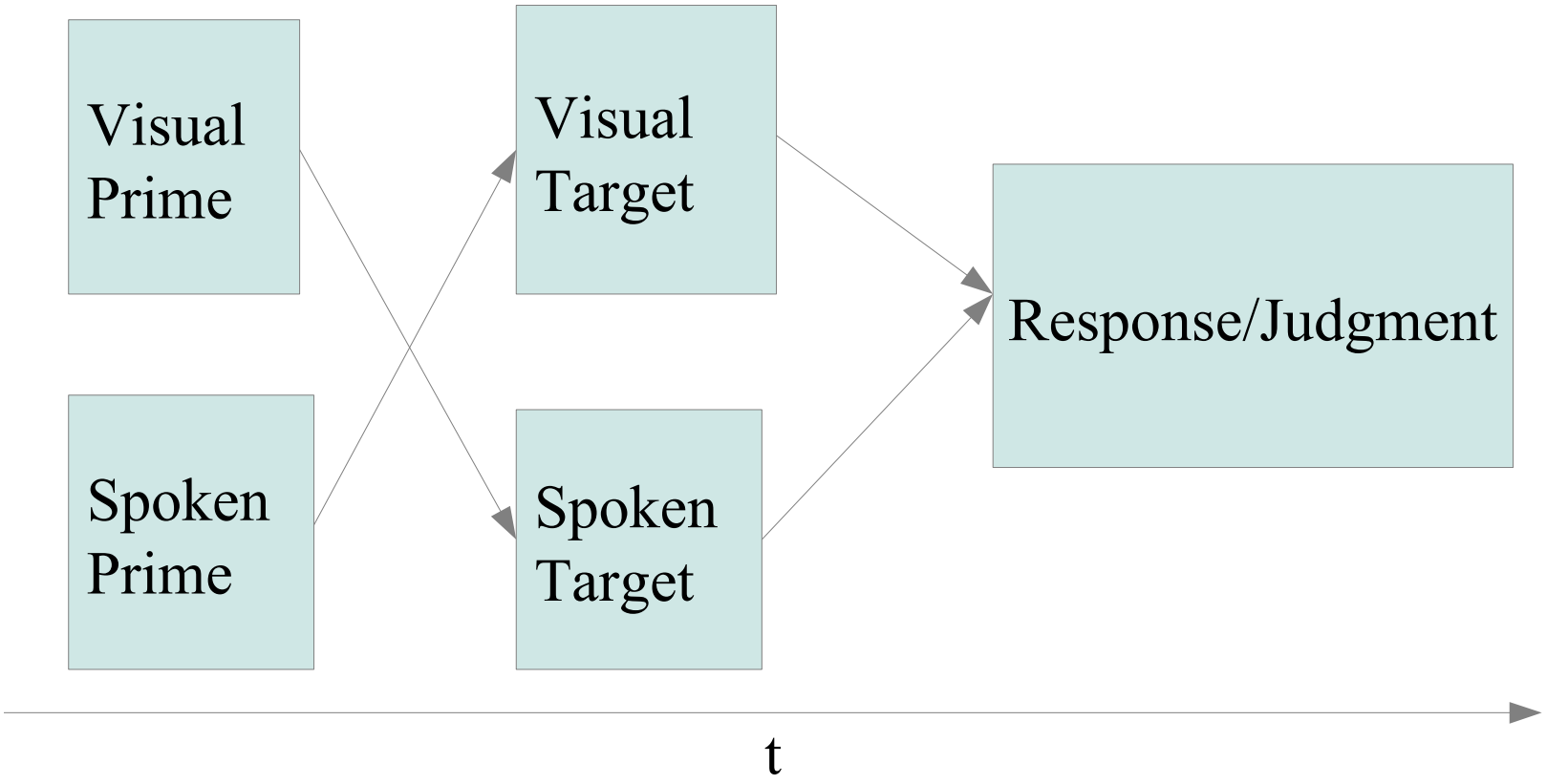
Definitions

- Unimodal Lexical Decision Task



Definitions

- Crossmodal Lexical Decision Task



Starting Point

- Morphological priming has been proven for German verbs
  - *mitkommen*/*umkommen* facilitate *kommen*
  - Visual lexical decision task, 300ms&1000ms SOA (Smolka, Komlósi, & Rösler, 2009)
- Till now: semantic priming only as by-product of morphological priming (Marslen-Wilson et al., 1994, Smolka, Komlósi, & Rösler, 2009)

Scope

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Therefore:

- Effects of transparency on purely semantic priming with regard to German verbs are **not explored very well** yet.
- Is there purely semantic priming concerning German complex verbs?
  - Would *mitkommen*/*umkommen* facilitate *nahen?*
  - Different experiments yielded different results (Smolka et al. (2009), Zwitserlood et al. (1996)

Scope

- If transparent items show better results than opaque items, this is a cue, that **opaque** verbs are **stored separately** as a whole in the mental lexicon.

Scope

Smolka et al. (2009) conducted two visual semantic priming experiments but found significant effects only in one of them.

kommen (to come) – nahen (to approach)

Scope

Zwitserlood, Drews, Bolwiender, & Neuwinger (1996) tested visually pairs without finding any effects.

umbringen (to kill) – Mord (murder)

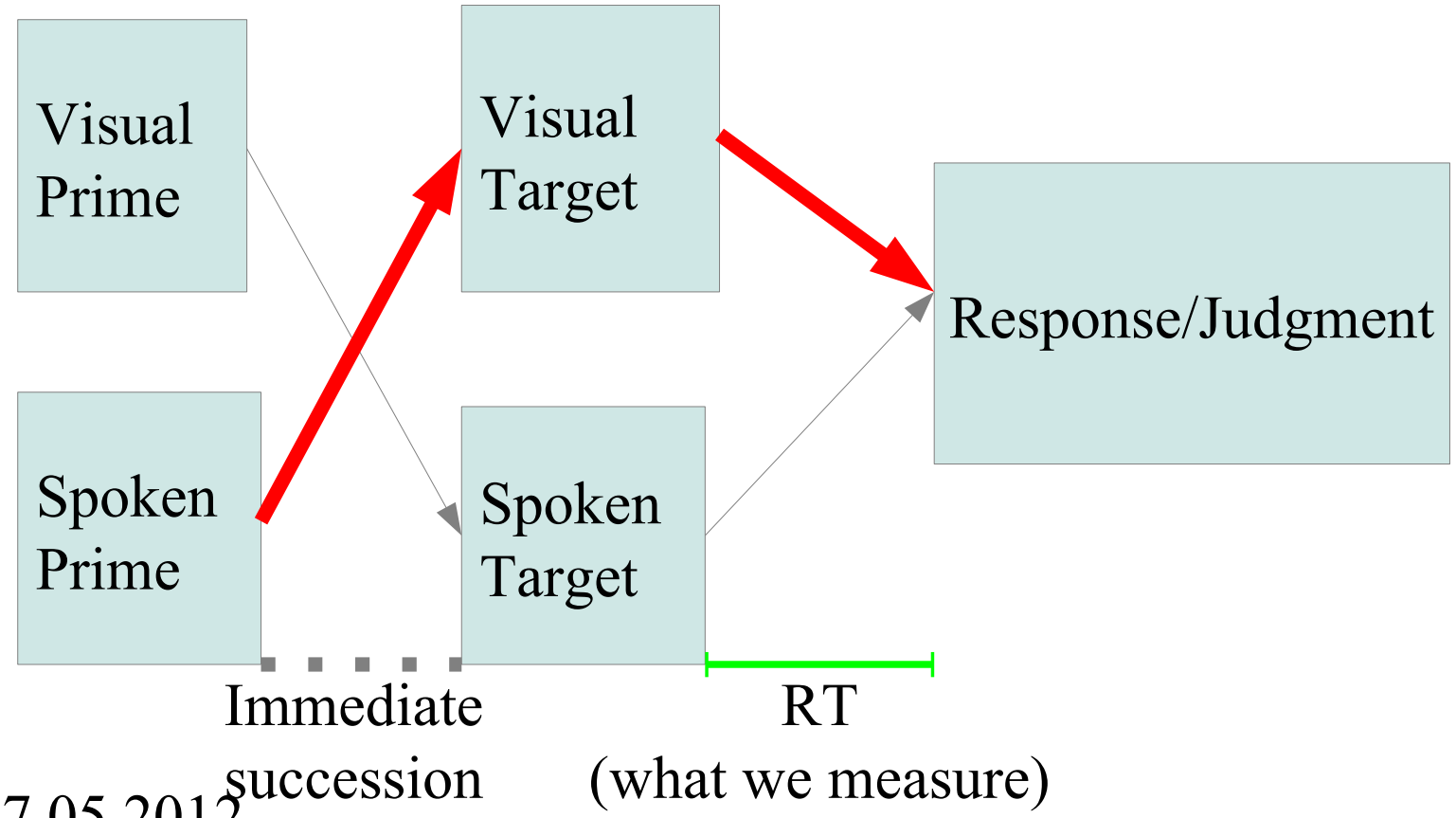
umbringen (to kill) – holen (to fetch)

Conjecture

- There is semantic priming with German complex verbs
- There are **differences** in the processing of semantically transparent and semantically opaque verbs

Design

- Crossmodal Lexical Decision Task



Design

- **Cross modal** lexical decision task: Subject shall perceive the primes completely
  - Meaning included
- Suppression of phonological or orthographic associative priming effects (Moss et al., 1997)
- Only German **particle verbs**: A comparison with prefix verbs would have broken the mold

Participants

- 54 participants were tested
- 8 participants were excluded
  - 3x technical issues
  - 2x too familiar with the data
  - 1x bilingual
  - 1x extremely slow responses: μ=955ms
  - 1x extremely fast responses: μ=286ms

Materials: Primes

- Experimental items: 3x24 German complex particle verbs
- Conditions:
  - Semantically transparent
  - Semantically opaque
  - unrelated
- Fillers: 208 other complex German verbs

Materials: Targets

- Targets were gathered via an association task
- Web-experiment: participants saw a **verb stem** of one of the primes and had to type in their first **association**

Materials: Targets

- Conducted in Aachen and Leipzig
- No participants from Konstanz were tested to **eliminate interference** with the main experiment
- 105 participants took part

Materials: Targets

- The **most frequent answers** for each item were chosen as the targets
- Range from 11%-63%; μ=32%
  - Zwitserlood et al. (1996) had a mean associative strength of 30%
- 1/3 of the most frequent answers were nouns, the rest were verbs
- Answers were **classified** semantically
  - Sturz/stürzen/plumpsen/umfliegen → Sturz

Operationalization: Experimental Items

- Three lists, latin-squared
- Each list contains 232 trials:
  - 24 critical stimuli
    - Eight semantically transparent prime pairs
      - hinfallen/Sturz
    - Eight semantically opaque prime pairs
      - auffallen/Sturz
    - Eight formrelated prime pairs (control condition)
      - ausfalten/Sturz

Operationalization: Fillers

- 208 Fillers, 50%+24 nonwords to compensate the experimental items
- Matched for word length
- Matched for word class:
  - 1/3 nouns/noun-like
  - 2/3 verbs/verb-like

Processing

- The trials were presented to participants in **two blocks** with a self-administered **break** in between
- Participants received **no feedback** concerning the correctness of their answer to to keep them focussed

Evaluation

- R/languageR
- Linear Mixed Model: lmer()

- 1104 critical samples gathered
- 368 for each condition

Evaluation: Errors

- 11 errors in 1104 samples = 0.996% errors
- Formrelated: 0.27%
- Opaque: 1.63%
- Transparent: 1.0%

  → 1093 correct

- An error analysis did not yield significant differences

Evaluation: Outliers

- 1052 samples left that are correct and within the range of 2.5 SD (286ms- 957ms)

  → 52 samples excluded

Results

- Random effects:
  - Participant
  - Target
- Fixed effects
  - Gender, Word Length, Word Frequency, log(prevRT), prev_corr, Word Class
  - Everything in two-way interaction with condition

Results

- Model selection was done using **backward elimination** (t-values (<|1|)) and log likelihood ratio tests (function **anova** in R).
- log-likelihood of the full model: 611.25
  final model: 603.38
- Remaining fixed effects: **Block** and **prevRT**, that is the reaction time of the previous item.

Results: RT diagram

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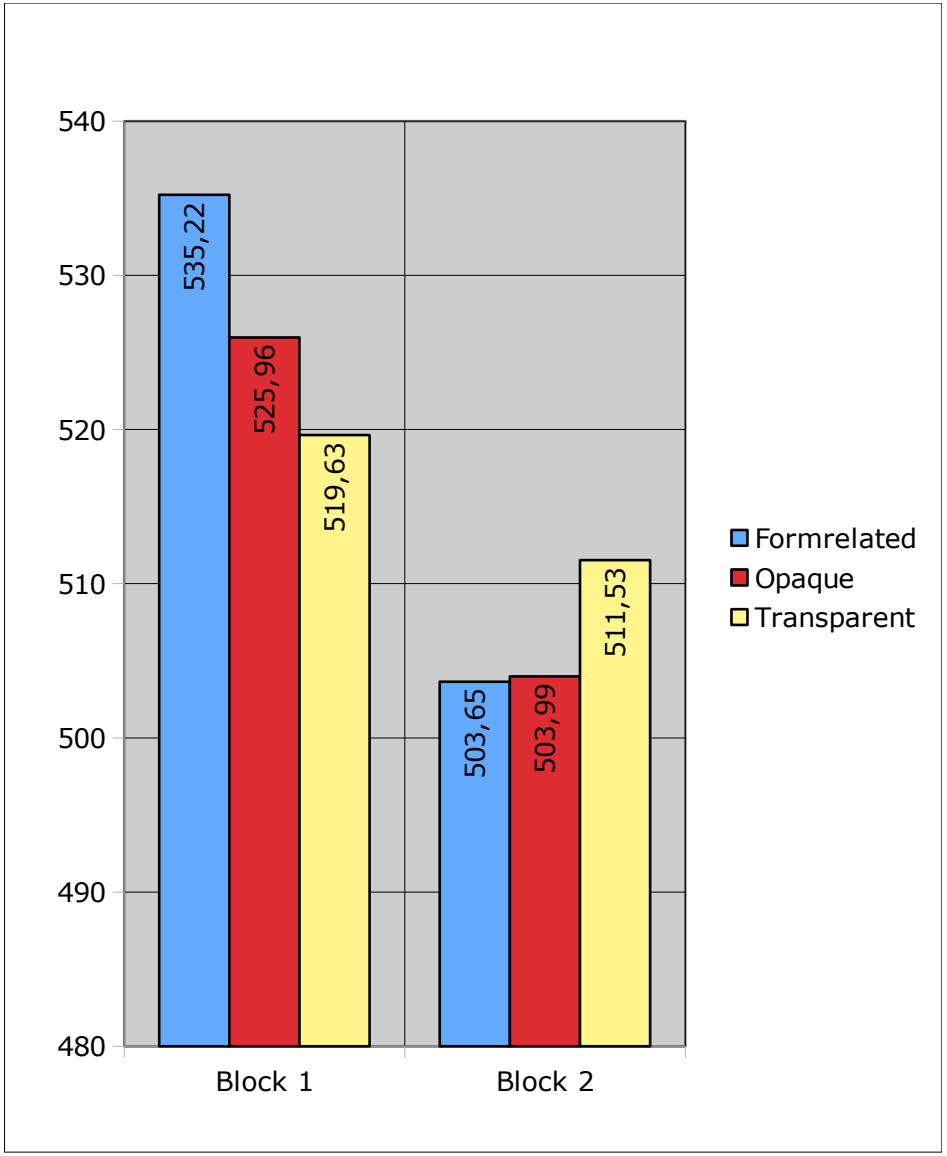
- Blocks differ significantly:

  Block 1 is **slower** than Block 2, $p < 0.05$

- Block 1: Transparent is **faster** than unrelated: $p=0.04$ but not faster than opaque: $p = 0.21$

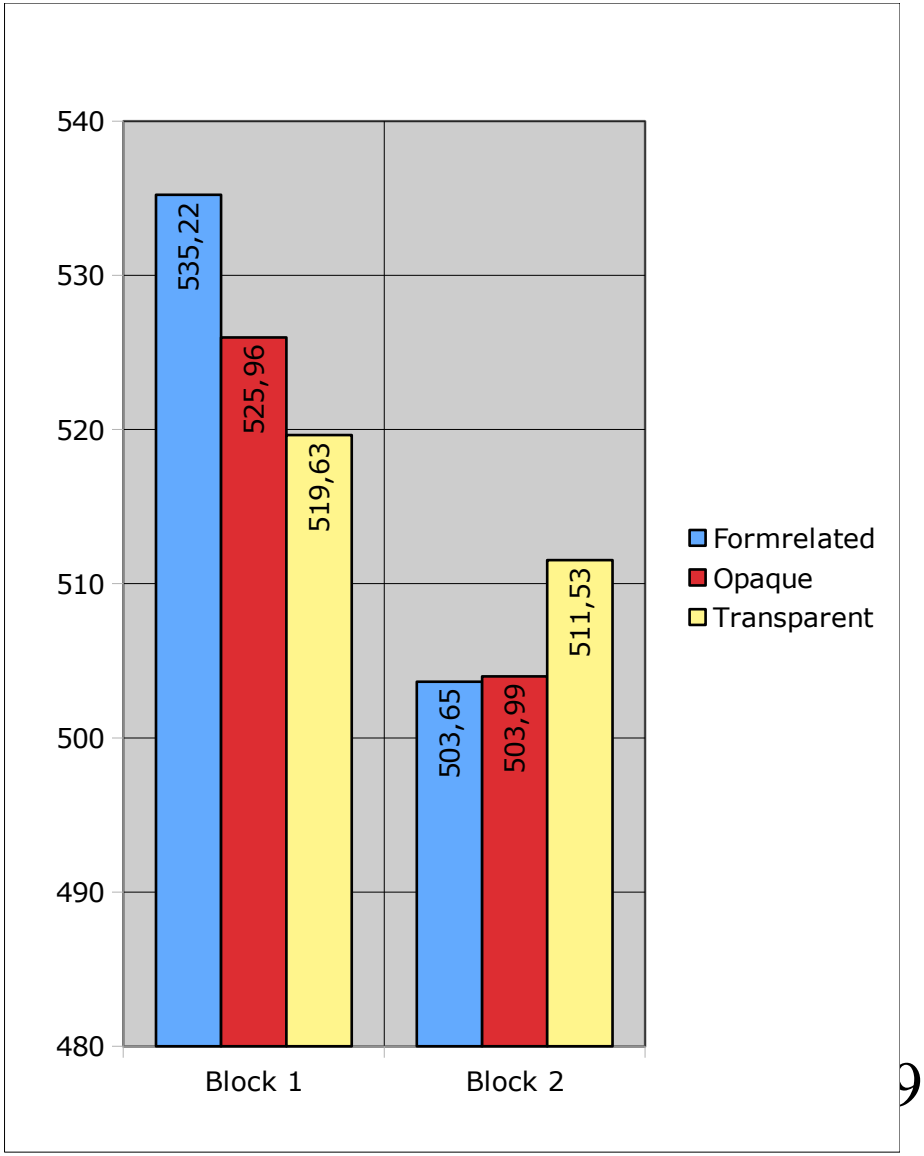
  (converted diagram)



Results: RT diagram

- Block 1: Opaque is **not faster** than unrelated: p=0.25

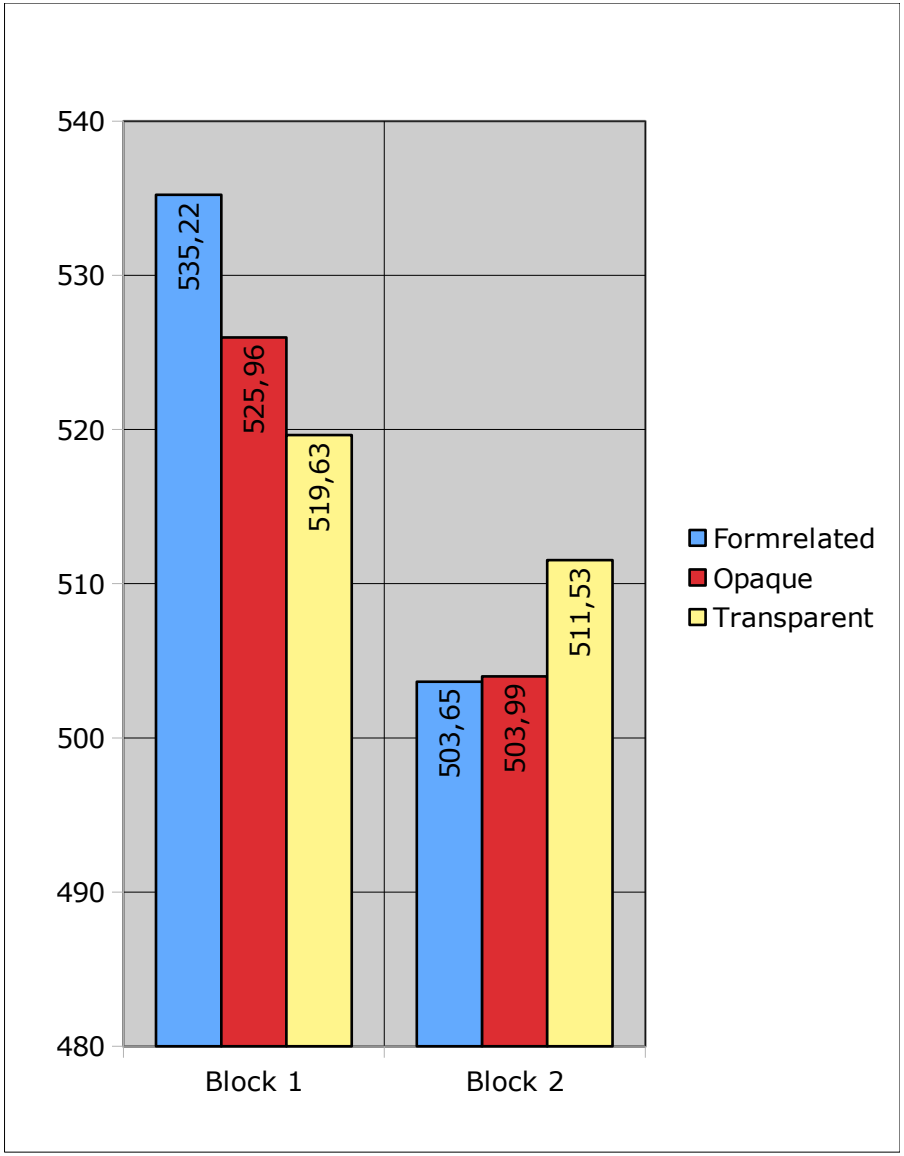
  (converted diagram)



Results: RT diagram

- Block 2: **no effect** of condition
- unrelated / transparent: p = 0.24

  (converted diagram)



Conclusion

- There is **semantic priming** with German transparent verbs, but it **fades** after some time
- There are differences in the processing of semantically opaque and semantically **transparent verbs** as far as the responses on the latter are **faster** than on the unrelated verbs (Block 1)

Conclusion

- Participants responded faster in Block 2, most likely a **training effect**
- This increased speed may have crossed a **breaking point** at which meaning is not reflected any more
- Compare: Smolka et al. (2009): longer SOA (1000ms) yielded more semantic priming

Future Work

- Repeat the experiment with **idle time** after the target presentation
- After every target appears the message to wait for a beep before responding:

  “Push the button after the beep!”

Future Work

- Conduct a gating task to find
  - the point of isolation
  - the point of uniqueness
  - the point of recognition
- Feed the points into the model
- But: Van Petten et al. (1999) found diverging N400-patterns even **200ms before** the point of isolation

Thank you for your attention!

References

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