

# CONTRASTING LEXICAL PRE-ACTIVATION, PREDICTION-BASED AND POST-LEXICAL INTEGRATION ACCOUNTS OF THE N400 ERP EFFECT IN PRIMING STUDIES

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## INTRODUCTION

The N400 ERP component has been associated with the cost of lexical-semantic processing. Its amplitude is reduced for primed targets. However, there are still controversies surrounding the mechanisms eliciting this effect.

### SEMANTIC PRIMING MECHANISMS

- ▶ **Automatic Spreading of Activation (ASA)**  
Mandatory co-activation of associated nodes in semantic networks in LTM (long-term memory) during word retrieval.
- ▶ **Expectancy or Prediction**  
More controlled; in LTM and working memory (WM)
- ▶ **Post-lexical semantic integration (PLI)**  
Primarily in WM; subject to strategy and context effects

### PREDICTION, PLI AND LIST EFFECTS

- ▶ **Lau et al (2013)** reports N250 and N400 priming effects for lists with a high Relatedness Proportion (RP, 50% of related pairs) relative to lower levels of RP (10%). **They are thought to reflect predictions.**
- ▶ **McKoon & Ratcliff's (1995)** behavioural study showed that **priming effects disappear** when a word pair of one semantic relationship (e.g., part-whole: *finger-hand*) is moved into a list of word pairs that belong to another type of relationship (e.g., antonyms: *fast-slow*). They concluded that **priming cannot rely exclusively on hard-wired connections in LTM**. Findings are problematic for priming accounts focusing on ASA and semantic networks in LTM.

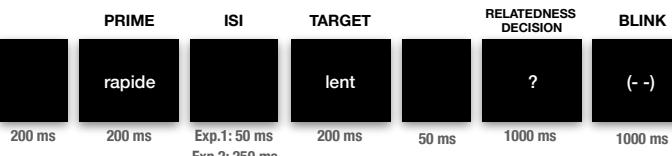
## RESEARCH QUESTIONS

- ▶ **Exp.1:** Does the N400 reflect only ASA and Prediction mechanisms, or does it reflect PLI mechanisms as well?
- ▶ **Exp.2:** Does a longer SOA reduce the latency of the late N400 consistency effect (found in Exp. 1), as predicted by the expectancy-based mechanism (e.g., Lau et al., 2013)?

| MECHANISM                       | PREDICTED EFFECT OF CONSISTENCY                      |
|---------------------------------|--|
| <b>Prediction</b>               | Reduced negativity before 300 ms (N250 + early N400) |
| <b>Post-lexical integration</b> | Reduced negativity after 400 ms (late N400)          |

## METHODOLOGY

### PROCEDURE



### Stimulus Onset Asynchrony (SOA): Exp. 1: 250 ms | Exp. 2: 450 ms

The EEG of right-handed native French speakers (18 in Exp.1, 20 in Exp.2) was recorded while participants read, and subsequently judged the relatedness of prime-target pairs (324 in Exp.1, 720 in Exp.2), distributed in different blocks (4 in Exp.1, 9 in Exp. 2).

### EXPERIMENTAL LISTS

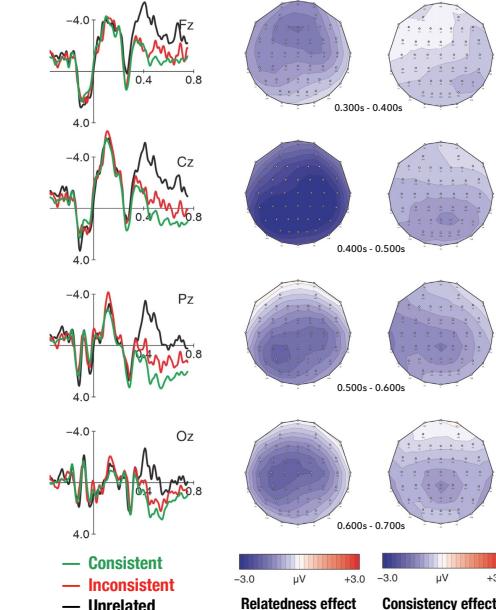
| TYPE OF PAIRS IN EACH BLOCK      | 80% CONSISTENT             | 10% INCONSISTENT            | 10% UNRELATED                      |
|----------------------------------|----------------------------|-----------------------------|------------------------------------|
| Example for an 'antonyms' block: | rapide-lent<br>'fast-slow' | doigt-main<br>'finger-hand' | docteur-rideau<br>'doctor-curtain' |

Same words were used to create all 3 conditions (across subjects). Presentation order was pseudo-randomized and counterbalanced across experimental lists.

| EXPERIMENT 1 | SYNTACTIC CATEGORY         | SEMANTIC RELATIONSHIP          | EXAMPLES                                     |
|--------------|----------------------------|--------------------------------|--|
|              | Adjectives, Verbs or Nouns | ANTONYMS                       | riche-pauvre<br>'rich-poor'                  |
| EXPERIMENT 2 | Adjectives, Verbs or Nouns | SYNONYMS                       | minitieux-méticuleux<br>'careful-meticulous' |
|              | Nouns                      | METONYMS (Part-Whole)          | doigt-main<br>'finger-hand'                  |
|              | Nouns                      | HYPERONYMS (Member-Category)   | guêpe-insecte<br>'wasp-insect'               |
|              | Adjectives                 | ANTONYMS                       | riche-pauvre<br>'rich-poor'                  |
|              |                            | SYNONYMS                       | minitieux-méticuleux<br>'careful-meticulous' |
|              |                            | SUPERLATIVE-REGULAR            | magnifique-beau<br>'magnificent-beautiful'   |
|              | Nouns                      | ANTONYMS                       | origine-destination<br>'origin-destination'  |
|              |                            | HYPERONYMS                     | guêpe-insecte<br>'wasp-insect'               |
|              |                            | METONYMS                       | doigt-main<br>'finger-hand'                  |
|              | Verbs                      | ANTONYMS                       | infirmer-réfuter<br>'deny-refute'            |
|              |                            | SYNONYMS                       | accepter-refuser<br>'accept-refuse'          |
|              |                            | TROPONYMS (specific - generic) | déguster-manger<br>'savor-eat'               |

## RESULTS

### EXPERIMENT 1



#### Relatedness effect (UNR - INC)

Starts at 300 ms until 700 ms

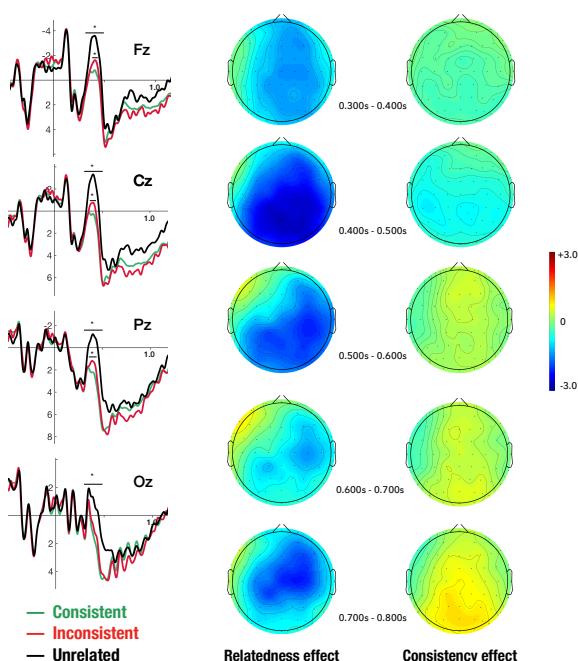
#### Consistency effect (INC - CONS)

Reaches significance only after 400 ms

#### No N250 modulation

250 ms SOA might be too short for predictions

### EXPERIMENT 2



#### Relatedness effect (UNR - INC)

Observed as soon as 320 ms until 580 ms

#### Consistency effect (INC - CONS)

Starts just before 400 ms, until 450 ms

#### No N250 modulation

In Inconsistent condition as compared to Consistent

## CONCLUSION

N400 attenuation for semantically related prime-target pairs is significantly stronger when most other word pairs in the list have the same type of semantic relationship and the same word category. This **consistency effect appears no later than 400 ms** after target word onset and modulates the N400 within its classic time window (300–500 ms). This effect is best explained by **context-driven post-lexical integration mechanisms**.

Even with a longer SOA of 450 ms, we did not find any effect in the N250 or in the early N400 time windows that could reflect prediction of target words' formal features.

▶ **ASA-driven priming/word retrieval: 300–500 ms.**

▶ **Post-lexical integration: starts around 400 ms.**

