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Introduction

Can top-down predictions override bottom-up lexico-semantic access during comprehension?

To assess this, psycholinguists have long used homographs: (e.g., *bank-finance* vs. *bank-river*)

Effects of different sentence constraints:

- Weak constraining contexts: both meanings are accessed¹
- Contexts that strongly constrain for the dominant meaning: only the dominant meaning is accessed¹
- Contexts that constrain for the subordinate meaning²⁻⁴:
 - Some studies show that only the subordinate meaning is accessed
 - Others show that both meanings are accessed

Our theory:

- Conflicting results in subordinate-constraining contexts can be resolved by assuming that lexico-semantic access is not a single, static stage of processing

Present Study:

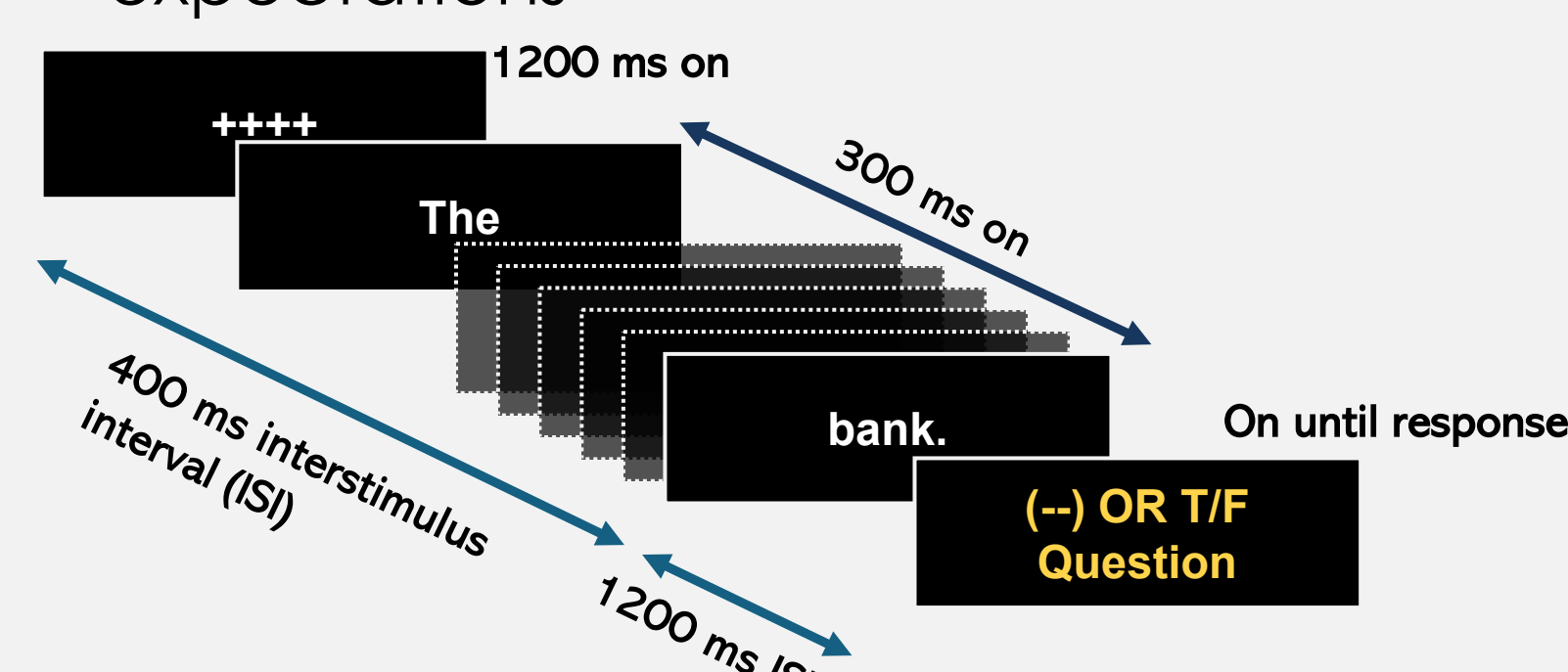
- The **N400** (300-500ms):
 - Ease of lexico-semantic access⁵
- The **late frontal positivity** (LFP; 600-1000ms):
 - Violation of strong lexico-semantic predictions⁶
 - The top-down selection of unexpected (but plausible) words⁷

Methods & Design

Participants: English-speaking adults (N = 33)

Design:

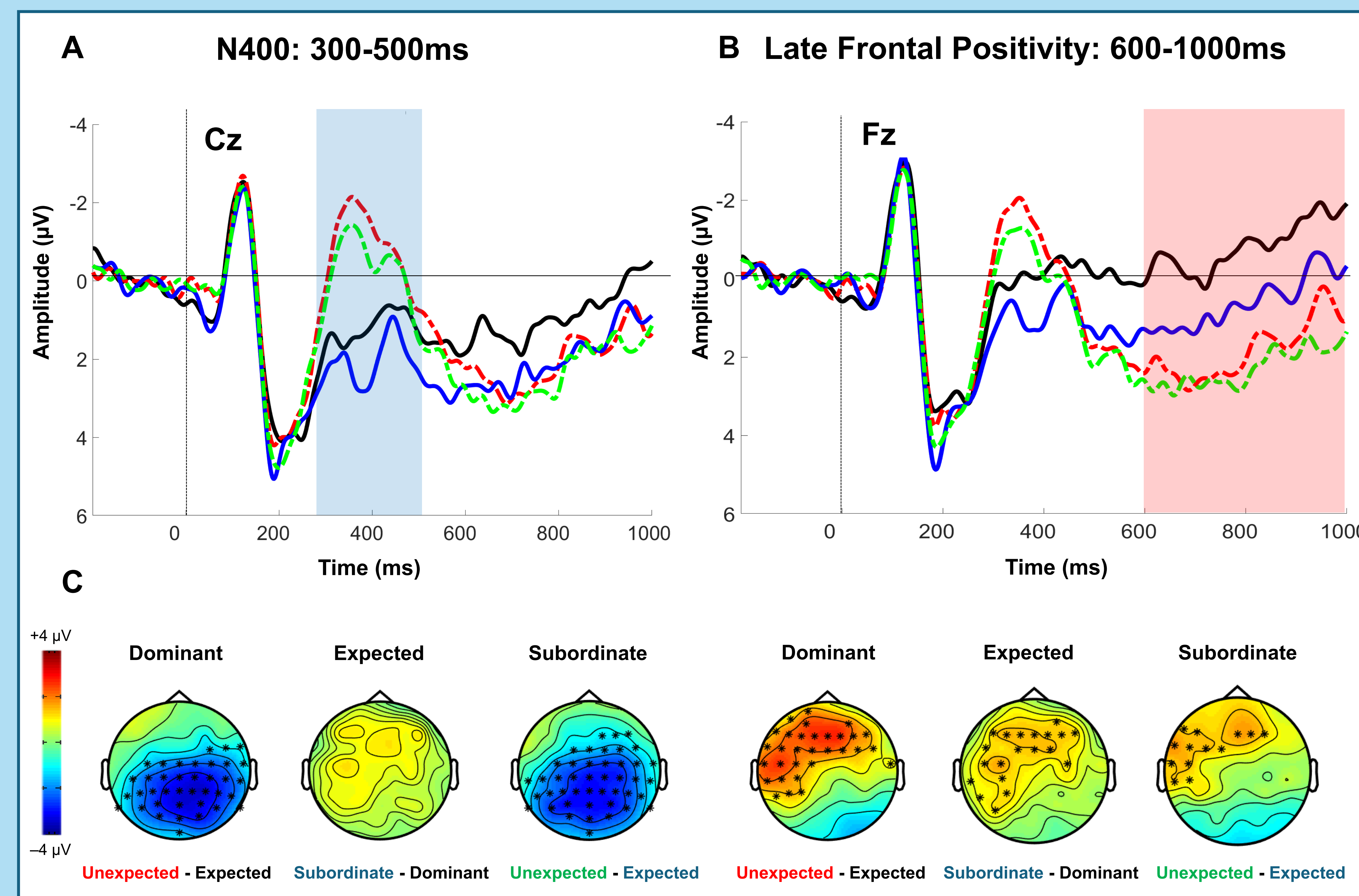
- Sentences that constrained either for a homograph's dominant or subordinate meaning (*Mean Constraint: 88%*)
- Words that violated or confirmed expectations



Pairwise comparisons using a cluster-based permutation test: mean amplitudes (μV) in the N400 and LFP time windows

Question: Which meaning of a homograph is accessed when a sentence context strongly predicts its *subordinate* meaning?

Constraint	Stimuli
Dominant	1a) I went to deposit the check at the bank . (Expected, Dominant)
	1b) I went to deposit the check at the ATM . (Unexpected, Dominant)
Subordinate	2a) The muddy sides of the river are called the river bank . (Expected, Subordinate)
	2b) The muddy sides of the river are called the river slope . (Unexpected, Subordinate)



Pairwise Comparisons (Cluster-mass Permutations Tests)

	N400	LFP
<u>Expected, Dominant</u> (1a) vs. <u>Unexpected, Dominant</u> (1b)	$p = 0.002^{**}$	$p = 0.002^{**}$
<u>Expected, Subordinate</u> (2a) vs. <u>Expected, Dominant</u> (1a)	$p = 0.102$	$p = 0.012^*$
<u>Expected, Subordinate</u> (2a) vs. <u>Unexpected, Subordinate</u> (2b)	$p = 0.002^{**}$	$p = 0.014^*$

Results & Discussion

N400 Results

- Unexpected > Expected

LFP Results

- Unexpected > Expected
- Homographs in subordinate constraining > homographs in dominant constraining

Discussion:

- We interpret these findings within a predictive, generative framework of language comprehension⁸
- Continuous interactions between feedback and feedforward processes
- Meaning selection through constraint satisfaction⁹ across the language hierarchy
- In subordinate-constraining contexts, top-down constraints pre-activate the homograph's subordinate meaning
- This facilitates initial access to its lexico-semantic features (a reduced N400)
- However, top-down prediction cannot overcome the strong bottom-up constraints
- I.e., the dominant meaning of the homograph
- During bottom-up processing, the dominant meaning also becomes activated, despite its contextual irrelevance
- In the presence of inconsistent top-down and bottom-up information, later top-down processes are engaged (the LFP) to:
 - "clean-up" irrelevant lexico-semantic information
 - "sharpen" activity over the appropriate lexico-semantic representation

Acknowledgements

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References: [1] Simpson (1984). [2] Glucksberg, Kreuz, & Rho (1986). [3] Van Petten & Kutas (1987). [4] Duffy, Morris, & Rayner (1988). [5] Kutas & Federmeier (2011). [6] Kuperberg, Brothers, & Wlotko (2020). [7] Federmeier, Wlotko, De Ochoa-Dewald, & Kutas (2007). [8] Kuperberg & Jaeger (2016). [9] Lee & Mumford (2003).