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P3 Amplitude indexes the Degree of similarity-based Interference in Memory Retrieval during Sentence Comprehension

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Introduction

✳ Unitary memory models postulate a direct content-addressable (cue-based) retrieval in working and longterm memory [1]. Cue-based retrieval suffers from similarity-based interference. It increases with increasing cue overlap [2].

✳ The P300 effect correlates with memory retrieval in non-linguistic tasks. Amplitude is modulated by the number of involved features [3].

✳ **The present study**

- Is the P300 amplitude sensitive to the degree of similarity-based interference in memory retrieval during language comprehension?
- 2 ERP experiments investigated interference in memory retrieval in sluicing constructions

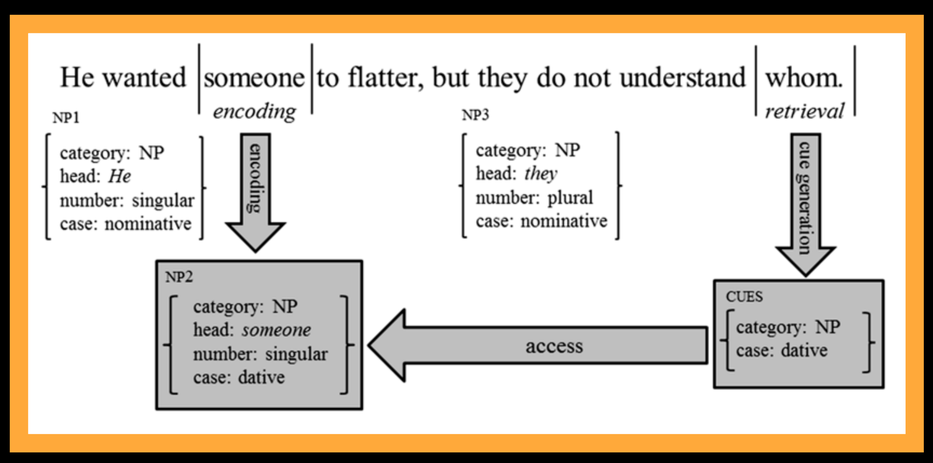


Illustration based on [4]

Experiments

Experiment 1

✳ How do the different cases in German behave as features / cues involved in retrieval?
✳ 2 × 2 Design: verb type (ACC / DAT) × cue case (match/ mismatch)

- 26 Ag/AgCl electrodes (impedances below 5 kΩ)
- 24 native, right-handed speakers of German (age range 19 – 28)
- 120 critical sentences (20 per condition), 180 fillers
- Fixation asterisk: 500 ms, word presentation time: 300 ms, ISI: 200 ms, blank screen after last word: 1000 ms, task: 2000 ms, ITI: 500 ms
- acceptability judgement after each sentence

Experiment 2

✳ How does similarity-based interference influence P300 amplitude?
- Additional manipulation of the intervening noun phrase, using either a pronoun as in experiment 1 or a highly/lowly plausible object of the matrix verb creating high/low interference due to semantic cue overlap.

✳ × 3 NP type (pronoun / high interference NP / low interference NP)

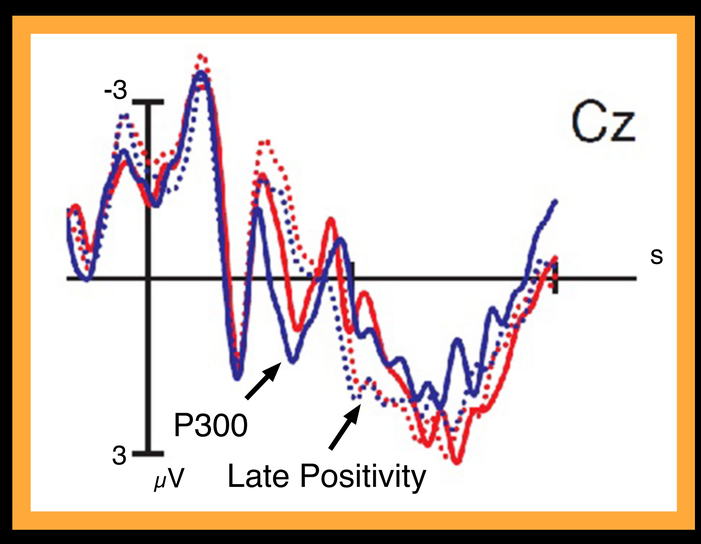
- 64 active electrodes (impedances below 15 kΩ)
- 22 native, right-handed speakers of German (age range 18 – 29)
- 240 critical sentences (40 per condition), 175 fillers
- presentation times cf. experiment 1
- task as in experiment 1

Results

Experiment 1

Er wollte jemanden pflegen, aber sie verstehen nicht, *wen* / **wer*.
He wanted someone to.take.care.of but they understand not *whom* / **who*.
ACC

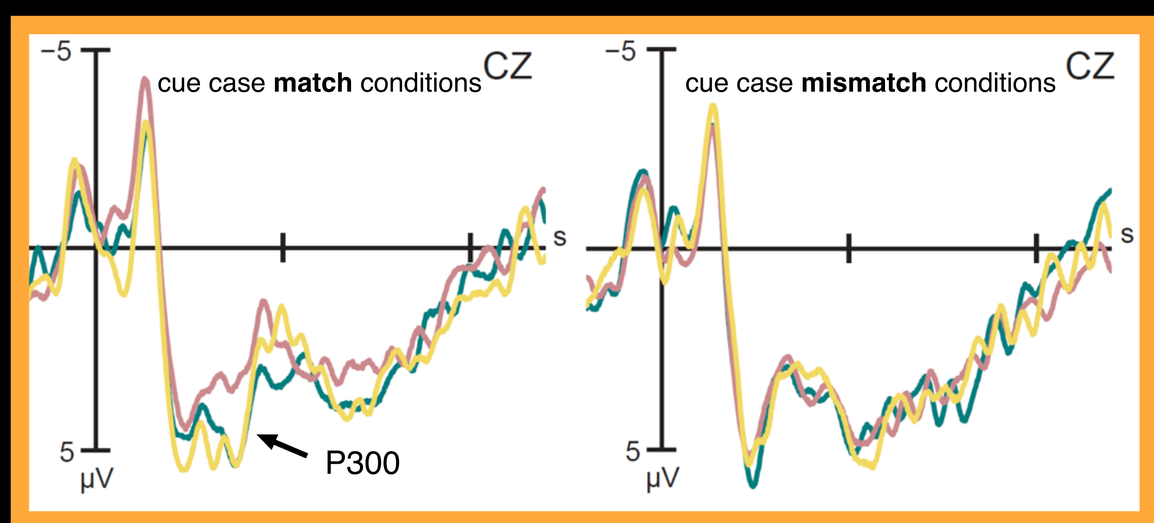
Er wollte jemandem schmeicheln, aber sie verstehen nicht, *wem* / **wer*.
He wanted someone to.flatter but they understand not *whom* / **who*.
DAT



Results of Factorial ANOVA
- 300 – 500 ms: • Main effect of verb type (red: ACC, blue: DAT) (midline: F (1, 23) = 8.06, p = 0.009)
  • cue case × ROI (lateral: F (4,92) = 5.26, p = 0.01)
- 500 – 700 ms: Main effect of cue case (solid line: match, dotted line: mismatch) (midline: F (1, 23) = 13.38, p = 0.001, lateral: F (1, 23) = 6.98, p = 0.01)

Experiment 2

Er wollte jemanden pflegen, aber sie / die Senioren / die Verbrecher verstehen nicht, *wen* /**wem*.
He wanted someone to.take.care.of but they / the elderly / the criminals understand not *whom*/**whom*.
ACC / *DAT



Results of Factorial ANOVA
- 200 – 400 ms: NP type × cue case (F (2, 42) = 3.26, p = 0.048)
- 450 – 650 ms: Main effect of cue case (F (1,21) = 11.33, p = 0.0029)

Summary

✳ The easier the retrieval — i.e. the more distinctive the target — the greater the P300 amplitude.

✳ P300 amplitude for grammatical conditions is reduced for high interference conditions.

✳ These results suggest that domain-general retrieval mechanisms are indexed by the P300. This opens up the possibility of linking retrieval mechanisms to current, neurobiologically grounded theories on the P300 in language processing [5].

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