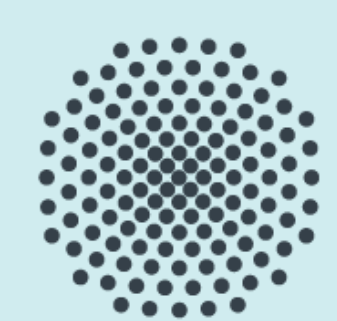
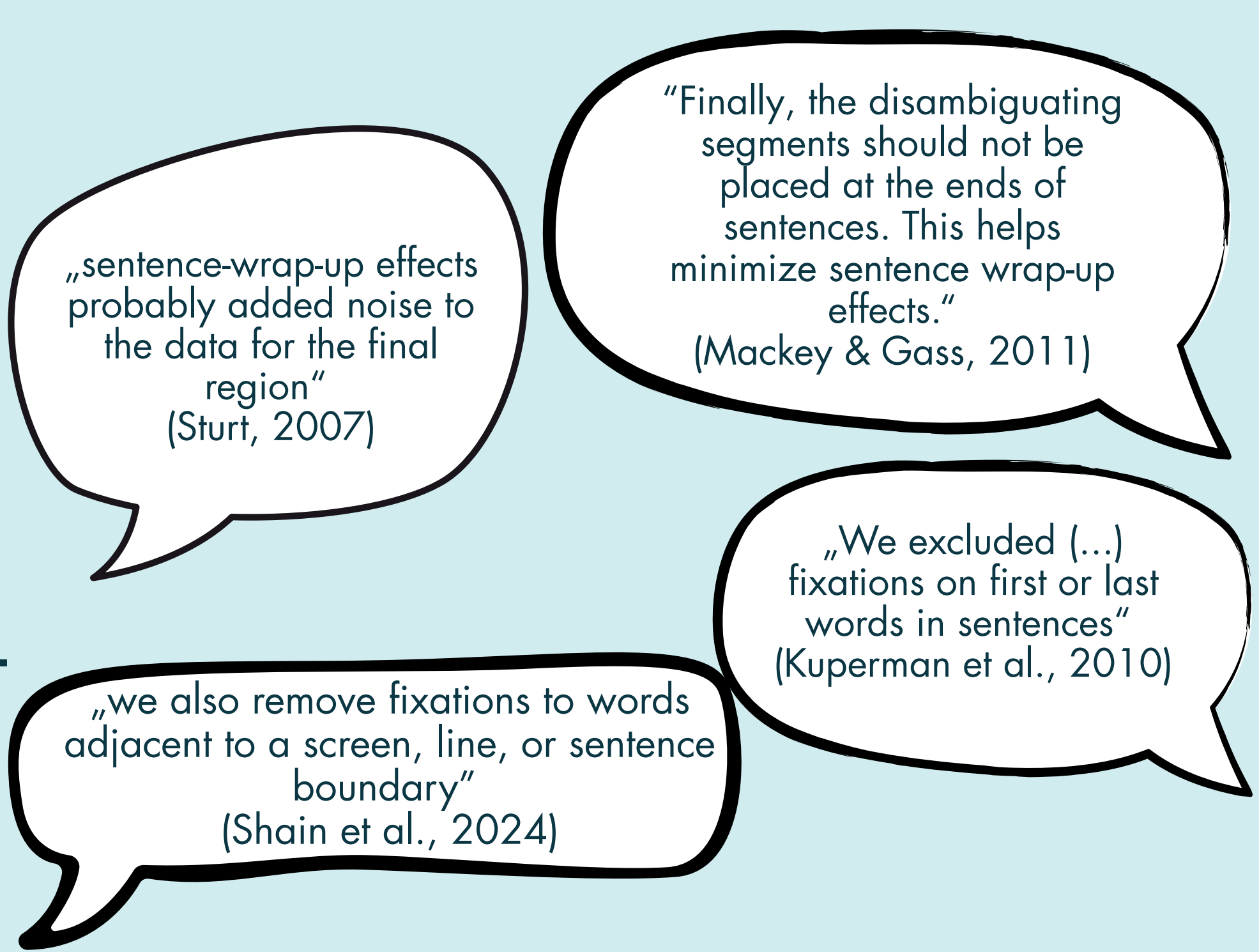




CLAUSE BOUNDARY EFFECTS IN CONNECTED TEXT: READERS SLOW DOWN AT BEGINNINGS AND ENDS OF SYNTACTIC CLAUSES

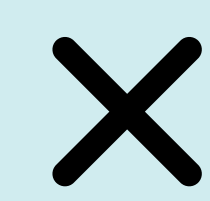
ONDŘEJ DROBIL, TITUS VON DER MALSBURG

Institute of Linguistics, University of Stuttgart

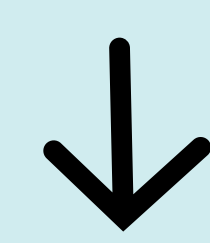


1.INTRODUCTION

Wrap-up effect (Just & Carpenter, 1980):
prolonged reading times at the end of clauses or sentences



If language processing is incremental (Levy, 2008)...



Is there something left to be wrapped up?

2.RESEARCH QUESTIONS

A: Does sentence and clause wrap-up effect exist in reading unambiguous texts in German?

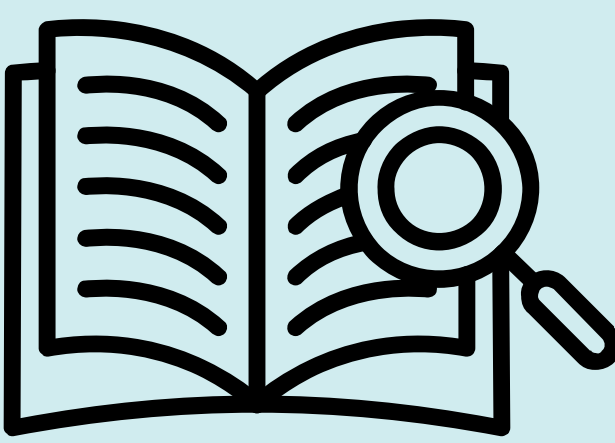
B: Are there corresponding effects at the beginnings of clauses or sentences?

C: What is the magnitude of these effects compared to other RTs predictors (word surprisal, length or frequency)?

D: How does wrap-up relate to incremental (surprisal-based) theories of human sentence processing?

3.EYE-TRACKING CORPUS DATA

- PoTeC Corpus (Jakobi et al., 2025):
- 12 German texts (6 physics + 6 biology)
 - 75 participants (students of physics or biology)
 - 1895 words:
 - ~ 158 words per text
 - ~ 8.4 sentences in a text



“Um DNA-Fragmente sichtbar zu machen, behandelt man das Gel mit einer wässrigen Lösung von *Ethidiumbromid*.”

4.MIXED-EFFECTS REGRESSION

Dependent variables:

- gaze duration and go-past time on ALL individual words

Fixed effects:

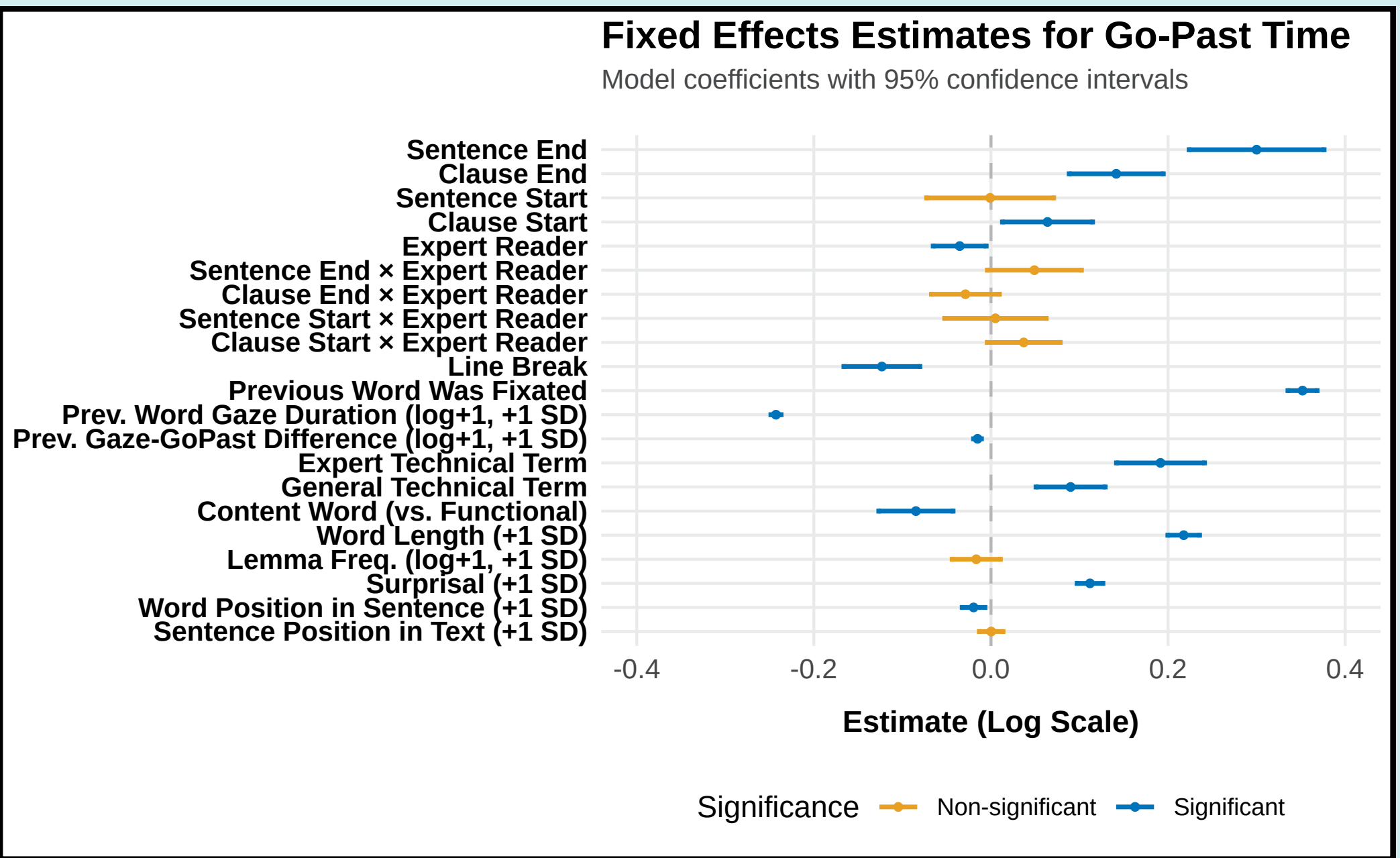
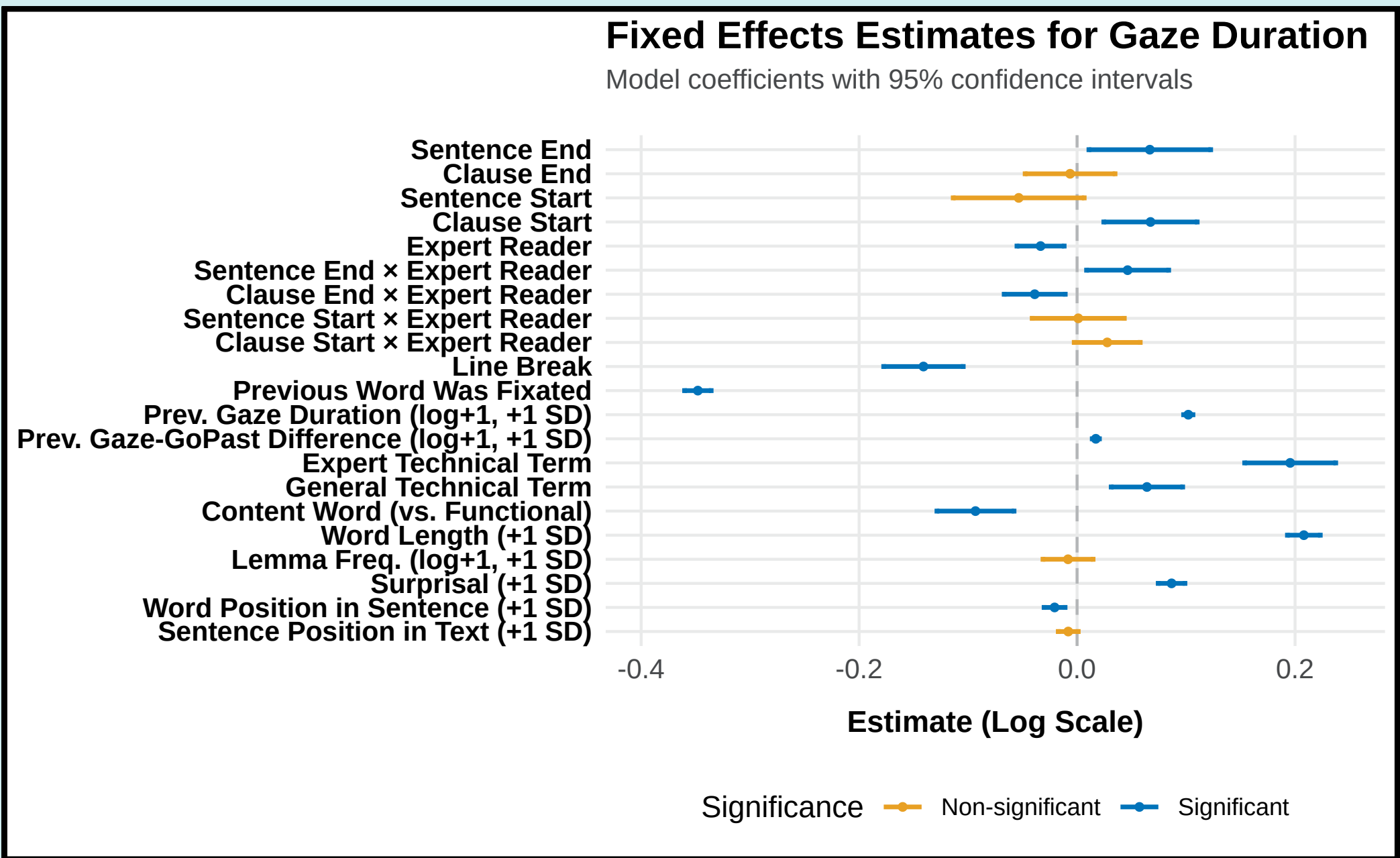
- **sentence end**, **clause end**, **sentence start**, **clause start**

Covariates:

- level of expertise + word-level (e.g., GerPT-2 surprisal) + sentence-level (e.g., word index) + text level (e.g., line breaks) + spillover effects

Random effects:

- subject: intercept + slopes for fixed effects
- word, clause, sentence, text: intercept



5.FINDINGS

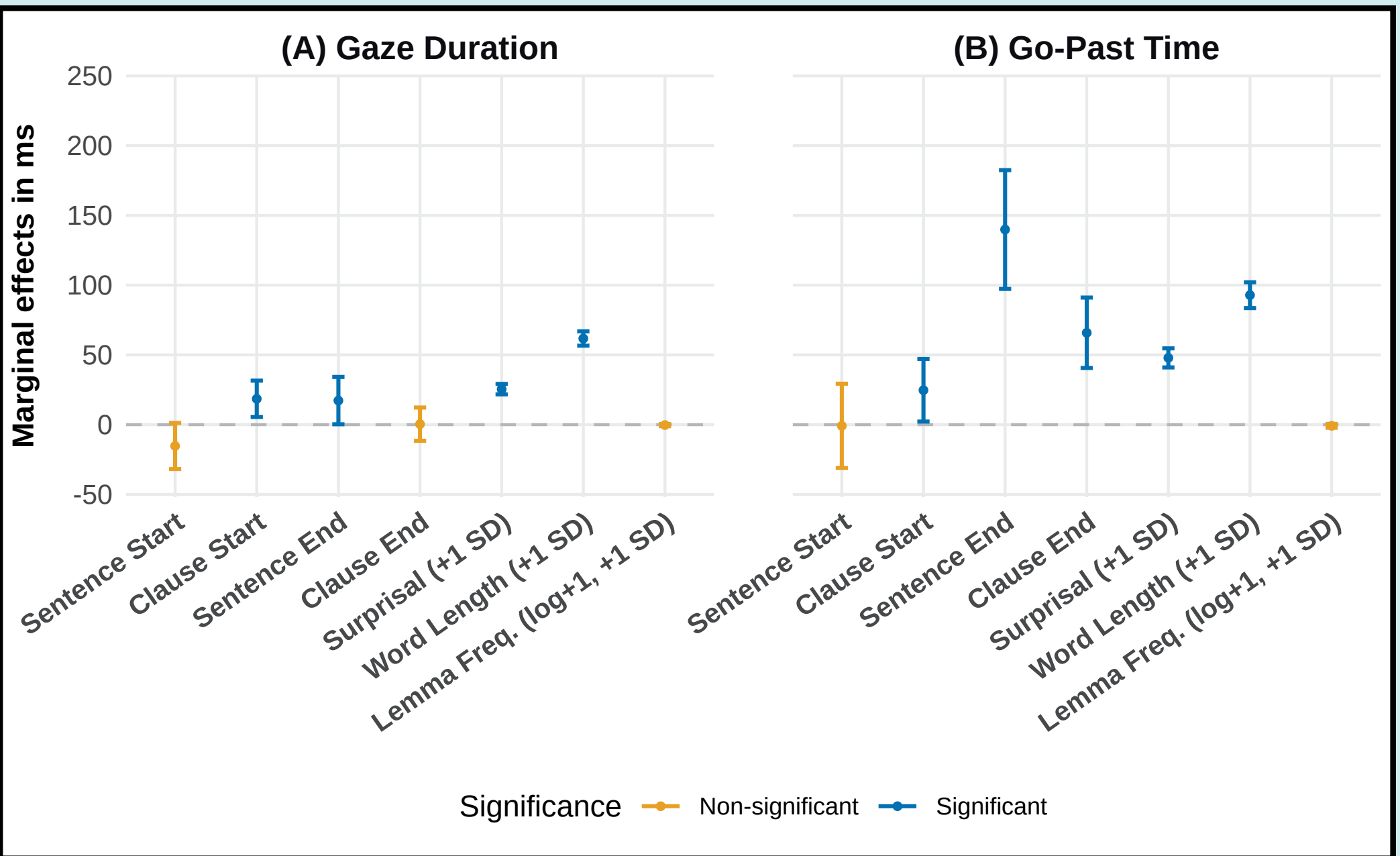
A: Wrap-up was observed in BOTH early and late measures:

- increased gaze durations on sentence-final words
- increased go-past times on clause- and sentence-final words

B: Clause-initial words were also associated with increased gaze durations and go-past times.

C: Boundaries effects go beyond and above previously attested predictors of RTs and are of a comparable size.

D: GPT-2 surprisal cannot account for wrap-up effect.



6.CONCLUSIONS

- Syntactic boundary effects occur both at the beginnings and ends of syntactic units and even when controlling for word-, sentence- and text-level properties.
- Such effects posit a challenge for “strictly” incremental models of sentence processing.
- A general model of language processing should account for syntactic boundaries, i.e. the dark matter of sentence processing.