Semantic Priming of Complex German Verbs: Effects of Transparency

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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
• 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

Visual Prime → Visual Target

Response/Judgment

spoken Prime → spoken Target

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

\[ \text{kommen (to come)} - \text{nahen (to approach)} \]
Zwitserlood, Drews, Bolwiender, & Neuwinger (1996) tested visually pairs without finding any effects.

\[\text{umbringen (to kill) – Mord (murder)}\]

\[\text{umbringen (to kill) – holen (to fetch)}\]
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

- Visual Prime
- Spoken Prime
- Visual Target
- Spoken Target
- Immediate succession
- Response/Judgment
- RT
  (what we measure)
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: $\mu=955\text{ms}$
  – 1x extremely fast responses: $\mu=286\text{ms}$
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%; $\mu=32\%$
  
  – 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 $\rightarrow$ 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
• 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 keep them focused
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

• 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)

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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!


