Changing the Narrative: ERP markers of updating situation models during deep comprehension

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Introduction

What we know:

The **N400** (300–500 ms) reflects the relative ease of accessing a word's **lexico-semantic features**

Supportive contexts facilitate lexico-semantic access, leading to reduced N400 amplitudes in:

- *Prime-target pairs* (e.g., salt-PEPPER)
- *Sentences* and *broader discourses*

Comprehension involves more than lexico-semantic access—it also requires the building and updating of a **"situation model"**

- **Situation models:** a higher-level representation that connects linguistic events with retrieved information from broader world knowledge [1]

Some argue **late frontal positivities** (**LFPs**; 500–1000 ms) are linked to **successful situation model updating** [2,3]

Others argue **LFPs** only occur when unexpected (but plausible) words **violate strong expectations** [4]

What remains unclear:

Prior work on LFPs have used controlled experiments, matching expected & unexpected critical words

No one has asked if LFPs (like N400s) **are evoked by *all* content words during naturalistic reading**

Predictions:

- ***Violation LFP account*** predicts LFPs are *only* evoked by plausible, unexpected words in high-constraint contexts
- ***Updating LFP account*** predicts LFPs to be routinely evoked by all words—with LFP amplitude being associated with the *degree* of the update

Method

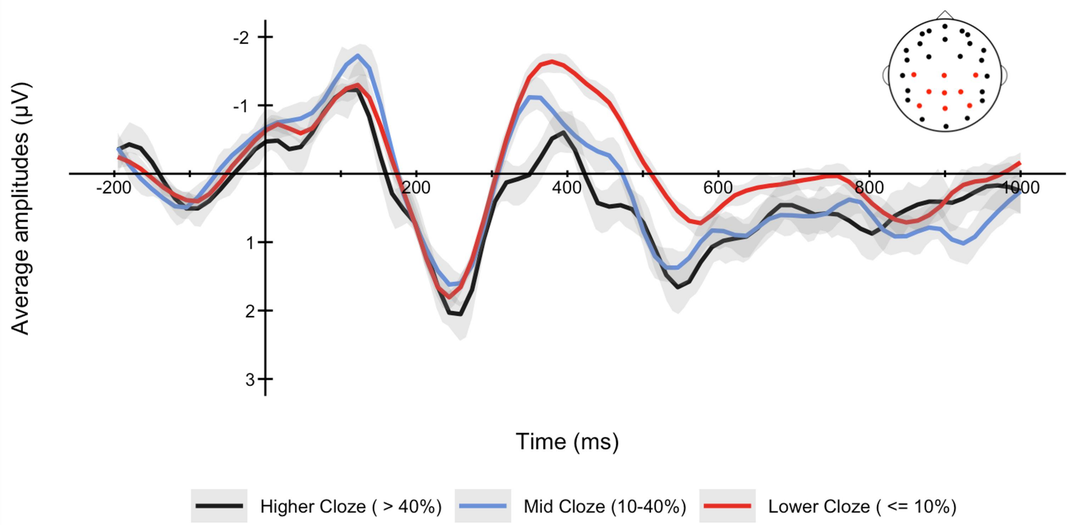
Participants: English-speaking adults (N = 22)

Design:

- Read short, engaging vignettes (3–5 sentences)
- Word-by-word, self-paced reading
- Deep comprehension questions after each passage

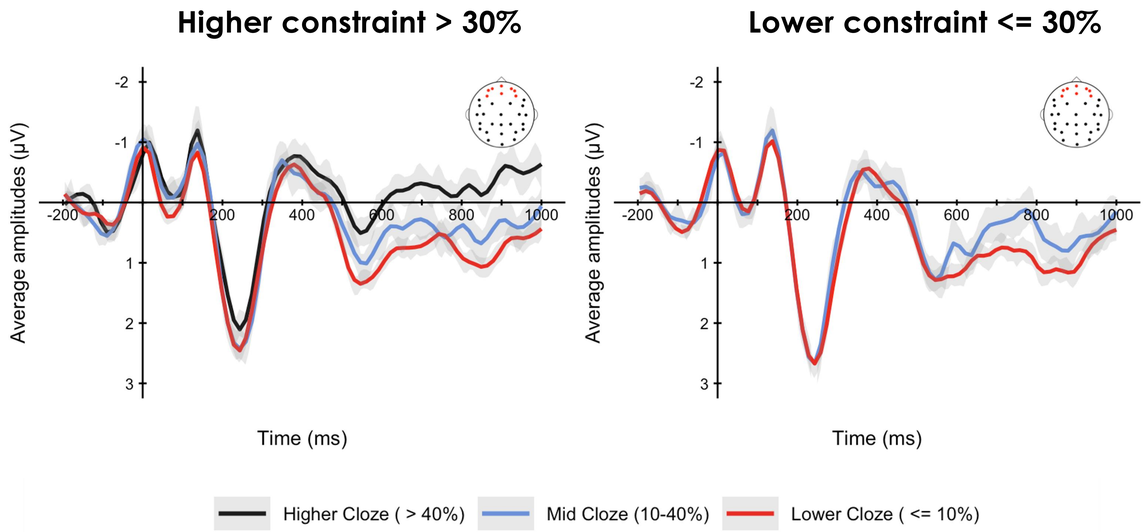
Analysis:
LMERs regressing **N400s** (*centroparietal*) or **LFPs** (*frontal*) onto *Lexical Predictability* (cloze), *Contextual Constraint (modal cloze),* and lexical controls (ONsize, frequency, and concreteness)

N400s for all content words



N400 Results: Reduced N400s to more predictable words (b = 0.48, t = 5.85, p < .001)

LFPs for all content words



LFP Results:

- LFPs evoked by all content words
- Increased LFPs to less predictable words (b = – 0.3, t = – 4.31, p < .001)
- No effect of contextual constraint

Results & Discussion

N400 Findings:

Replicated **graded sensitivity to cloze** in naturalistic comprehension

LFP Findings:

LFPs evoked by all content words, even in lower-constraint contexts

- *Not exclusive to unexpected (but plausible) words in high-constraint contexts* [5-7]
- Evidence for a continuous, graded effect that occurs routinely during natural reading
- **LFPs were graded by cloze** (and not constraint)

Open Questions:

Why are LFPs sensitive to cloze and not constraint?

- Cloze could be a proxy for *how much new information* was retrieved during update
- **To test this:** must develop *new metrics* for how much information a single word contributes to a comprehenders' higher-level understanding

Does task design influence the LFP?

- Discourse-based designs encourage deep comprehension → necessary for situation models
- Building a situation model in other tasks could be more difficult…unless the sentence is sufficiently constraining!

Take aways:

Comprehension involves **lexico-semantic access** AND the **maintaining/updating** of a higher-level interpretation of the communicative message

- Occurs through *mutual constraint satisfaction* [8]
- Arguably indexed by N400 and LFP responses
- Consistent with hierarchical generative frameworks like predictive coding [9]

Acknowledgements

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