

The role of the foot in the processing of stress in German

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CUNY conference on the foot



The stress foot in German

- General goal: Empirical study of the role of the stress foot in the processing of German words
- Specific goal here: Clarify the type of foot and the extent of its role in processing

The stress foot in German

- Overview:
 0. Previous EEG experiments on the foot and word stress
 1. Experiment 1: dissociation of word stress and sentence stress?
 2. Experiment 2: secondary stresses and the domain of footing?

Previous EEG experiments on the foot and word stress

- Typical stimuli:

Trisyllabic words with all possible stress patterns:

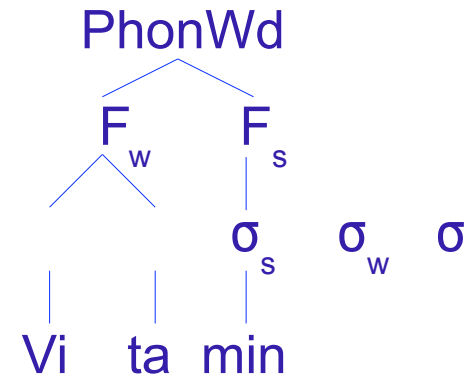
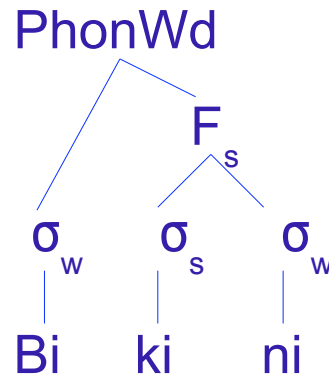
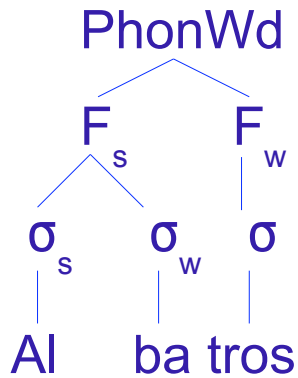
- Final stress: *Vitamín, *Vítamin, *Vitámin*
- Penultimate stress: *Bikíni, *Bíkini, *Bikiní*
- Antepenultimate stress: *Álbatros, *Albátros, *Albatrós*

- Carrier sentence:

- *Er soll nun _____ sagen.*
'He must now ____ say.'

Previous EEG experiments on the foot and word stress

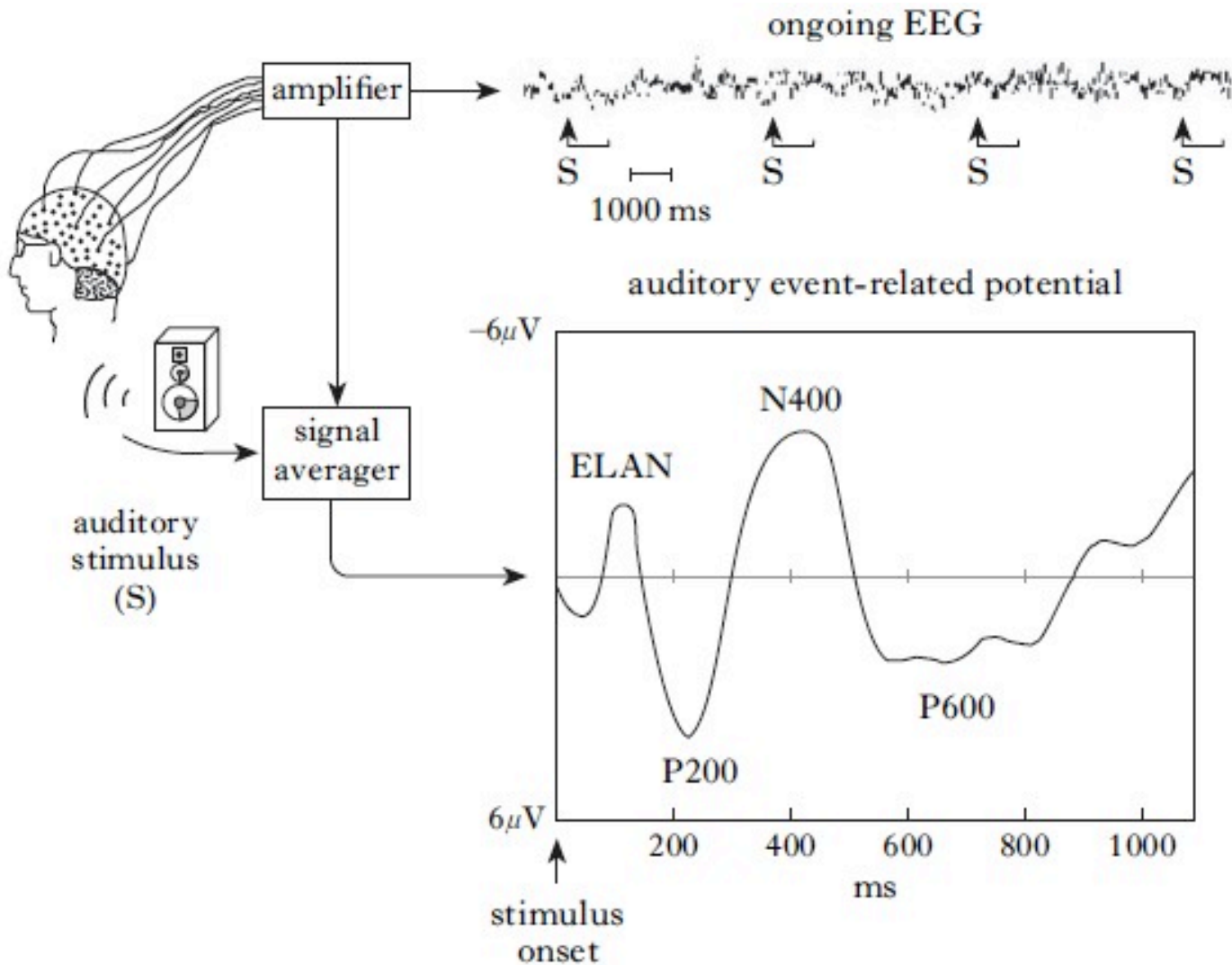
- Prosodic structures of crucial words:



Previous EEG experiments on the foot and word stress

- Prosodic assumptions:
 1. Feet are trochaic, and maximally binary: $(\sigma \sigma)$ or (σ)
 2. Feet are constructed according to:
 - the number of syllables
 - the weight of syllables
 - the direction in which syllables are parsed into feet

Overview of EEG method



Previous EEG experiments on the foot and word stress

- Method:
 1. Measuring event-related potentials time-locked to occurrence of stress patterns
 2. Stimuli (German words with correct and incorrect stresses) spliced into carrier sentence
 3. Auditory presentation to adult native German subjects (sometimes preceded by visual presentation)
 4. Items controlled for frequency, syllable structure and phonetic parameters of stress realization

Previous EEG experiments on the foot and word stress

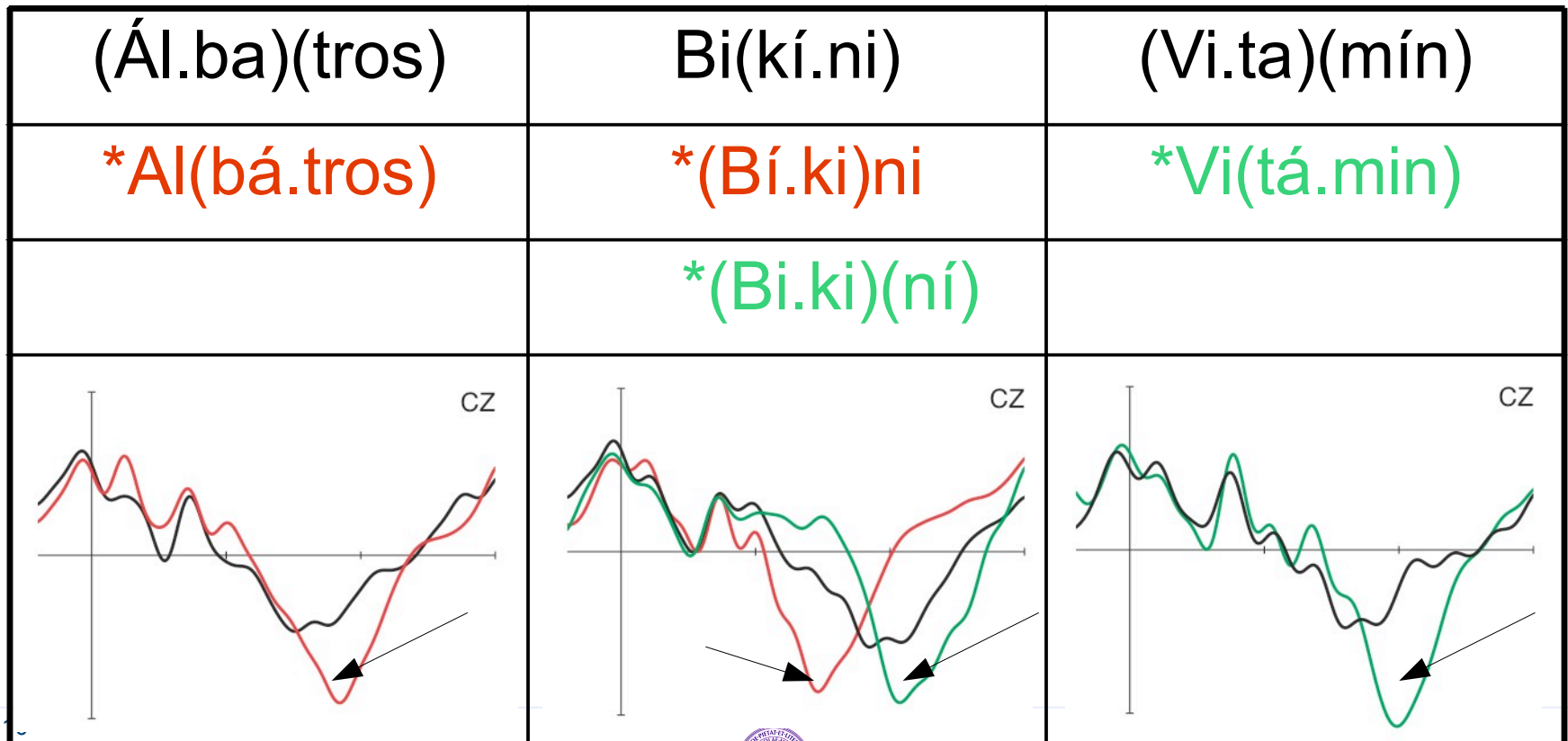
- Some results:
 1. Stress violations produce N400 effects and P600 effects,
 2. N400 caused by lexical search; P600 caused by detection of stress mismatch,
 3. Position of wrong stress influences latency and amplitude of positivity:

* J. Knaus, R. Wiese & U. Janßen (2007) The processing of word stress: EEG studies on task-related components. *Proc. of the International Congress of Phonetic Sciences 2007, Saarbrücken, 709-712.*

U. Domahs, R. Wiese, I. Bornkessel-Schlesewsky & M. Schlewsky (2008): The processing of German word stress: Evidence for the prosodic hierarchy. *Phonology 25, 1-36.*

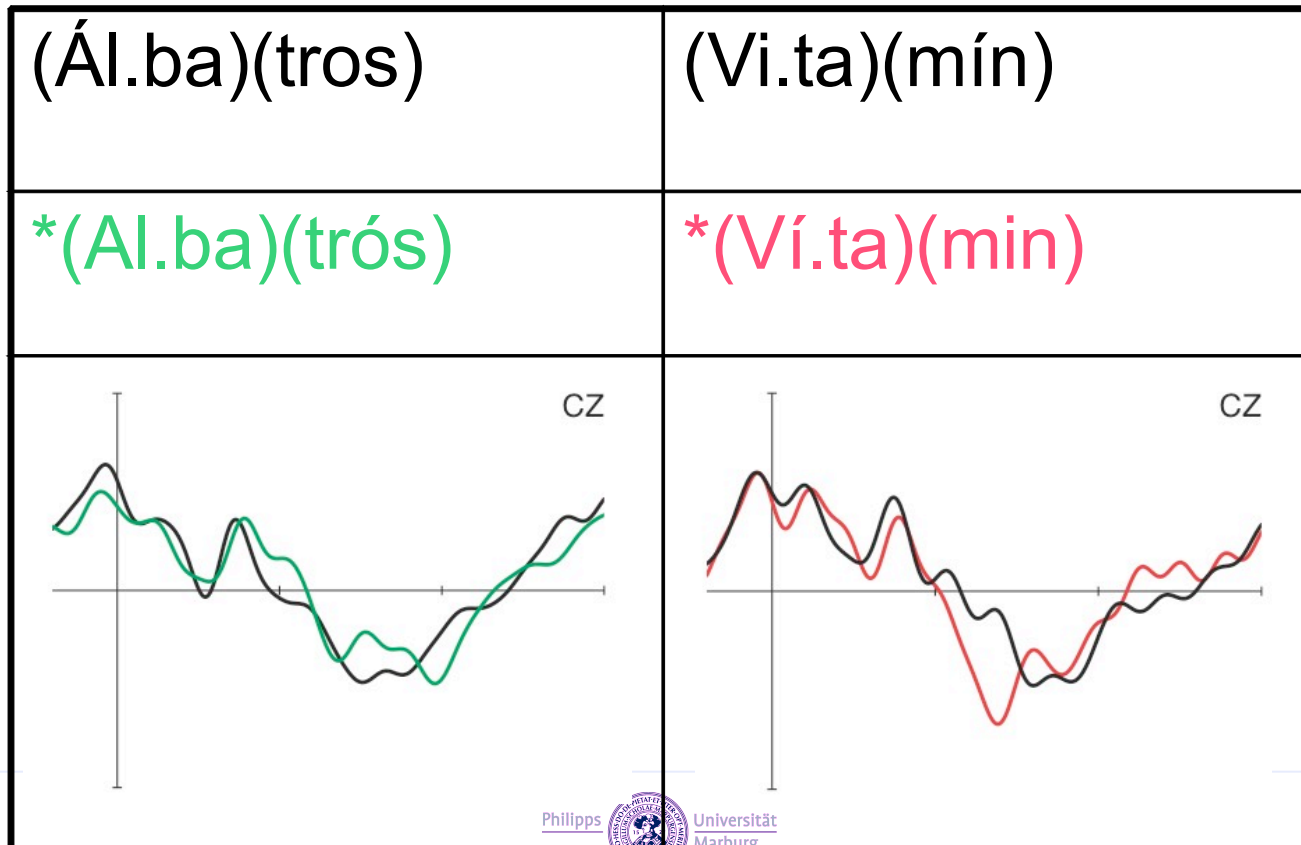
Previous EEG experiments on the foot and word stress

- Positivity effect occurs:



Previous EEG experiments on the foot and word stress

- Positivity effect does *not* occur:



Experiment 1: word stress or sentence stress?

- Word stress in previous experiments co-terminous with sentence stress:

Sentence 1

Er soll nun **Bikiní** sagen.

Sentence stress

Word stress

- Solution: different carrier sentence:

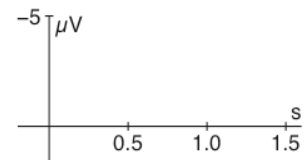
Sentence 2

Er hat **núr** noch **Bikiní** gesagt. (He has only **Bikiní** said.)

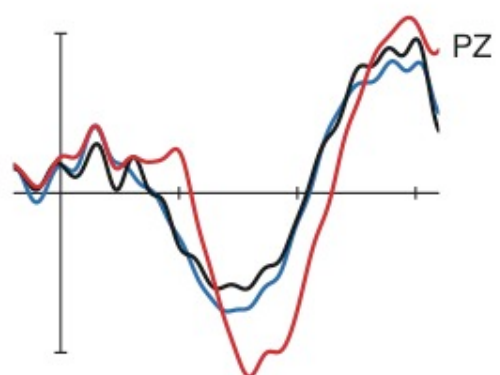
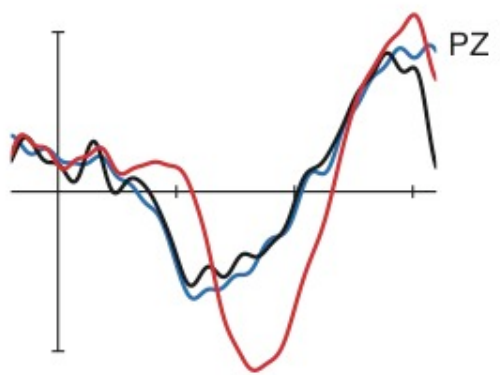
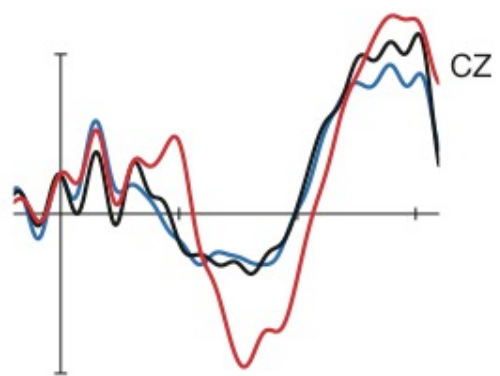
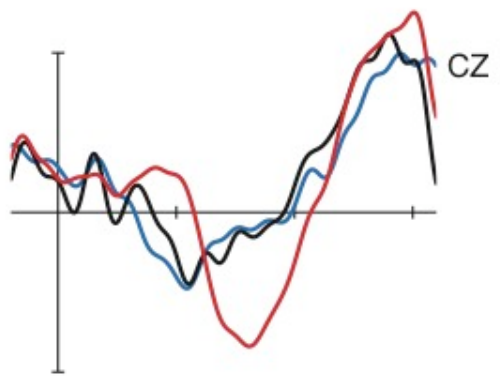
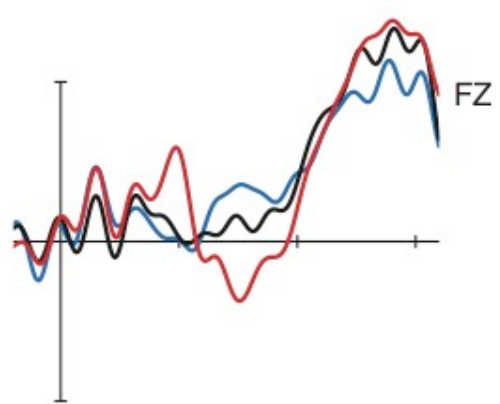
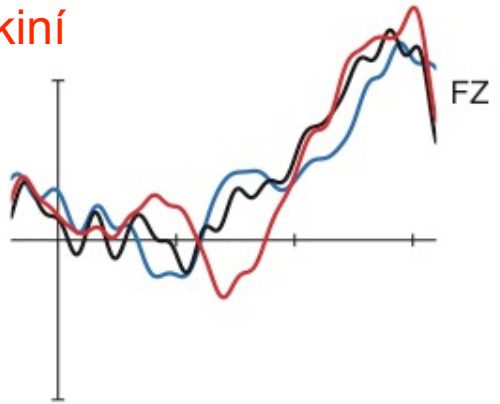
Sentence stress

Word stress

Bikíni – *Bíkini – *Bikíní

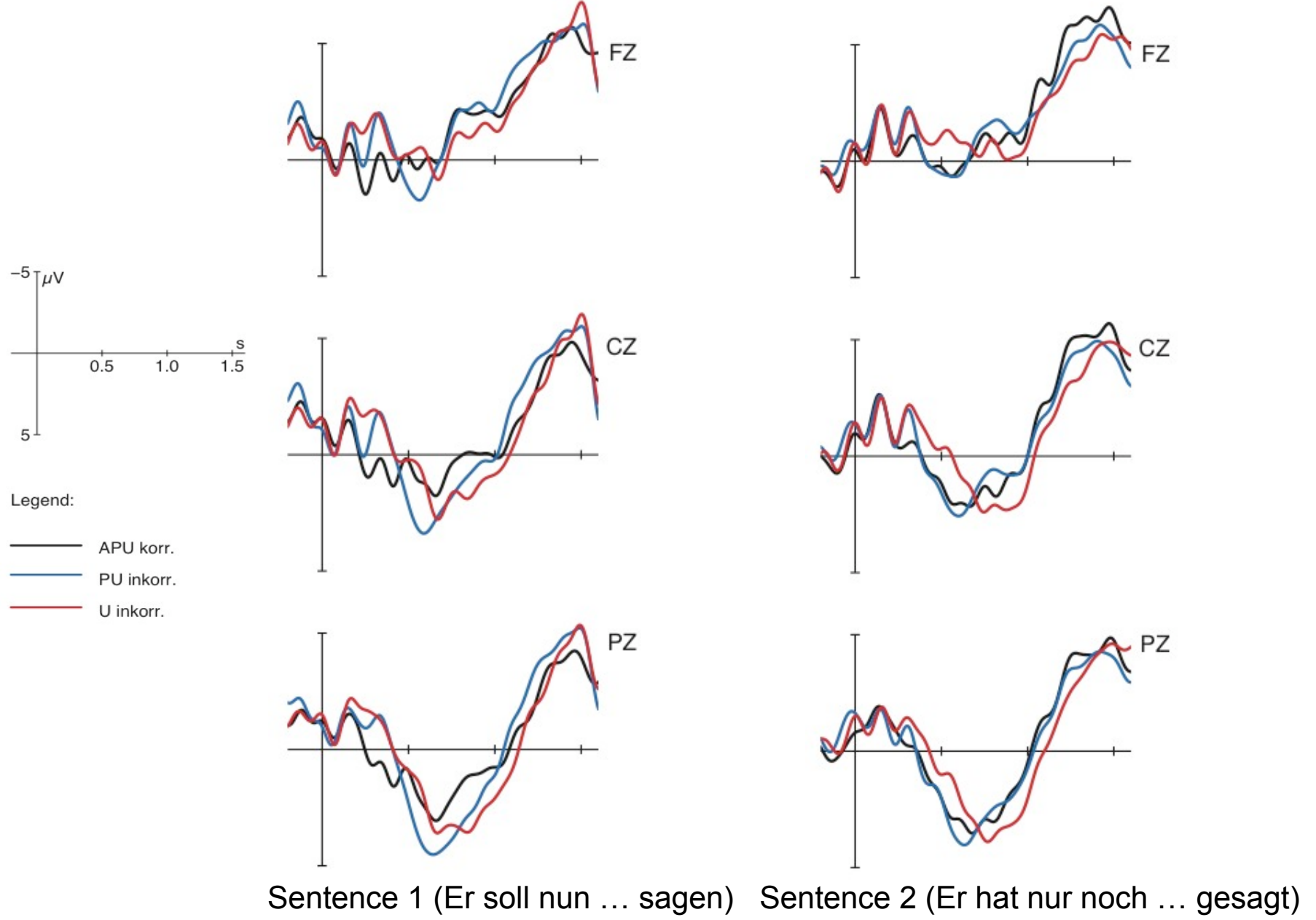


- Legend:
- PU korr.
 - APU inkorr.
 - U inkorr.

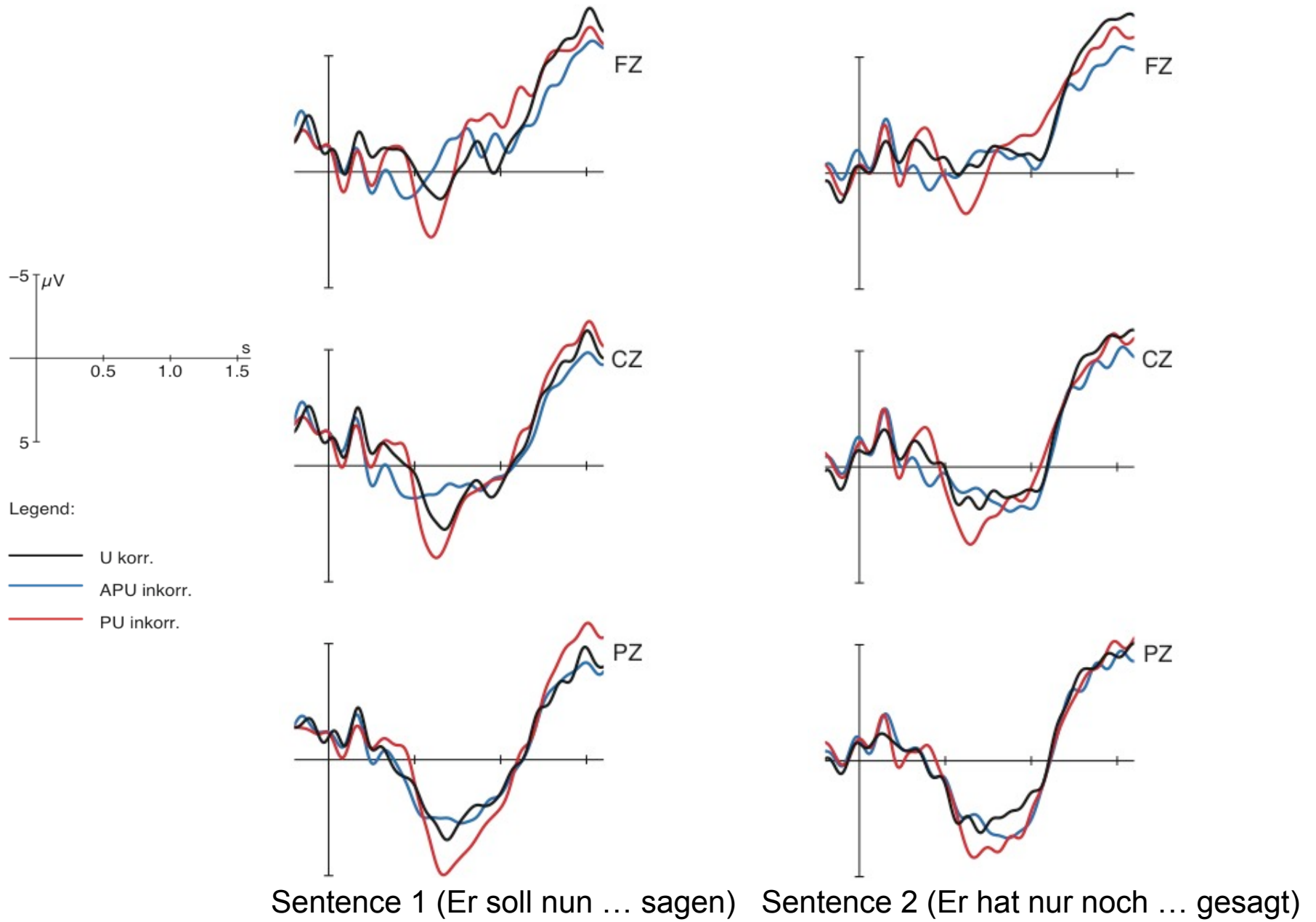


Sentence 1 (Er soll nun ... sagen) Sentence 2 (Er hat nur noch ... gesagt)

Álbatros – *Albátros – *Albatrós



Vitamín – *Vítamin – *Vitámin



Experiment 1: word stress or sentence stress?

- Results:
 - P600 effects; (partial) replication of previous experiments
 - Effects in both sentence contexts; deflection not restricted to sentence stress
 - Some deflections weaker in context 2 than in context 1

In general: the effects reflect wrong word stress, not just sentence stress

Experiment 2: Secondary stress and the foot

- Questions:
 - Is the method used so far adequate to identify positions with secondary stress (non-head feet)?
 - Do we find evidence for a preference of initial stress?
 - Does the positioning of secondary stress depend on the position of main stress?

Experiment 2: Secondary stress and the foot

- Secondary stresses and feet:
 - (Thè o) (ríe)
 - (À dap) ta (tíon) / A (dàp ta) (tíon)
 - (Dè mo) (krà ti) (síe rung)
- Two views on secondary stresses (in German):

<i>Foot domain:</i>	Word	Utterance
<i>Foot placement:</i>	left word-boundary	Stress clash leads to non-initial stresses
<i>Length of feet:</i>	binary feet only	ternary feet allowed
<i>Proponents:</i>	Alber, Wiese	Noel, Vennemann

Experiment 2: Secondary stress and the foot

- EEG-study on German pentasyllabic words
 - Assumption: one or two secondary stresses before main stress
 - Participants: 20 speakers of German; stress matching task
 - Visual presentation of item before auditory presentation
 - Stimuli with main stress on the 3rd, 4th or 5th syllable
 - Each word presented with stress on each syllable (1 to 5)
 - Other main stress positions as filler items
 - All stimuli embedded in carrier sentence:
“Er soll nun ____ sagen.”

Secondary stress and the foot: behavioral data

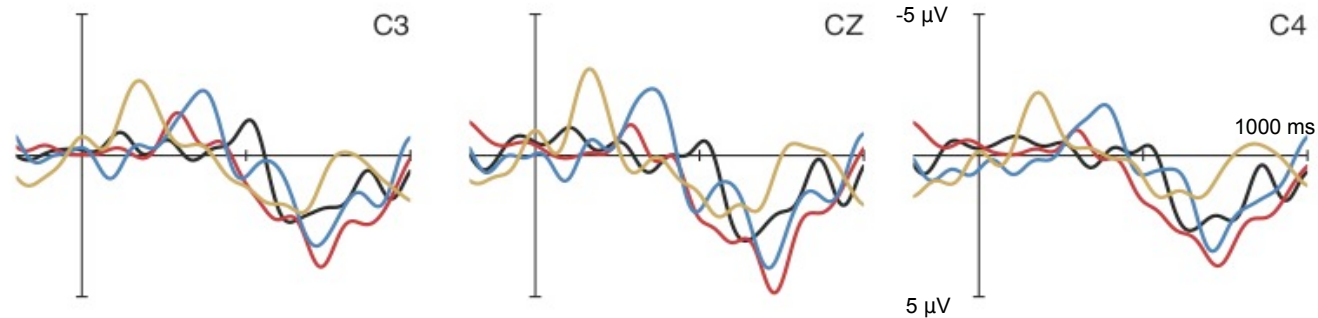
- Stress judgement; Accuracy Scores

	1 st	2 nd	3 rd	4 th	5 th
APU	86%	98%	98%	97%	95%
PU	83%	98%	96%	95%	94%
U	71%	97%	96%	97%	94%

Difference plots for words correctly stressed on 3rd syllable (e.g., *Kontrollierbarkeit*)

Legend:

- incorr. 1st syll.
- incorr. 2nd syll.
- incorr. 4th syll.
- incorr. 5th syll.

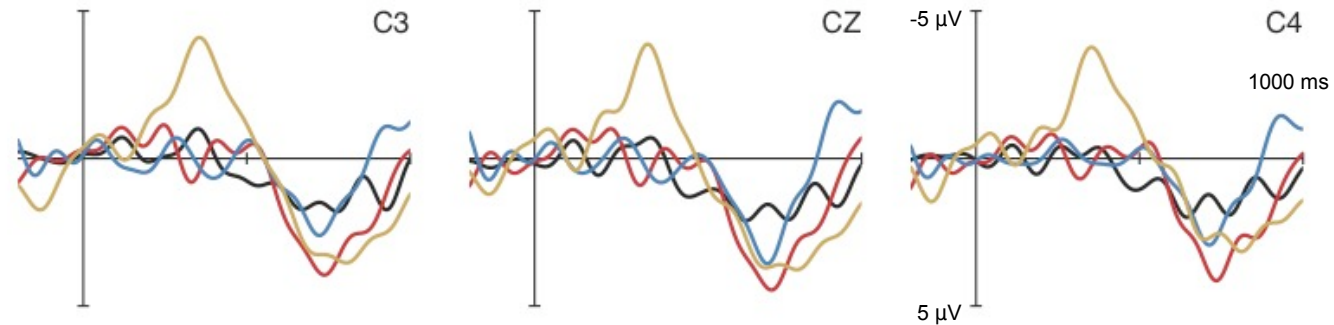


- Positivity for incorrect stress on the 1st and the 5th syllable is reduced in comparison to the other conditions.
- Positivity for incorrect stress on the 2nd and the 4th syllable is worst.
- 1st (and 5th) syllable are possible positions for secondary stress.

Difference plots for words correctly stressed on the 4th syllable (e.g., *Enthusiásmus*)

Legend:

- incorr. 1st syll.
- incorr. 2nd syll.
- incorr. 3rd syll.
- incorr. 5th syll.

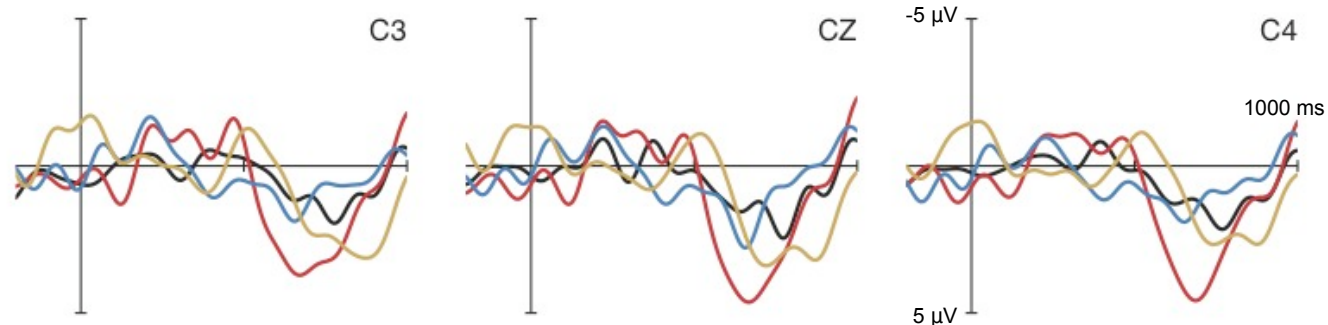


- Positivity for incorrect stress on 1st syllable is less pronounced compared to the other conditions.
- All other positions for incorrect stress are worse.
- 1st syllable is a possible position for secondary stress.

Difference plots for words correctly stressed on the 5th syllable (e.g., *Anoñymität*)

Legend:

- incorr. 1st syll.
- incorr. 2nd syll.
- incorr. 3rd syll.
- incorr. 4th syll.



- Positivity for incorrect stress on the 1st syllable is less pronounced compared to the other conditions.
- Incorrect stress on the 3rd syllable: positivity effect stronger than on the 1st syllable but less pronounced than on the 2nd and 4th syllable.
- Positivity for incorrect stress on the 2nd and the 4th syllable is largest.

Experiment 2: Secondary stress and the foot

- Summary:
 - Consistent with previous studies, positivity effects for violations of main stress position in pentasyllabic words.
 - Violations evoke positivity effects of different strengths:
 - Incorrect main stress on a syllable adjacent to correct main stress causes most pronounced positivity.
 - Incorrect main stress on the initial syllable and on a syllable non-adjacent to the correct stress position causes smaller effects.

The stress foot in German

- Conclusion:
 - Present EEG results confirm proposals
 - placing secondary stress on the word-initial syllable,
 - placing the foot below the Phonological Word.