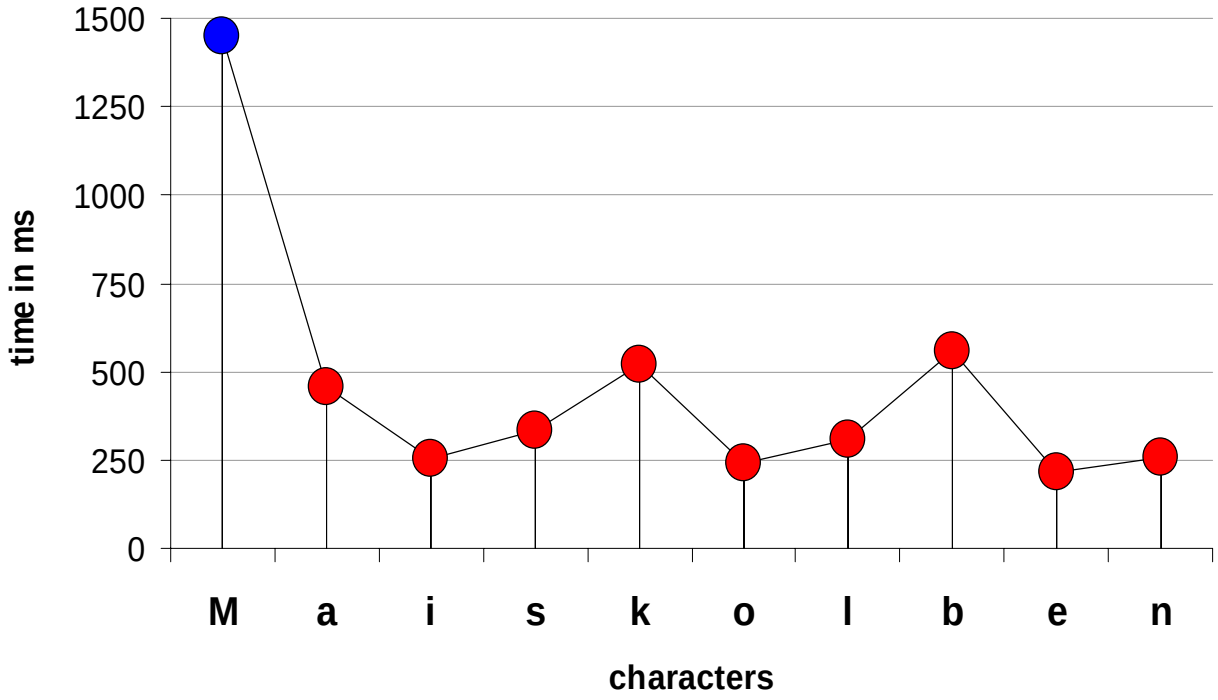
Timing in the written production of German compounds

Guido Nottbusch[1], Angela Grimm[2] & Rüdiger Weingarten[1]

[1]University of Osnabrueck, Germany
[2]University of Groningen, The Netherlands

General Method

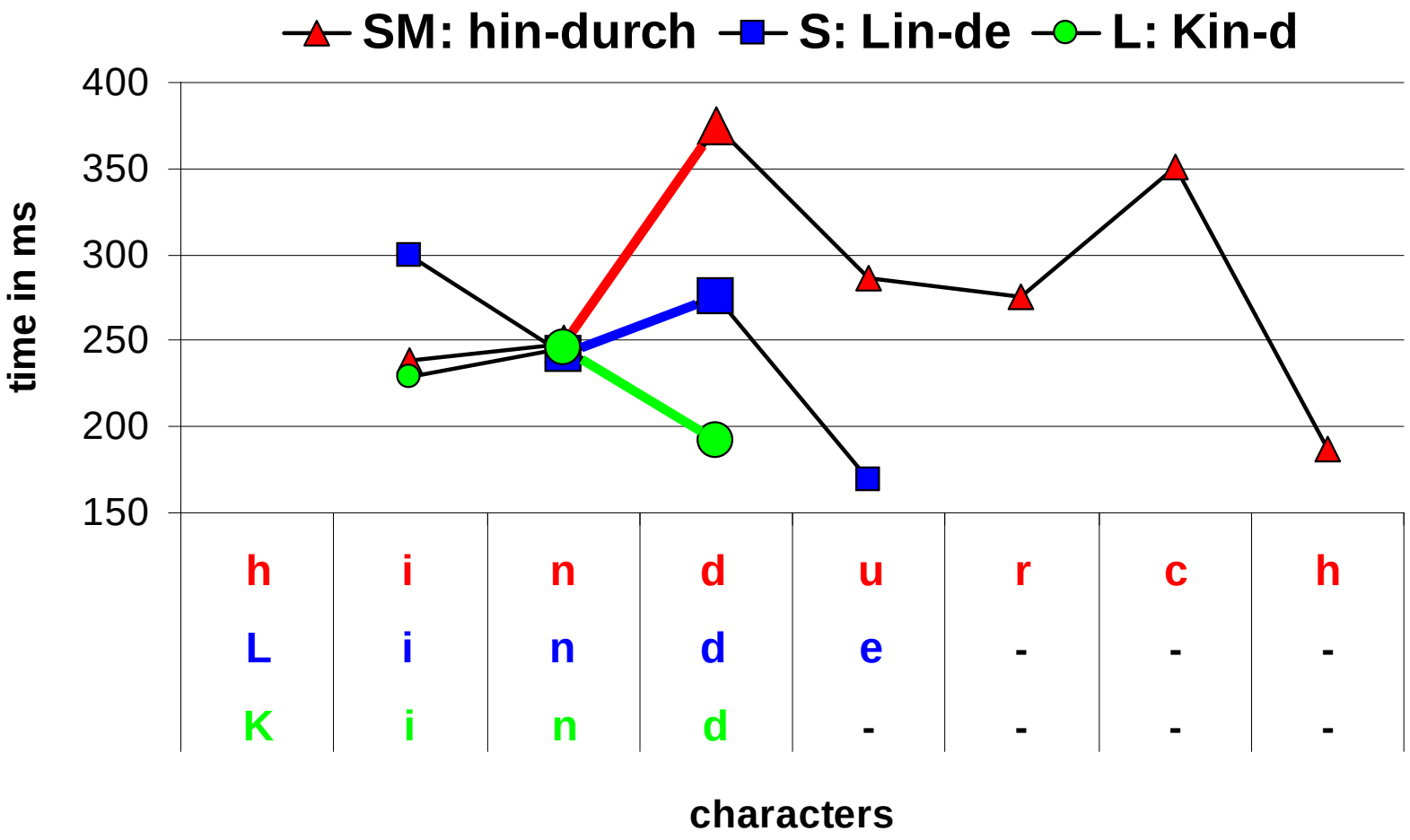
Measuring the time course of writing can give insights into the processes of word production *after the initiation of writing*.



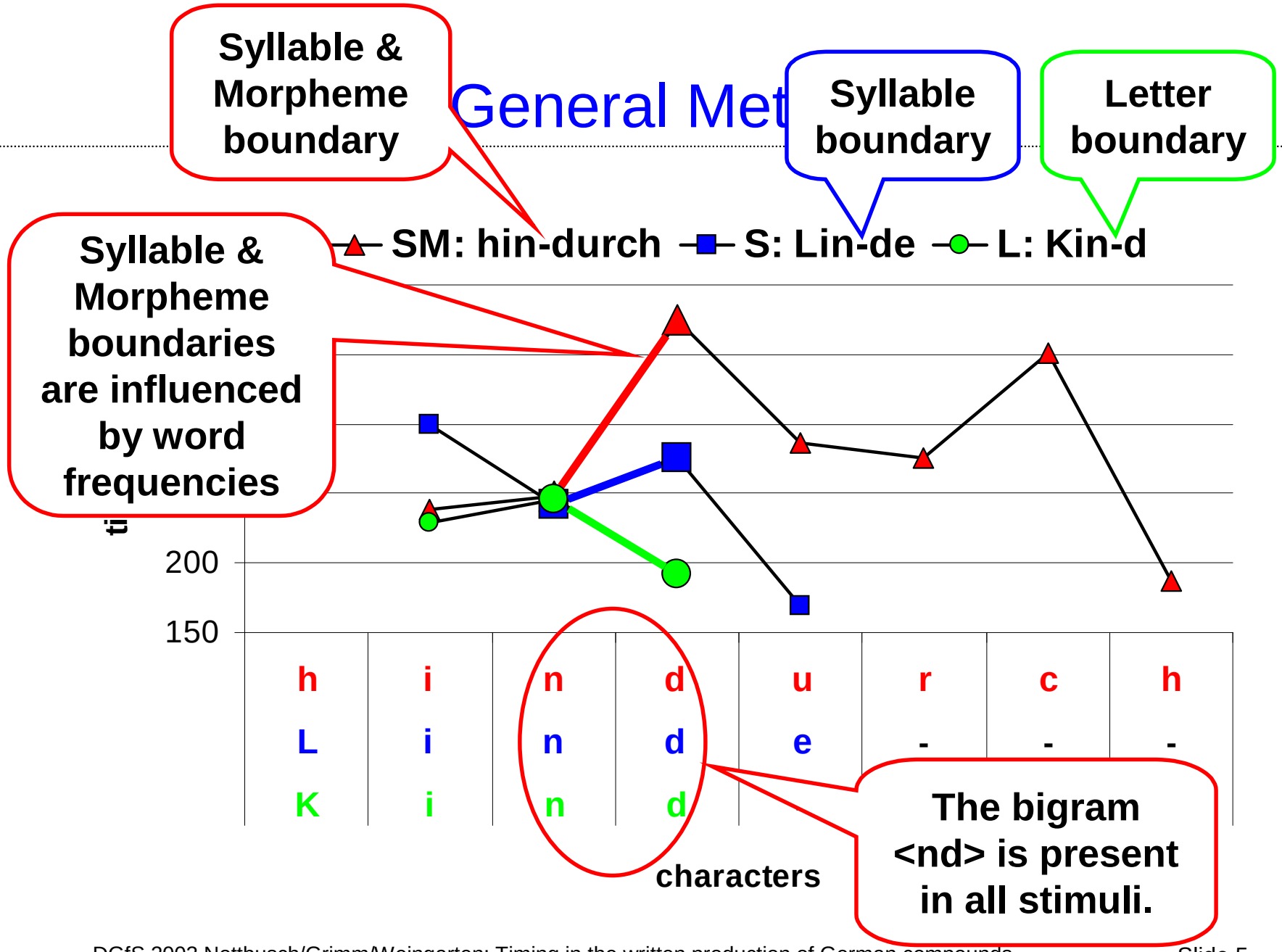
General Method: *Controlled influences*

- typing skill
- keyboard layout
- motor patterns
- letter context
- grapheme and bigram frequency
- ...

General Method



General Met


Syllable & Morpheme boundary
Syllable boundary
Letter boundary
Syllable & Morpheme boundaries are influenced by word frequencies
SM: hin-durch
S: Lin-de
L: Kin-d
200
150
h i n d u r c h
L i n d e - - -
K i n d
characters
The bigram <nd> is present in all stimuli.

Introduction

- Only syllable and morpheme boundaries are influenced by word-frequencies (SM-effect) (Will, et al., 2003).

- Word frequency effects are considered as evidence for lexical access to the word form (Jescheniak & Levelt, 1994).

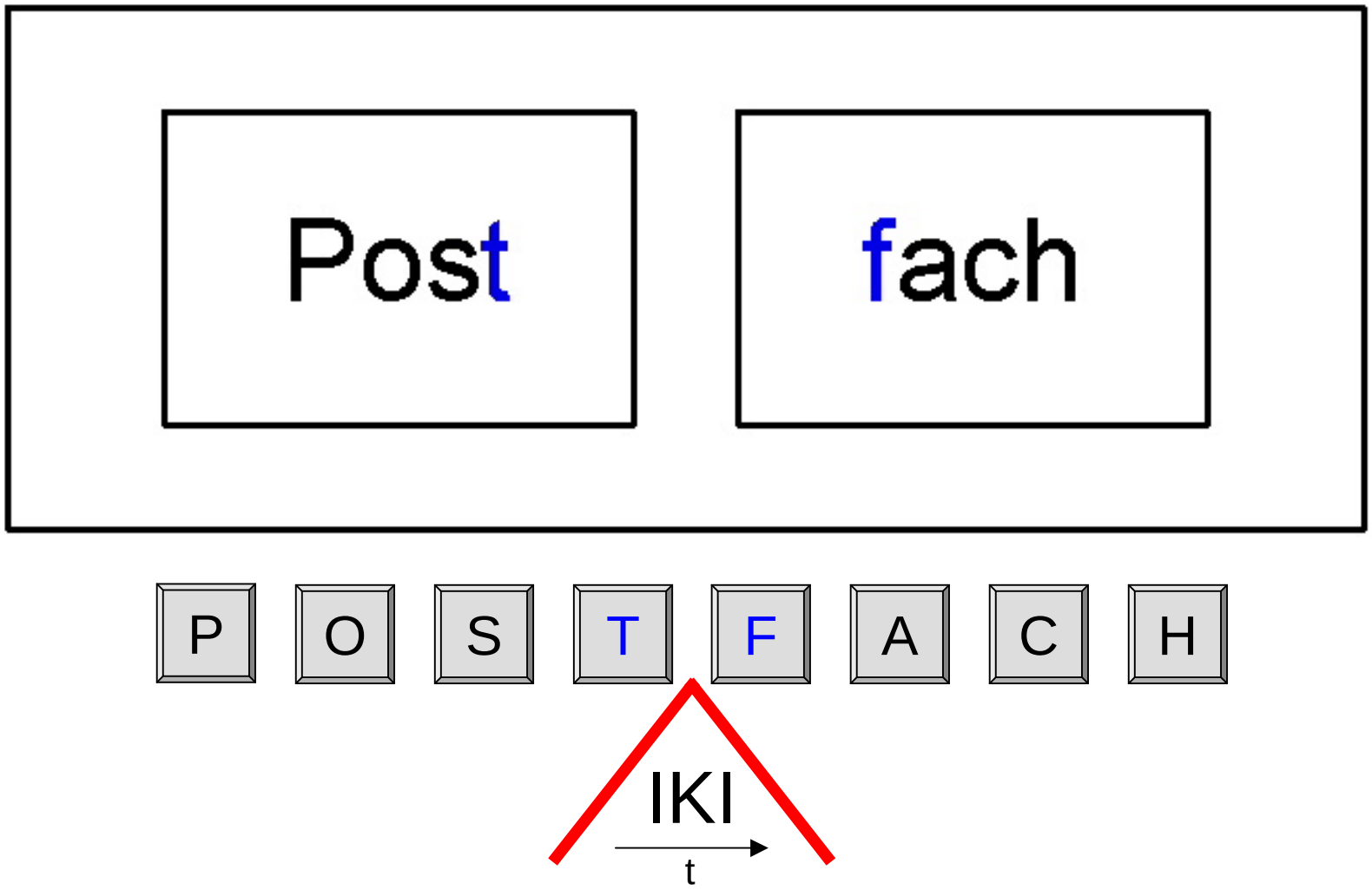
Introduction

Alternative explanations for the SM-effect

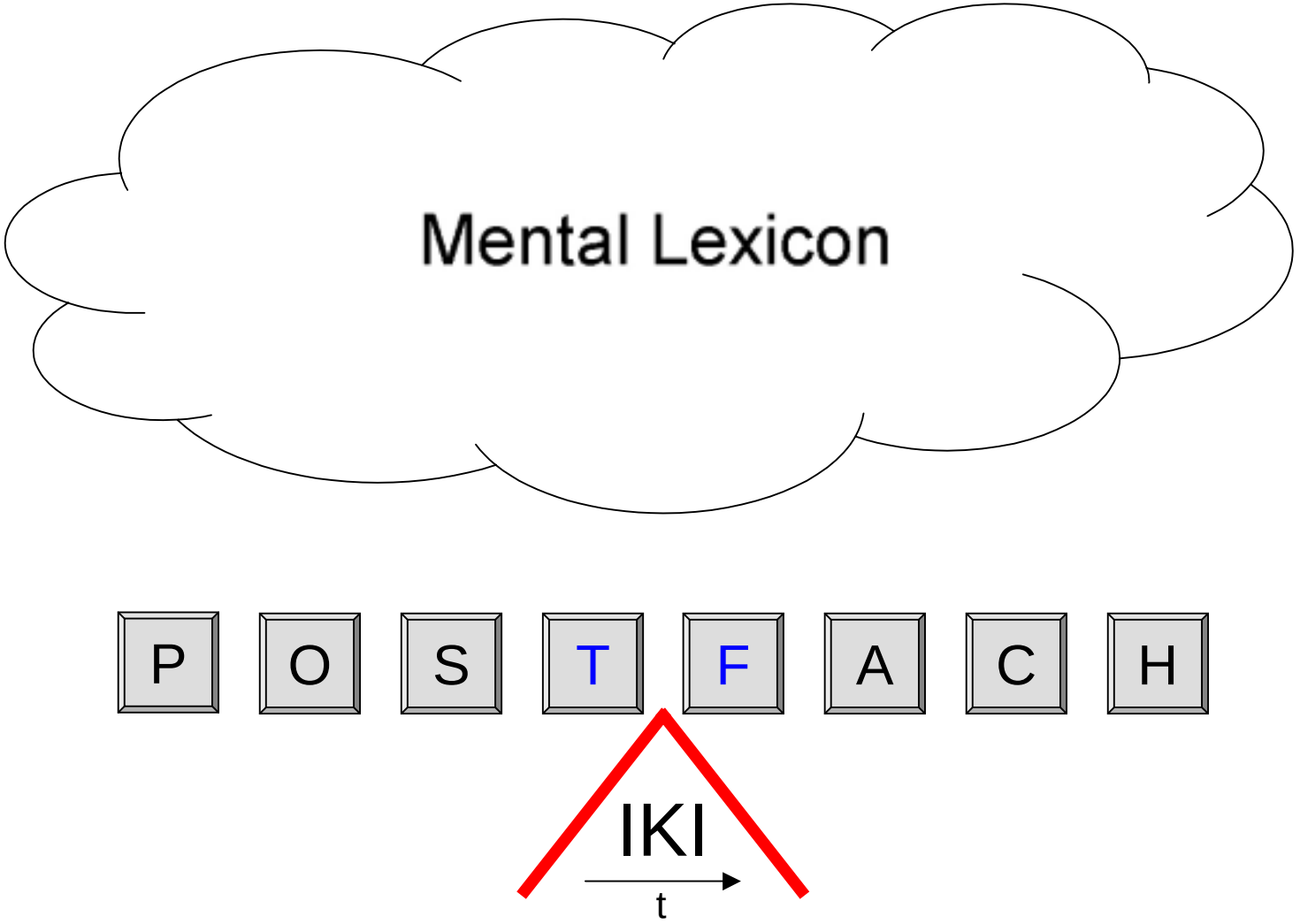
- composition: complex words are constructed from their morphemes
- holistic access: complex words are accessed as their whole word form

In current models both routes are available and compete (e.g. Caramazza et al., 1988) or can converge on a single representation (Baayen & Schreuder, 1999).

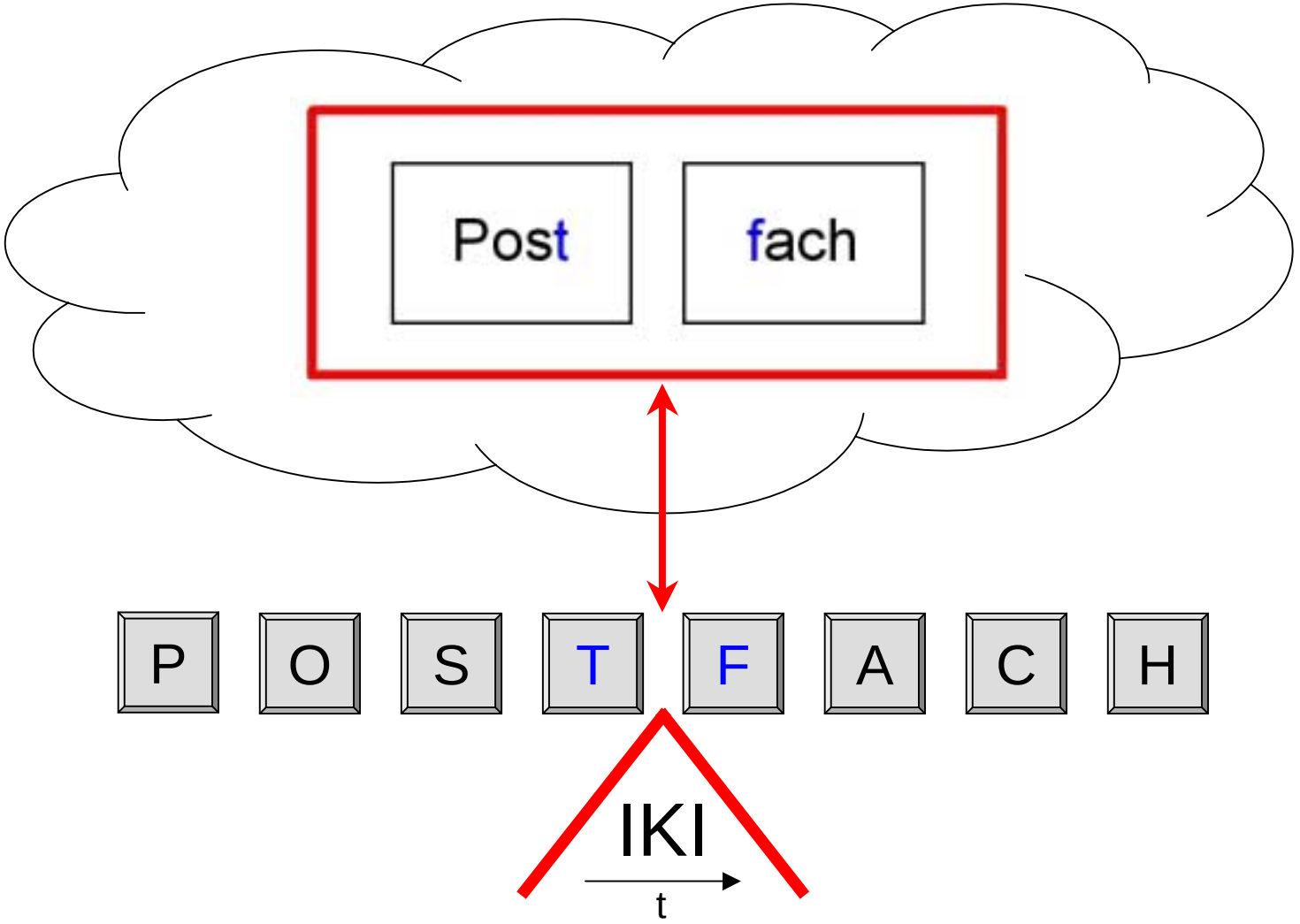
Method: *What we measure*



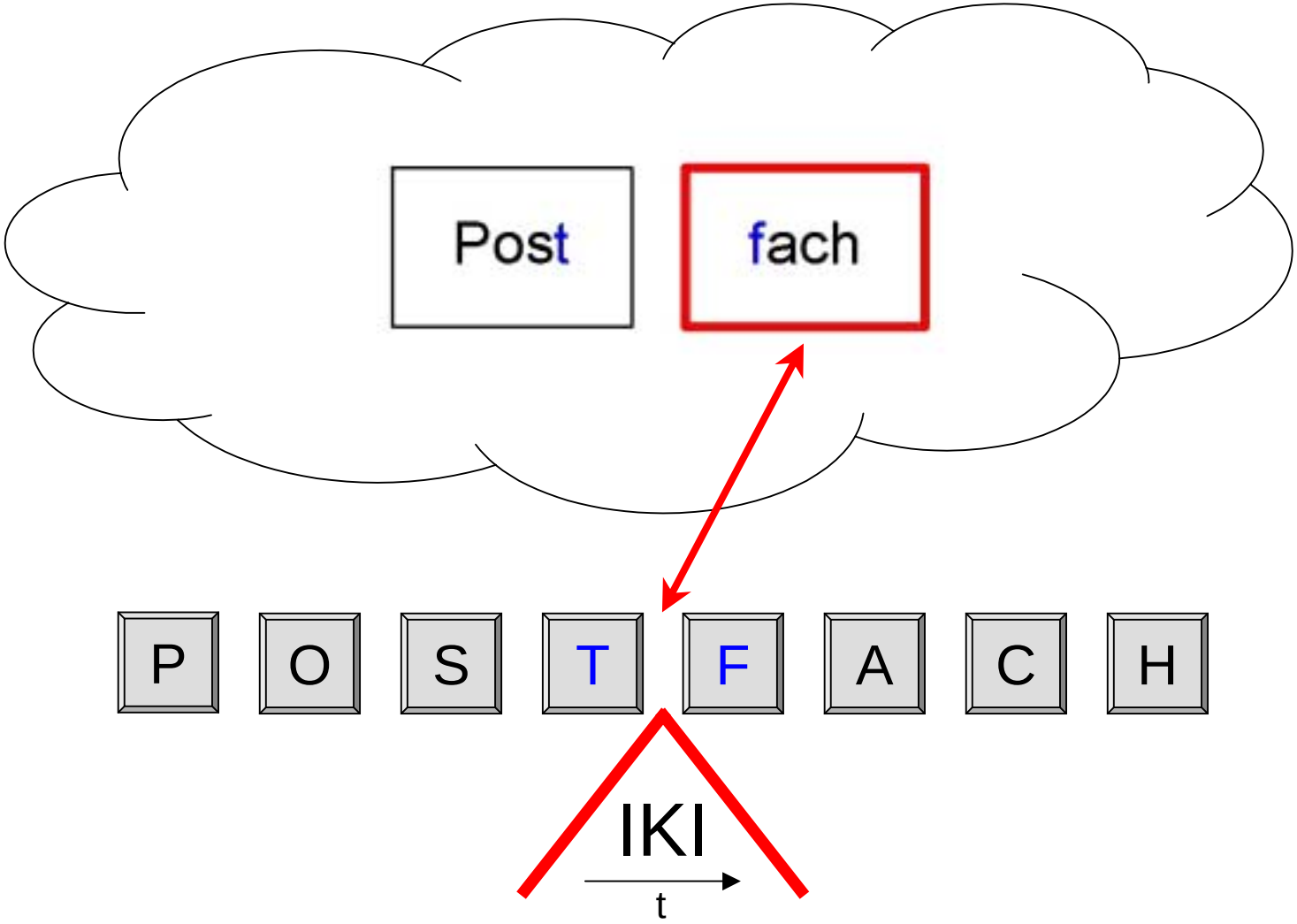
Method: *What we want to know*



Method: *Possibility 1*



Method: *Possibility 2*



Method

Lexical effects

- **relative frequency** (Hay, 2000)
- **semantic transparency**
- productivity
- phonological transparency
- graphotactic probability (prelexical)
- ...

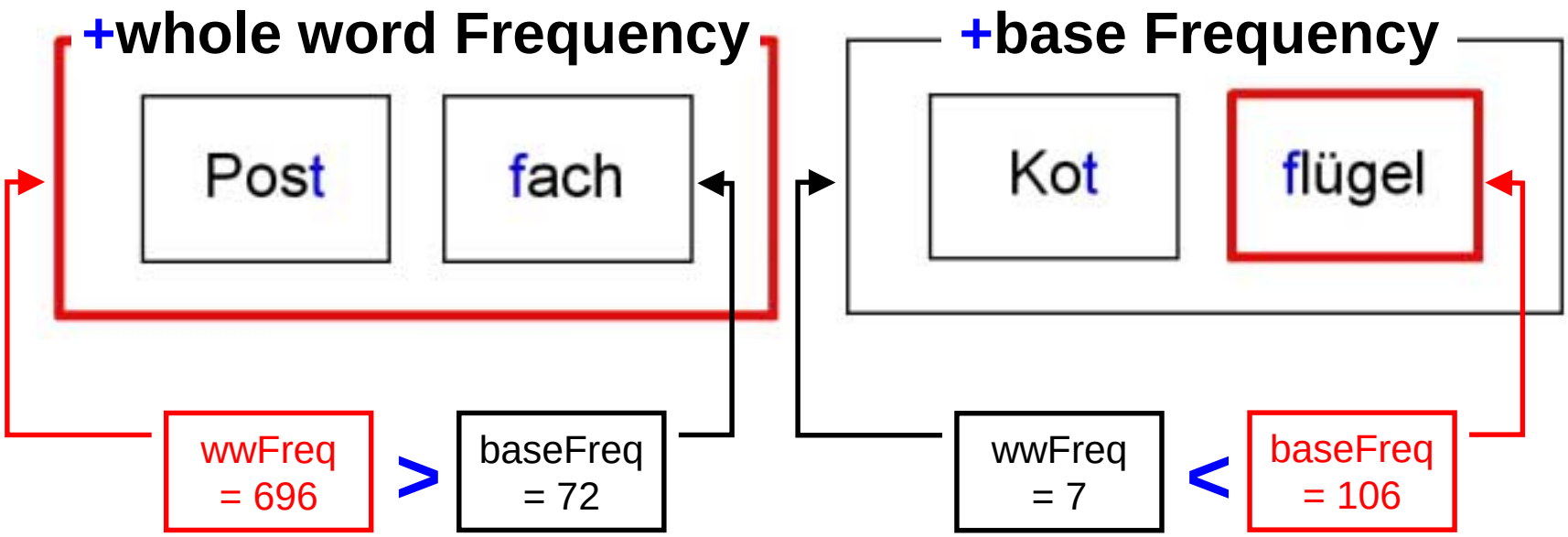
Method: *Stimuli dimensions*

Stimuli: German compounds were varied in three dimensions:

1. relative frequency (relation between the frequency of the whole word and the frequency of the base)
2. frequency level
3. semantic transparency

Method: *Stimuli*

Stimuli dimension 1: **relative frequency**

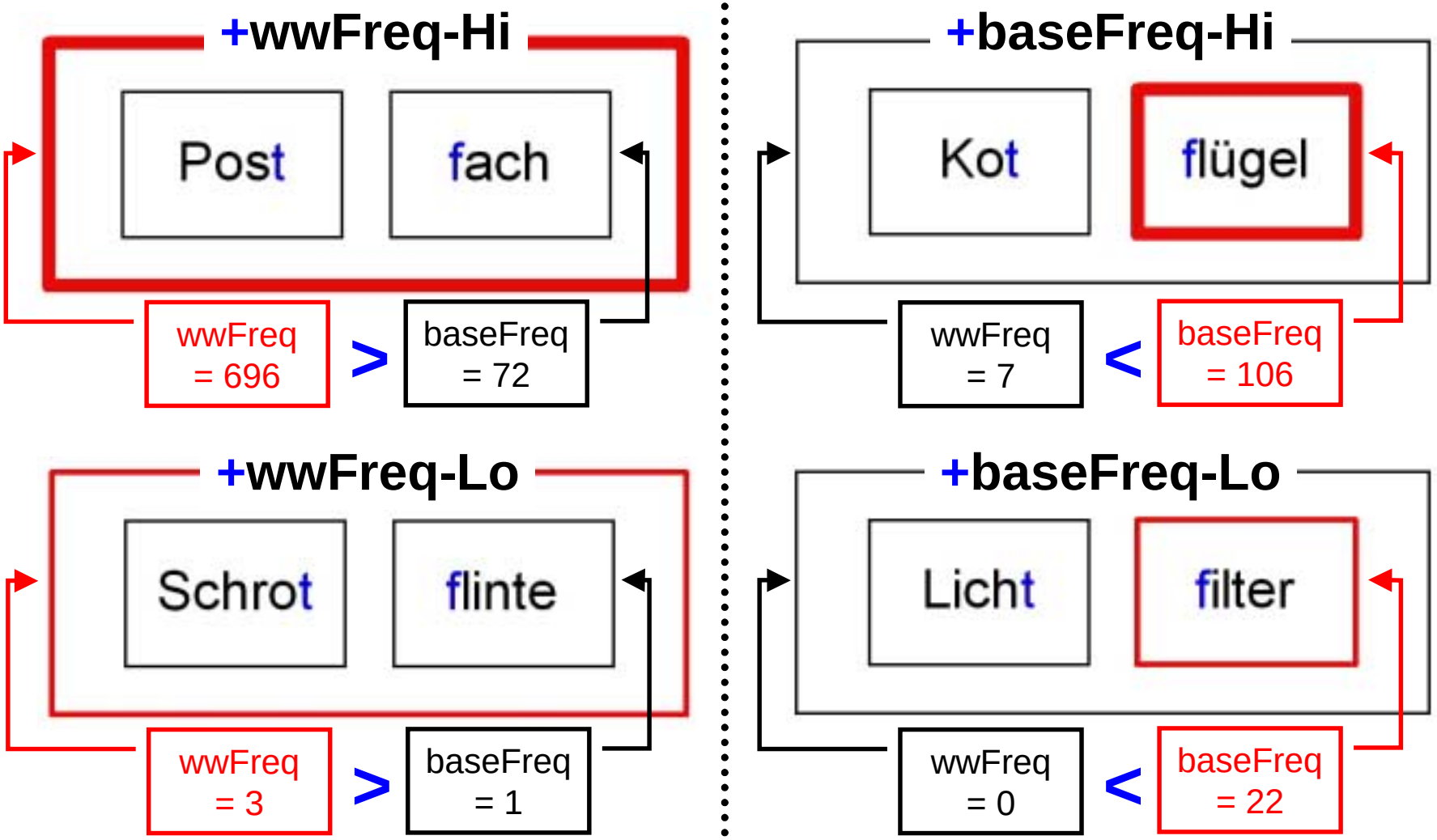


Postfach > Fach

Kotflügel < Flügel

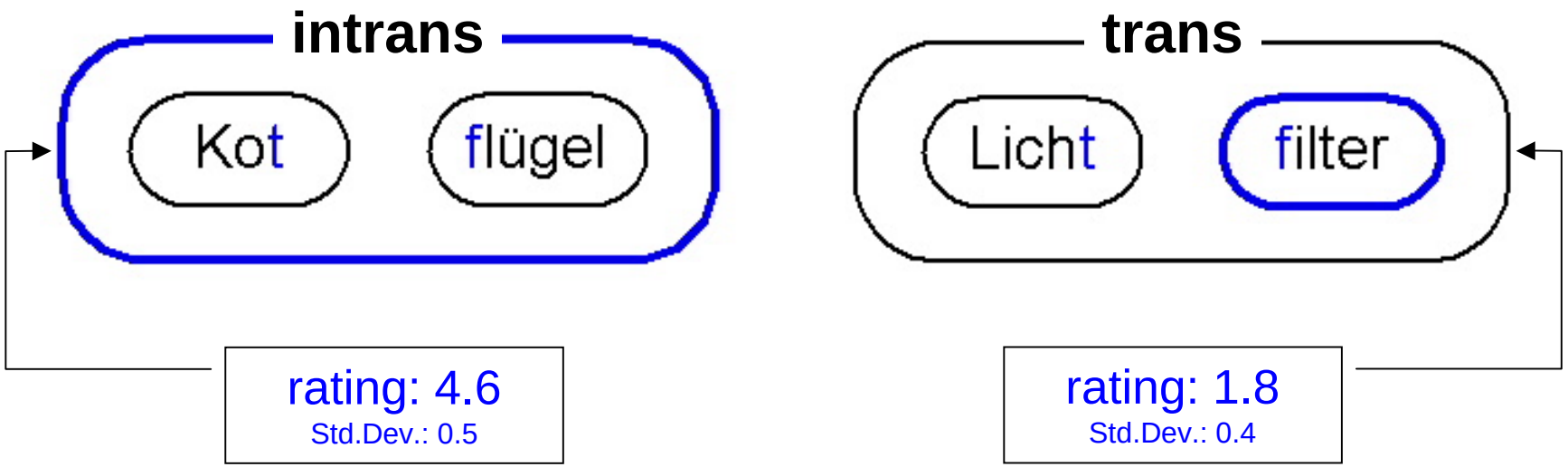
Method: *Stimuli*

Stimuli dimension 2: **Frequency level**

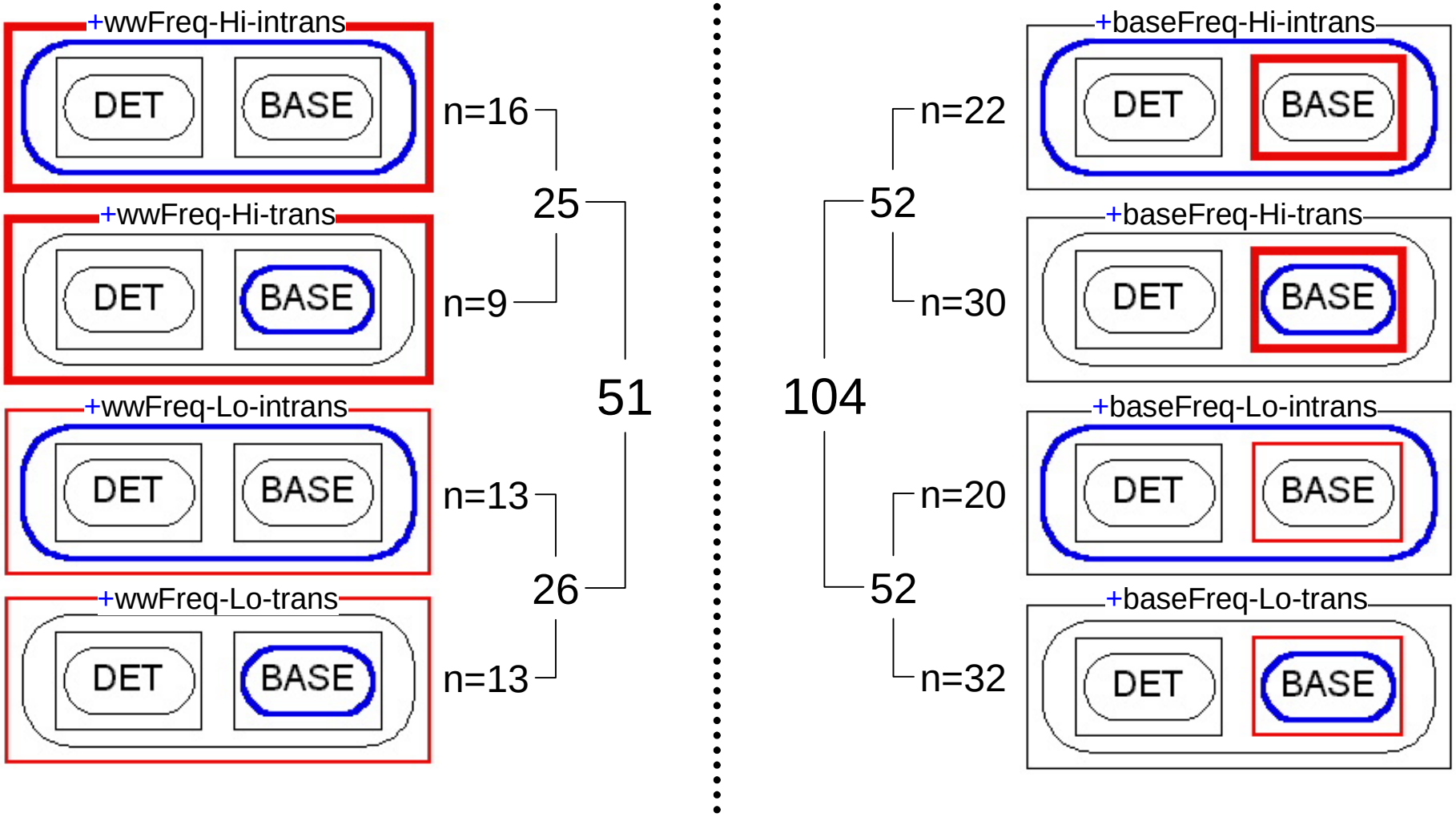


Method: *Stimuli*

Stimuli dimension 3: **Semantic transparency level**



Method: *Stimuli Distribution*



Method: *Procedure*

Procedure:

- Stimuli appeared in a randomised fashion in the upper half of a 19” computer screen.
- Participants were instructed to read the stimulus and to type the word on the keyboard as fast as possible without errors.
- Simultaneously, with the typing of the first letter of the target word, the stimulus disappeared from the screen, i.e. viewing times were self paced.

Method: *Participants*

Participants:

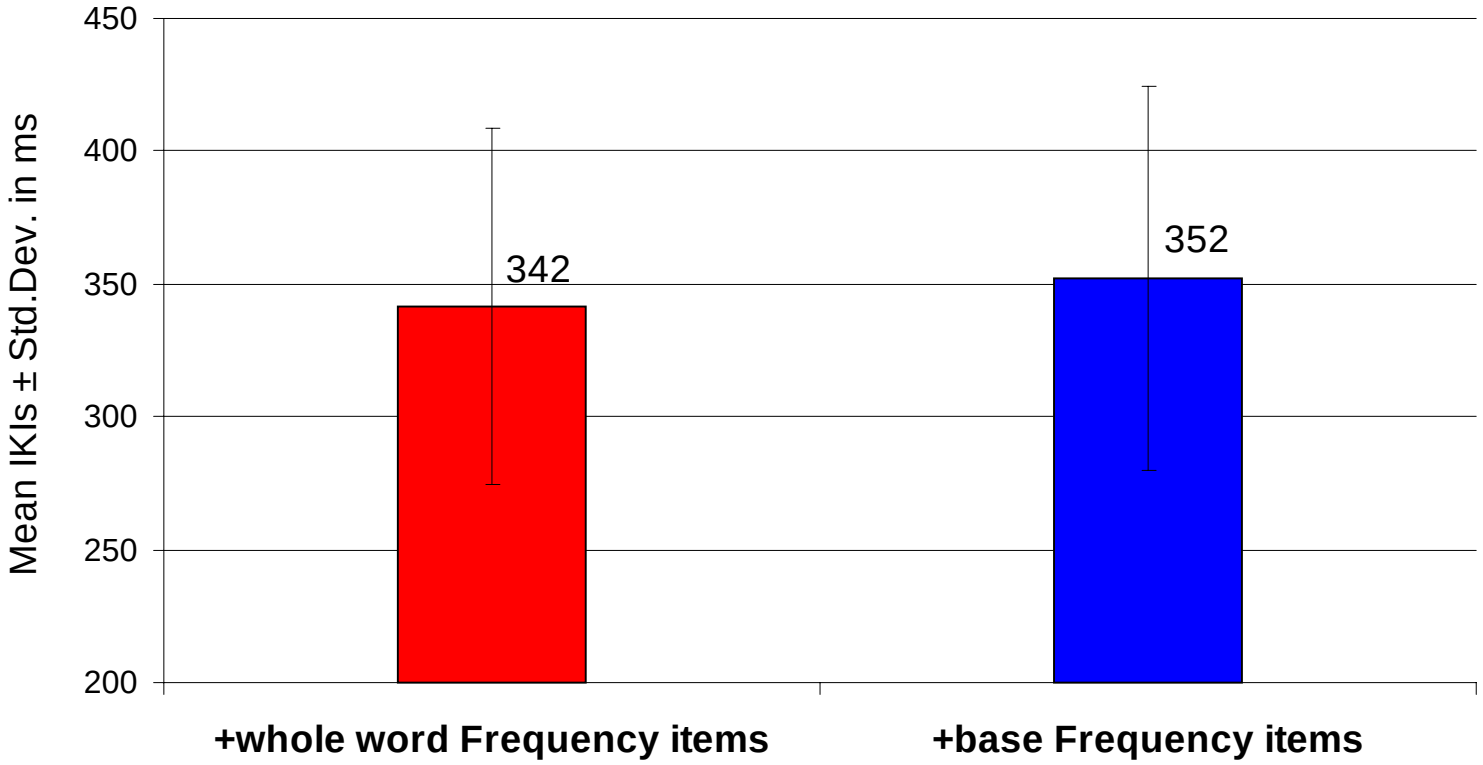
- 45 students of the University of Osnabrueck.
- All were native speakers of German.
- All were able to type fluently, although no strict criteria were applied (average writing speed: 46.0 words/min, std.dev.: 8.4).
- 34 female, 11 male.
- Mean age: 25.9 years, std.dev.: 3.6
- 42 students were right-handed, 3 left handed.

Results: *Statistical issues*

- Mistyped words (13.2 %) and values exceeding 2.5 standard deviations of the mean IKI of the participant/item (4.2%) were discarded from the analysis.
- Original measurements were averaged over subjects.

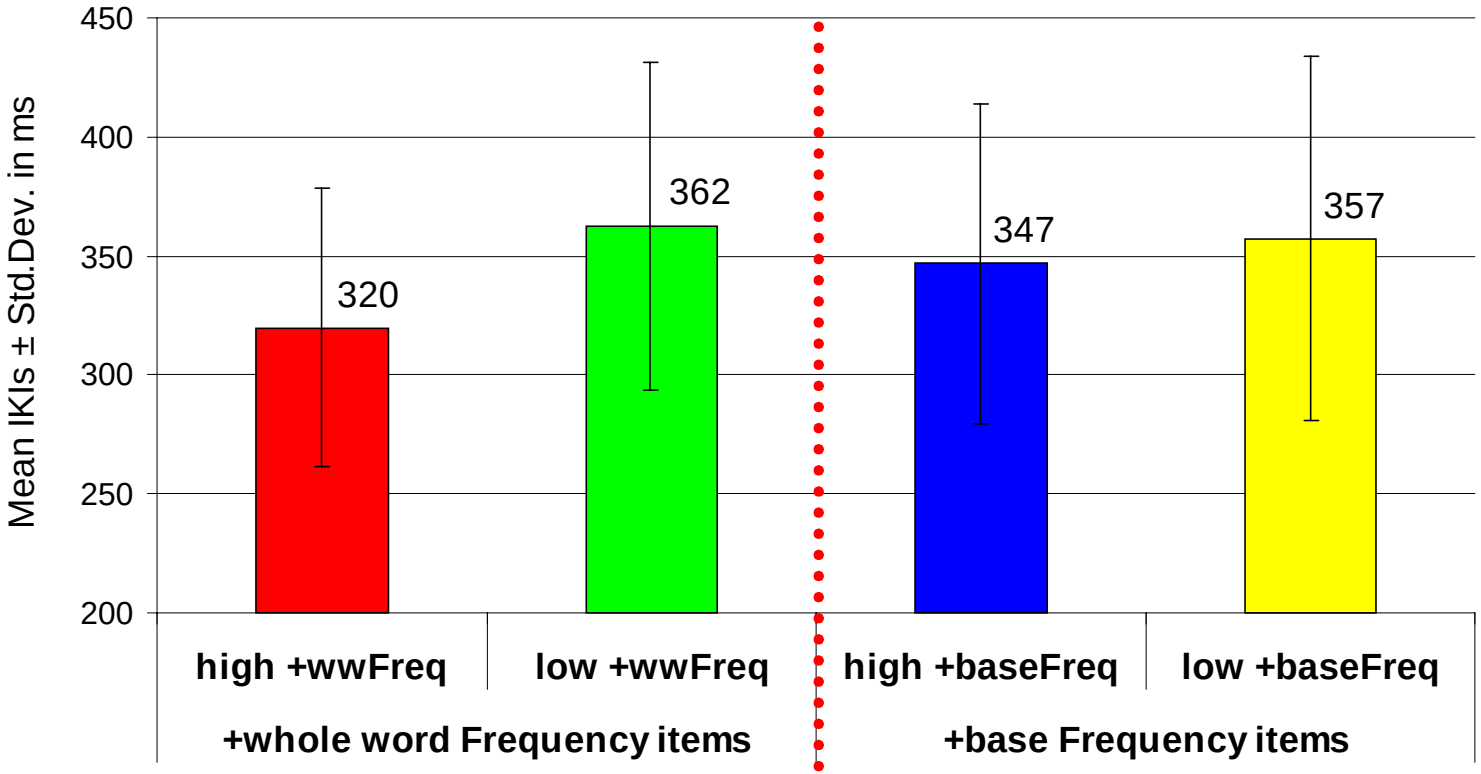
Results

Mean SM-InterKey Intervals in +whole-word frequency vs. +base frequency compounds



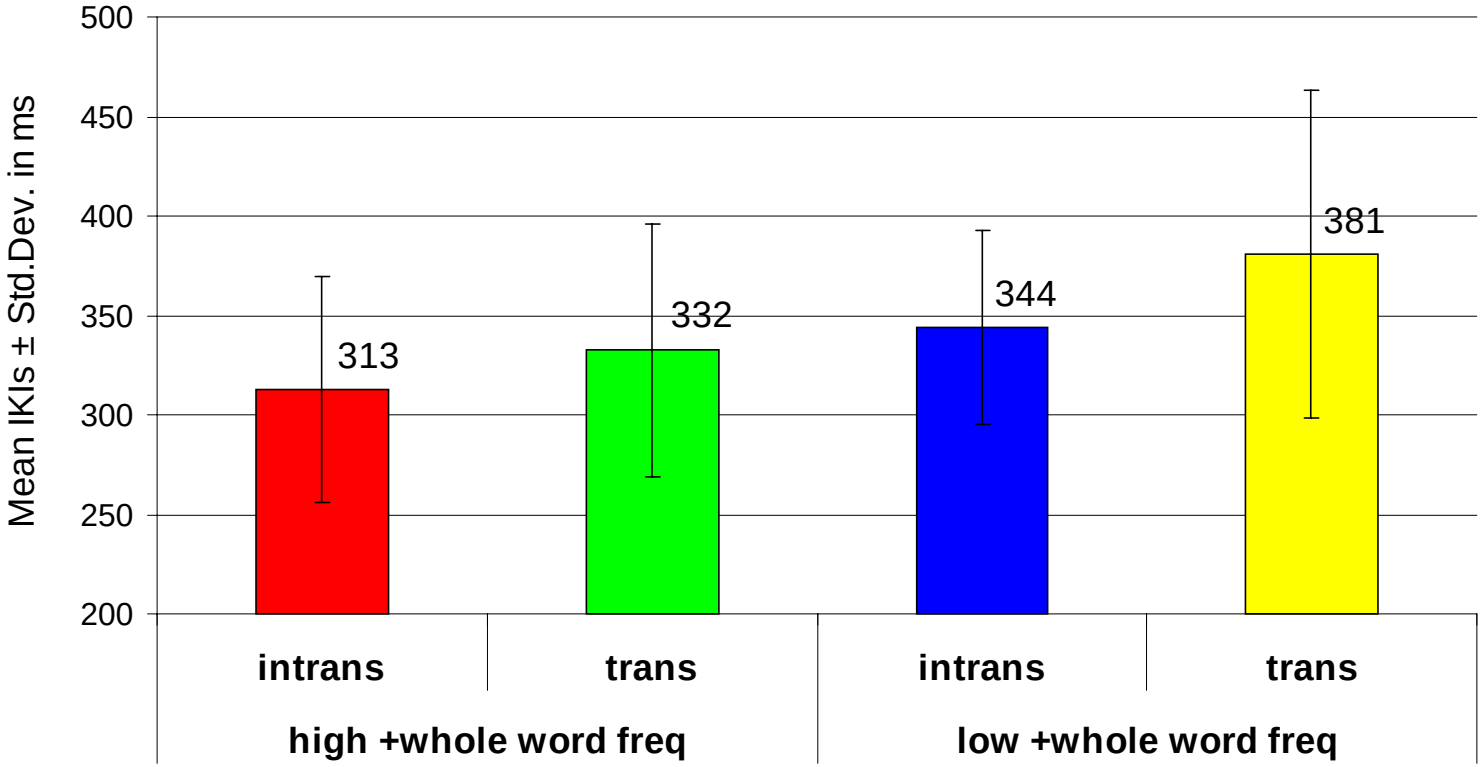
Results

Mean SM-InterKey Intervals in high vs. low +whole-word frequency and +base frequency compounds



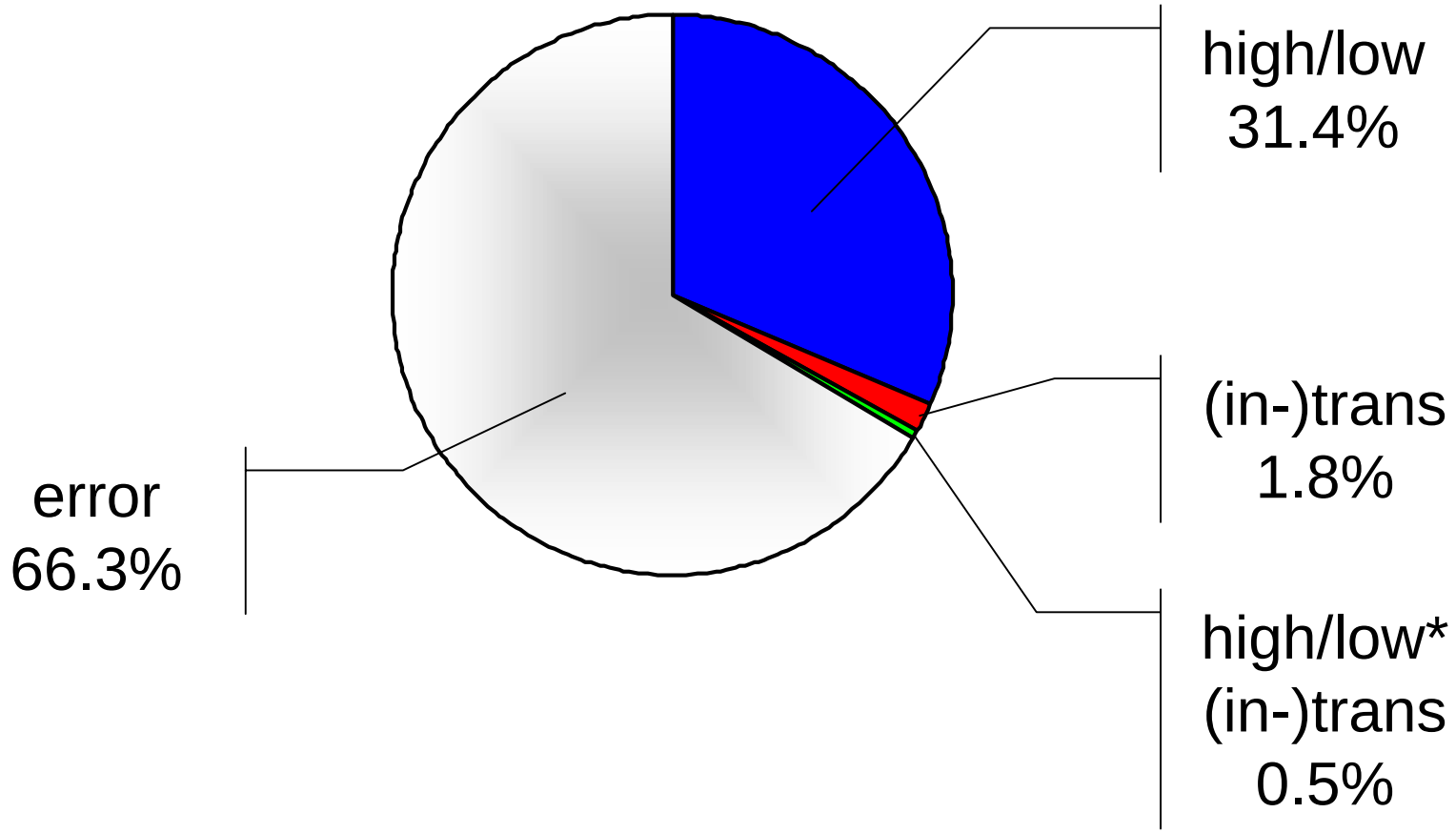
Results

Mean IKIs in semantically transparent vs. intransparent and high vs. low +whole-word frequency compounds



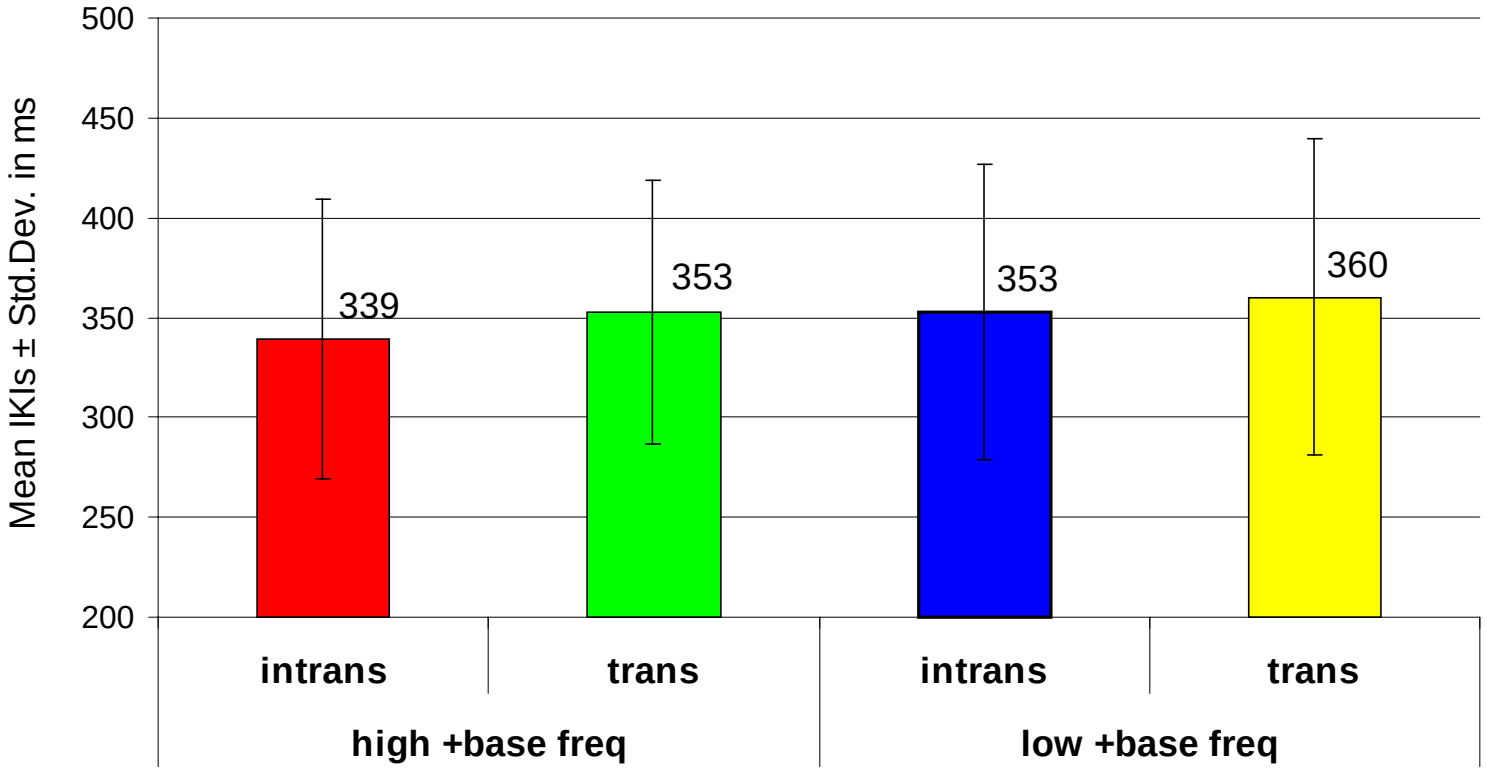
Results

Relative effect sizes (η^2) for +whole word Freq items



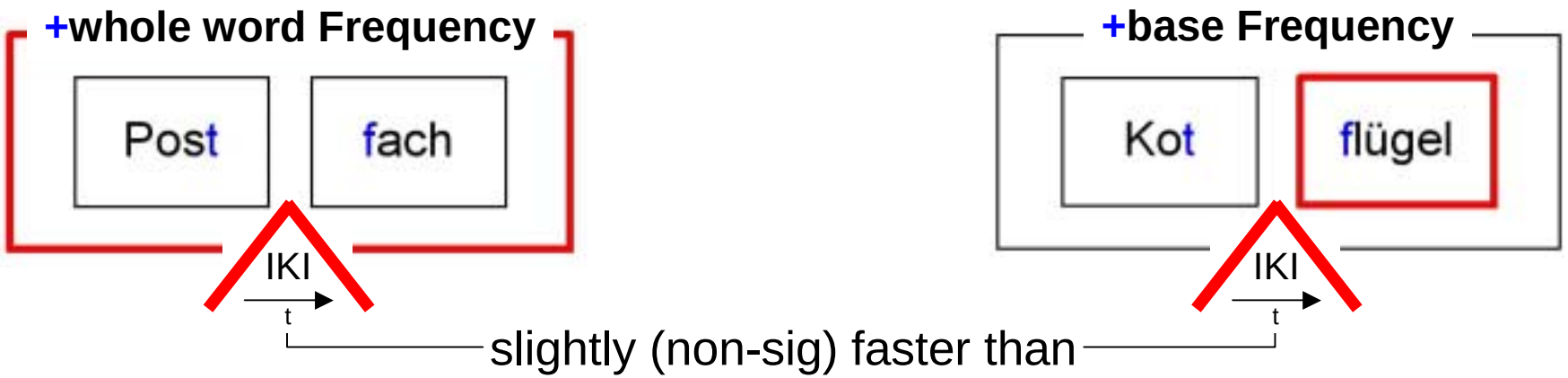
Results

Mean IKIs in semantically transparent vs. intransparent and high vs. low +base frequency compounds



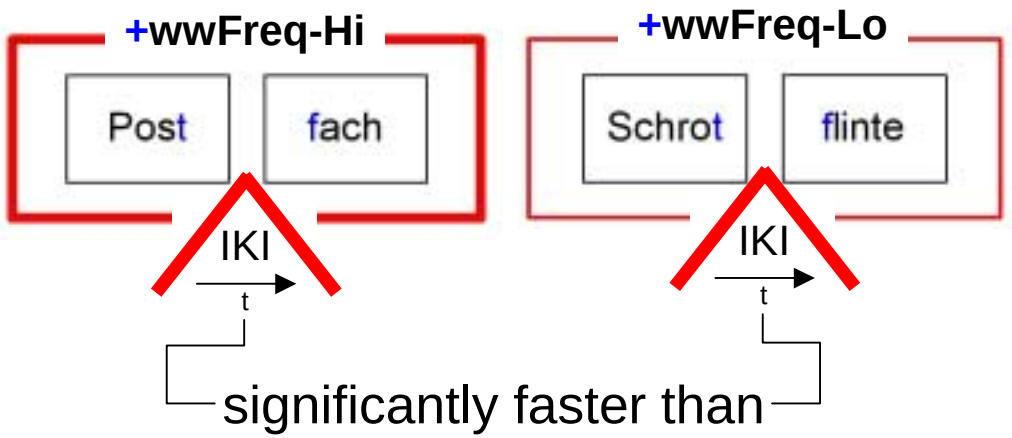
Results summary

- In the overall comparison, no significant influence of relative frequency was found.

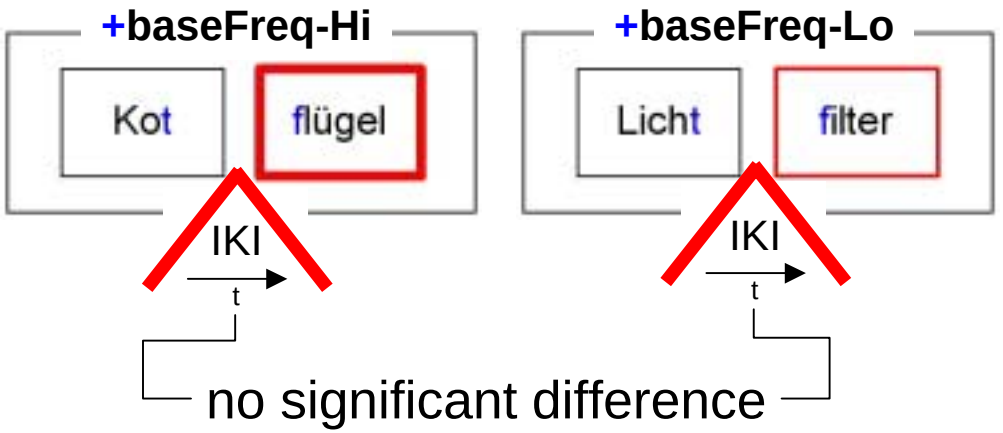


Results summary: *Frequency level*

- A significant effect of frequency was found in compounds with whole word frequency being higher than the base frequency.



- No effects were found in items with base frequency being higher than the whole word frequency.



Results summary: *Transparency*

- All SM-IKI mean values in semantically intransparent items were faster than those of the semantically transparent items.
- But no significant effect of transparency was found.

Discussion

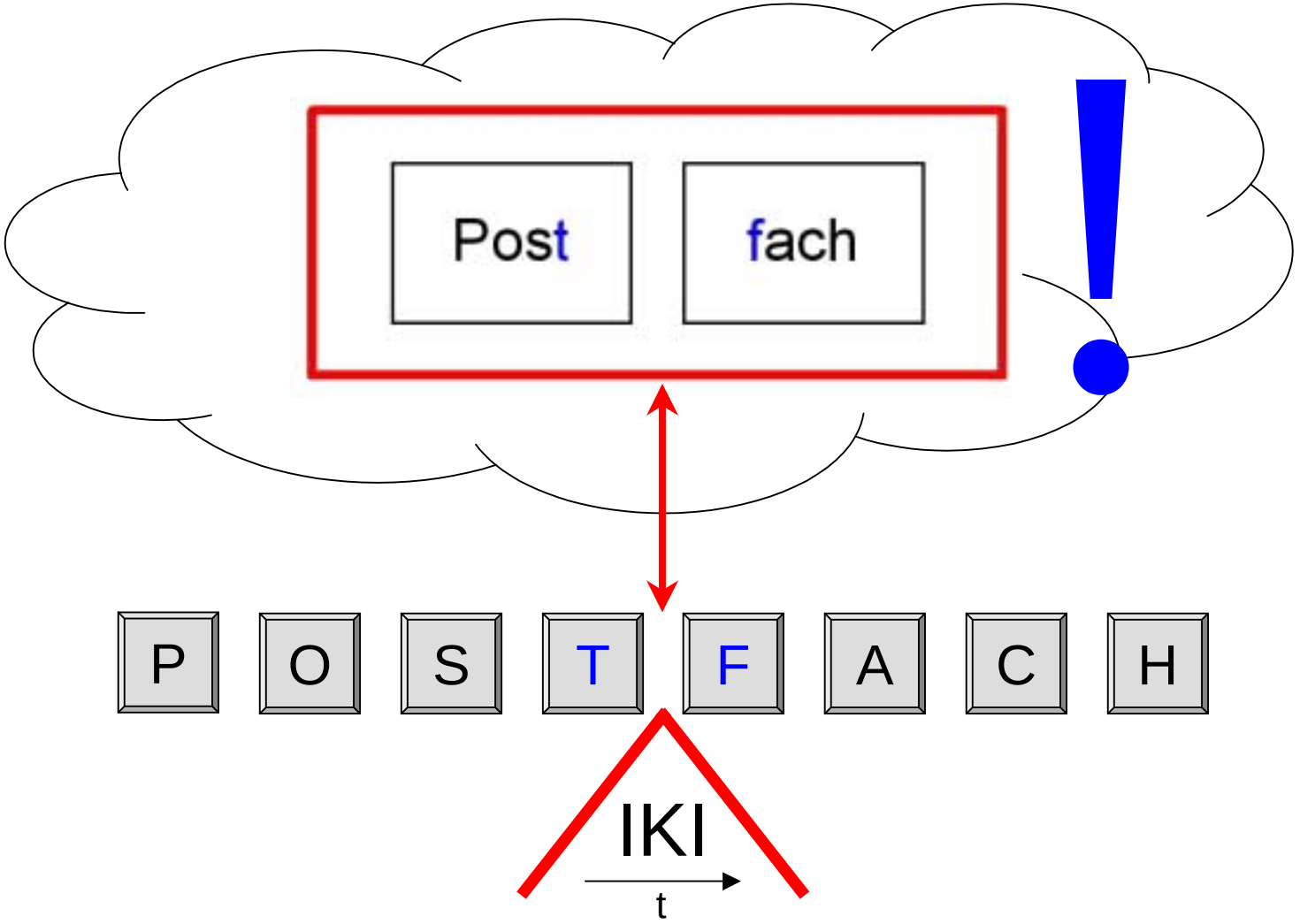
- The level of whole-word frequency affects timing of within word typing.
- The level of base frequency has no significant effect.

We conclude that we are

not dealing with compositional effects

but with a re-access of the whole-word form.

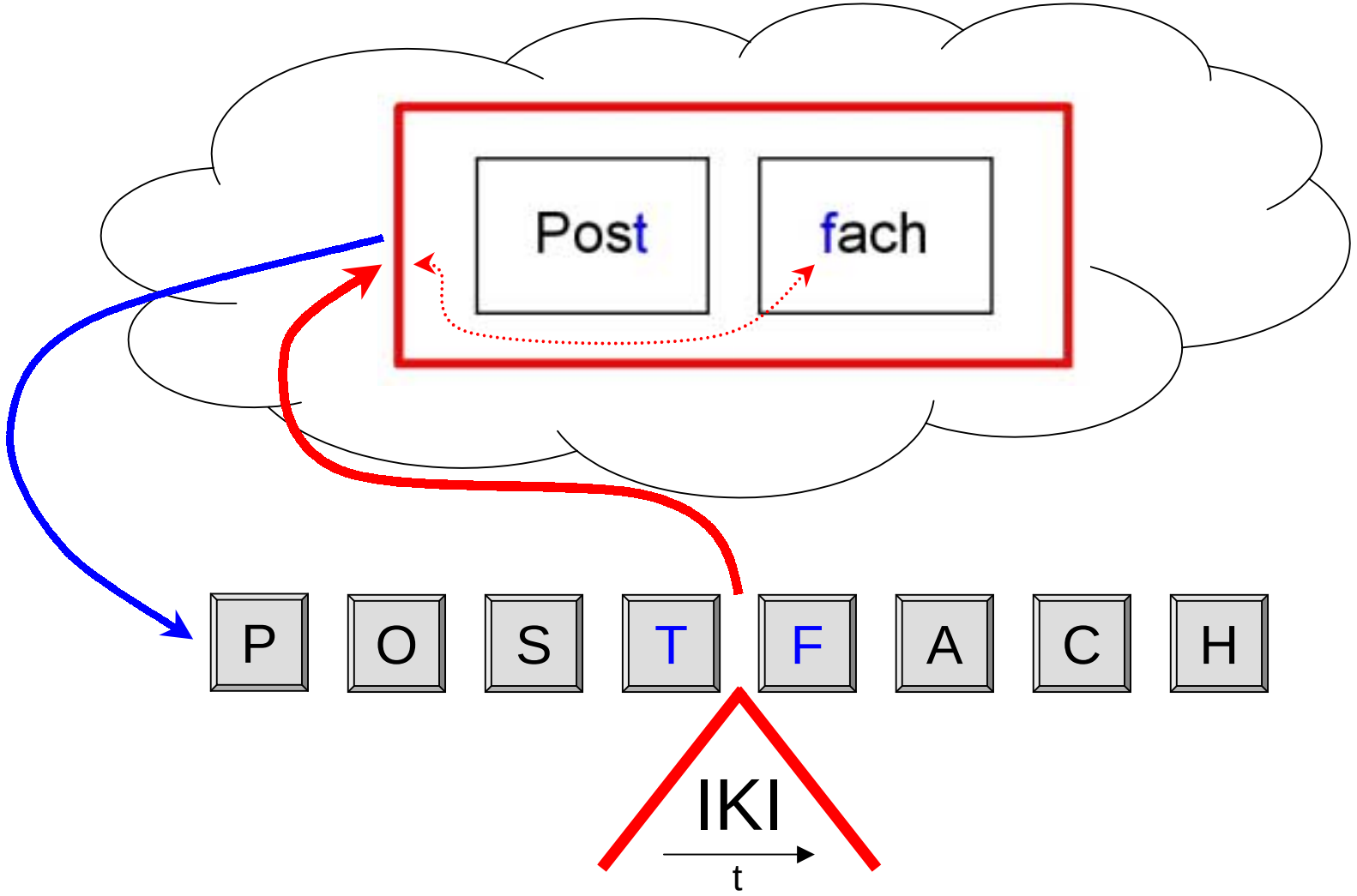
Discussion



Discussion

- The non-significant but consistent effect of transparency may reflect semantic influences occuring during the whole word form access.

Discussion



Timing in the written production of German compounds

Contact:

Guido.Nottbusch@uos.de

a.grimm@let.rug.nl

Ruediger.Weingarten@uos.de

References

Baayen, R.H., Piepenbrock, R. & van Rijn, H. (1993). The CELEX Lexical Database (CD-ROM). Linguistic Data Consortium, University of Pennsylvania, Philadelphia, PA.

Baayen, R.H., & Schreuder, R. (1999). War and Peace: Morphemes and Full Forms in a Noninteractive Activation Parallel Dual-Route Model. *Brain and Language, 68,* 27-32.

Badecker, W., Hillis, A., & Caramazza, A. (1990). Lexical morphology and its role in the writing process: Evidence from a case of acquired dysgraphia. *Cognition*, 35, 205-243.

Badecker, W., Rapp, B., & Caramazza, A. (1996). Lexical Morphology and the Two Orthographic Routes. *Cognitive Neuropsychology*, 13(2), 161-176.

Caramazza, A., Laudanna, A., & Romani, C. (1988). Lexical Access and inflectional morphology. *Cognition, 28,* 297-332.

Gentner, D. R. (1983). The Acquisition of Typewriting Skill. Acta Psychologica, 54, 233-248.

Hay, J. B. (2000). Causes and Consequences of Word Structure. Doctor of Philosophy, Field of Linguistics, Nothwestern University, Aus.

Will, U., Weingarten, R., Nottbusch, G., & Albes, C. (2003). Linguistische Rahmen und segmentale Informationen bei der Einzelwortschreibung. Evidenzen aus Zeitstrukturen und Fehlerverteilungen. In Habel, Christopher; Pechmann, Thomas, *Sprachproduktion*. Opladen: Westdeutscher Verlag.

Will, U., Weingarten, R., Nottbusch, G., & Albes, C. (submitted). Linguistic units, hierarchies and dynamics in word typing.