# Developmental Changes in Neuronal Processing of Irregular Morphosyntactic Rules During Childhood

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## Introduction

- Grammar follows patterns (e.g. verb conjugation)
- Theoretically possible patterns might exist or not exist in a language – see non-attested ABA pattern in German verbs (Bobaljik, 2012; Wiese, 2004):

| Pattern | | Present | | Past Participle | | Past (Preterite) | |
|---|---|---|---|---|---|---|---|
| regular | AAA | *sag-en* | 'say' | *ge-sag-t* | 'said' | *sag-te* | 'said' |
| irregular | ABC | *sing-en* | 'sing' | *ge-sung-en* | 'sung' | *sang* | 'sang' |
| | AAB | *komm-en* | 'come' | *ge-komm-en* | 'came' | *kam* | 'came' |
| | ABB | *reit-en* | 'ride' | *ge-ritt-en* | 'ridden' | *ritt* | 'rode' |
| not attested | ABA | *XAX-en* | | *ge-XBX-en* | | *XAX* | |

- Prediction: brain responds differently to correct grammatical pattern, incorrect pattern and non-attested pattern in a language
- Regel et al. (2015)
  - Comparison of patterns in German irregular verbs & pseudo-verbs
  - ERP study with adults: P600 correct < incorrect < non-attested
- Clahsen et al. (2007)
  - Over-generalization with respect to irregular German nouns
  - ERP study with children:
    - 6-7-year-olds: anterior negativity (error detection but immature neuronal processing)
    - 8-9-year-olds: P600 (adult-like, but smaller in amplitude)

➢ Current study:
conditions (correct, incorrect, non-attested) as in Regel et al. (2015)
in children within a similar age range as in Clahsen et al. (2007)

Hypotheses:

| | |
|---|---|
| 6-7-year-olds | negativity (error detection but immature processing)<br>correct < incorrect < non-attested |
| 8-9-year-olds | P600 (adult-like, maybe smaller in amplitude)<br>correct < incorrect < non-attested |

## Participants

- 15 6-7-year-old German native speakers
- 19 8-9-year-old German native speakers

Inclusion criteria:
- Raised monolingually
- Right-handed
- No prematurity
- No neurological, linguistic, visual or hearing impairments

## Stimuli

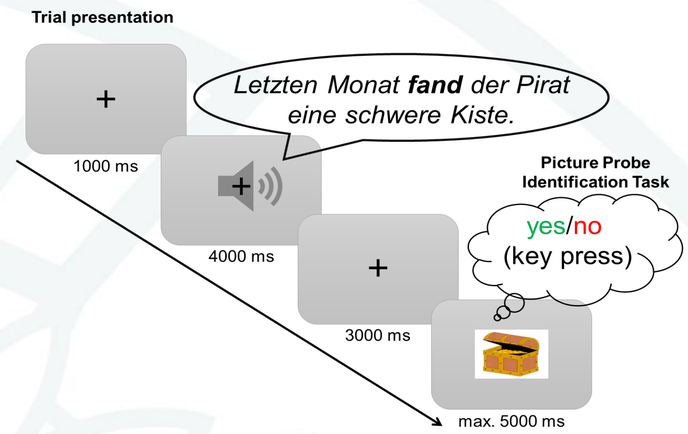
- 104 Trials (78 test + 26 filler sentences) after training
- Test items: 13 irregular verbs (ABC pattern)
  integrated in 2 different sentences per verb
- 3 conditions: correct (ABC)
  incorrect but possible rule (ABB)
  incorrect and non-attested rule (ABA)

| Condition | | Example |
|---|---|---|
| correct | ABC | *Letzte Woche sang das Mädchen einen neuen Kanon.*<br>'Last week, the girl sang a new canon.' |
| incorrect (rule) | ABB | *Letzten Monat sung das Mädchen einen neuen Kanon.*<br>'Last month, the girl sung a new canon.' |
| incorrect (non-attested) | ABA | *Letzten Sommer sing das Mädchen einen neuen Kanon.*<br>'Last summer, the girl sing a new canon.' |

- Filler items: 13 irregular verbs (AAB or ABB pattern)
  integrated in 2 different sentences; only correct condition
  (experimental correct condition + filler items
  = 50% correct sentences across the experiment)

## Design

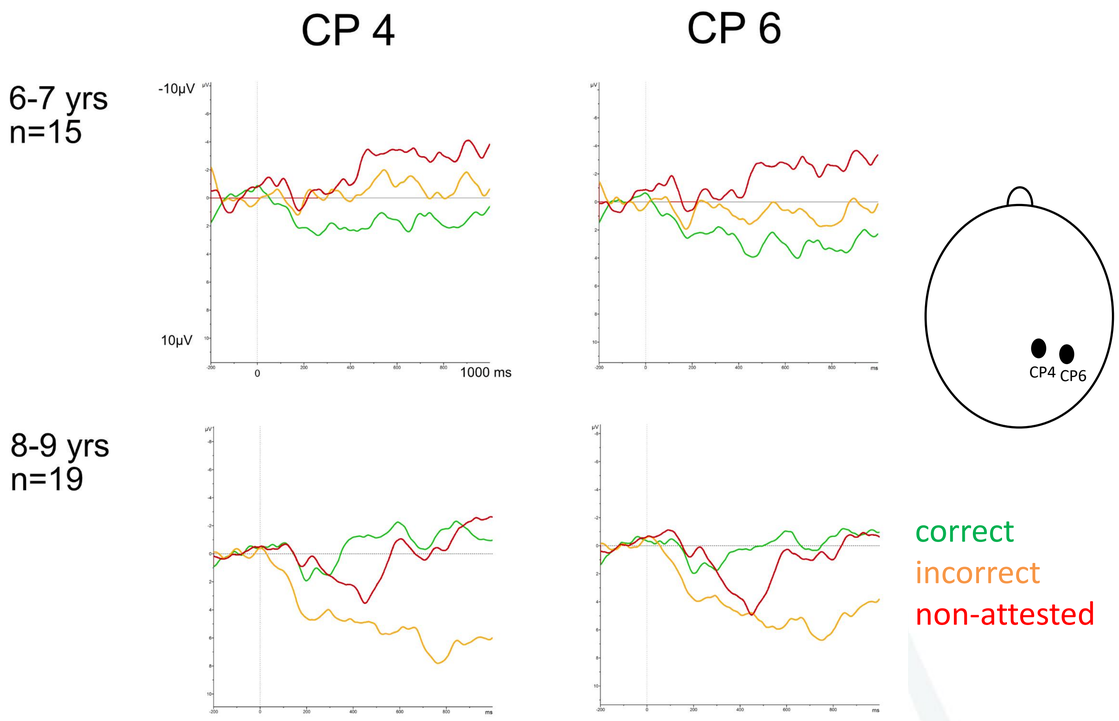
- Auditory presentation of sentences
- Picture Probe Identification Task after each trial for attention




## ERP Recordings

- 32 AgAgCl active electrodes
- Online-reference: left mastoid, re-referenced to averaged mastoids
- Electrode impedance < 10kΩ
- Sampling rate: 1000 Hz

## ERP Results




## Conclusion

- 6-7-year-olds immature N400-like response (as expected)
  correct < incorrect < non-attested
- 8-9-year-olds P600 but in unexpected order:
  correct < non-attested < incorrect

- Younger children detect non-attested rules
  → lexically driven(?)

- Older children show adult-like P600 response
  → morphosyntactic processing
  BUT unable to process non-attested pattern like adults
  → because of frequency(?)
  (simple past not used / heard by children that often & therefore rules acquired later)

→ Developmental changes in morphosyntactic rule processing

## References

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