



# The Influence of Discourse Focus on Anaphor Resolution: A Simultaneous Self-Paced Reading and ERP Investigation

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## Introduction

The ability to link multiple references to the same character or object – i.e., resolve anaphors – is essential for successful discourse comprehension. The ease of resolving an anaphor is contingent upon two factors: 1) lexico-semantic influences such as lexical repetition effects and 2) discourse influences such as focus of attention (i.e., to whom or what the reader/listener is attending).

Past studies have provided evidence for the contributions of these two factors.

- Greater feature overlap is preferred when an antecedent is not in discourse focus [3]. Thus, under these circumstances, a repeated noun-phrase (NP) anaphor is appropriate.
- When an antecedent is in discourse focus, a less lexically-specified anaphor (e.g., a pronoun) is preferred; using a repeated NP anaphor results in an increased processing cost, termed the repeated name penalty.
- With ERPs, the repeated name penalty has been replicated [5], with a larger amplitude N400 evoked to repeated NP anaphors referring to in-focus antecedents compared to non-focused antecedents. This larger amplitude N400 reflects the increased difficulty semantically integrating repeated NP anaphors when their antecedents are in focus.

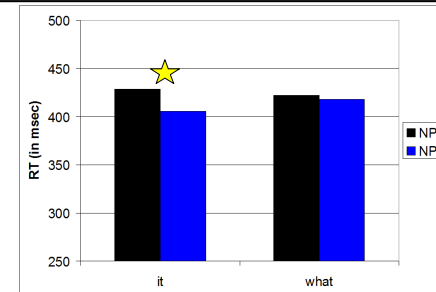
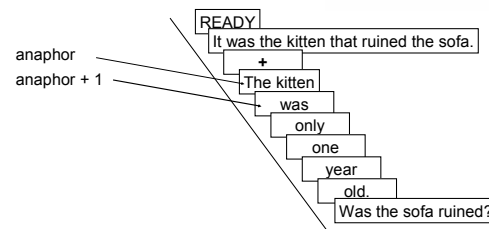
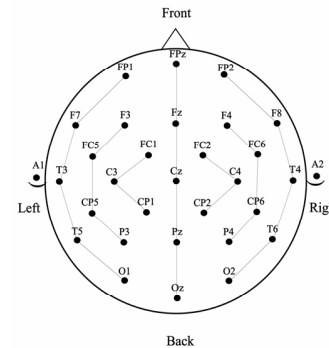
Recent studies have demonstrated that this finding is contingent on word presentation rate.

- Repeated name penalty observed with slower presentation rates [4;5]
- Lexico-effects observed (i.e., repetition priming) with faster presentation rates [2] and eye-tracking methodologies [4].

The present study examined the neural indices of anaphor resolution while participants read at a comfortable pace by using concurrent self-paced reading and ERP methodologies.

## Methods

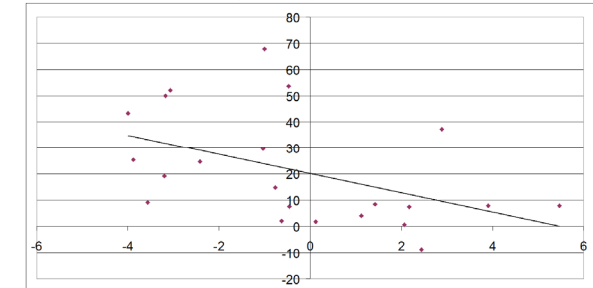
- 24 participants, native English speakers, right-handed
- 160 experimental stimuli, 160 fillers
- Self-paced, 10 msec ISI
- ERPs were collected from 29 electrodes across the scalp
- Left mastoid reference



Following wh-clefts, a repeated NP anaphor that referred to an NP2 antecedent evoked a larger LAN.

Readers were significantly slower at reading anaphors referring to NP1 relative to NP2 antecedents following it-clefts.

## Correlation between reading times (y) and ERPs (x) to it-clefts (NP1-NP2)



A negative correlation ( $r = -.47, p < .05$ ) demonstrated that longer reading times to anaphors referring NP1 relative to NP2 antecedents corresponded to increased negativity to NP1 relative to NP2 antecedents at CP5 (left centroparietal site).

### Present Experiment

The present study examined the neural indices of anaphor resolution using a paradigm similar to one developed by Almor [1]. It- and wh-clefted sentence constructions were employed to manipulate focus of attention. It-clefts focus attention on the first NP in the sentence whereas wh-clefts focus attention on the second NP.

It was the kitten that ruined the sofa. <u>The kitten</u> was only one year old. <b>Not Preferred</b>	It was the kitten that ruined the sofa. <u>The sofa</u> was only one year old.
What the kitten ruined was the sofa. <u>The kitten</u> was only one year old.	What the kitten ruined was the sofa. <u>The sofa</u> was only one year old. <b>Not Preferred</b>

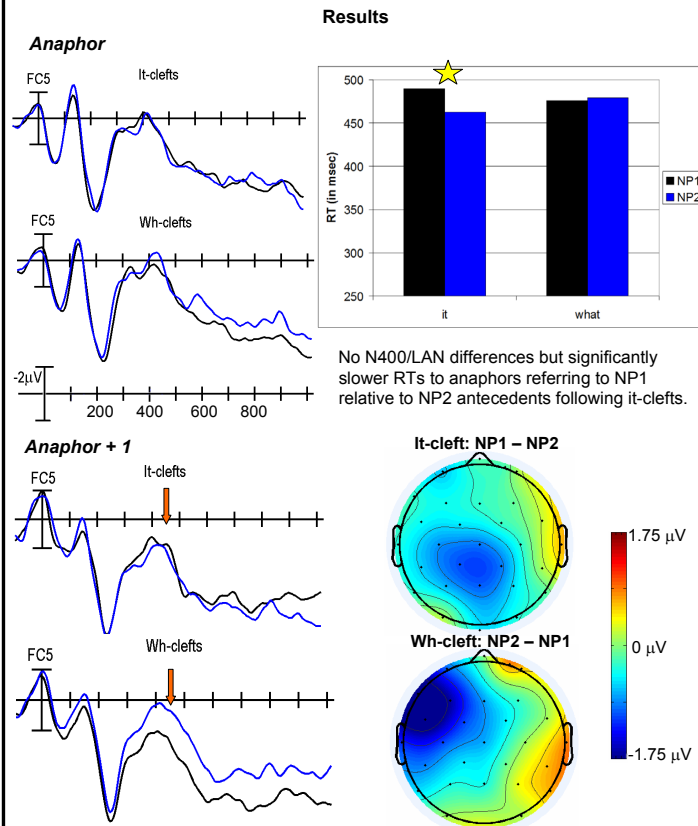
### Predictions

Following an it-cleft, an anaphor referring to the second NP in the first sentence (NP2: sofa) should be preferred relative an anaphor referring to the first NP (NP1: kitten)

- Increased reading times to anaphors referring to NP1 relative to NP2 antecedents
- Larger N400 or left anterior negativity (LAN) to anaphors referring to NP1 relative to NP2 antecedents, reflecting difficulty semantically integrating these anaphors or increased working memory load associated with processing these anaphors respectively

Following a wh-cleft, it should be easier to resolve repeated NP anaphors that refer to NP1 relative to NP2

- Increased RTs to anaphors referring to NP2 relative to NP1 antecedents
- Larger N400/LAN to anaphors referring to NP2 relative to NP1 antecedents



### Summary and Discussion

- Reading time differences replicated previous findings of longer reading times when anaphors referred to in-focus relative to non-focused antecedents following it-clefts (Almor, 1999).
- ERP results demonstrated that a larger left anterior negativity for repeated NP anaphors that referred to antecedents that were in focus of attention. This left anterior negativity provides some evidence that linking an anaphor with an in-focus antecedent involves an increased working memory load.
- Increased reading time sensitivity to the repeated name penalty following it-clefts was correlated with an increased neural sensitivity to this repeated name penalty.

### Validating Simultaneous Self-Paced Reading/ERP Methodology

Sentence Type	Explanation	Example	ERP
Non-violated (60)	Syntactically and semantically sound	At breakfast the boys would eat toast and jam.	Fz, Cz, Pz
Morphosyntactic Violation (60)	Verb changed to violate subject-verb agreement or by using finite in place of infinitival verb	At breakfast the boys would eats toast and jam.	
Pragmatic Violation (60)	Verb replaced by another verb taken from another sentence scenario	At breakfast the boys would plant toast and jam.	

### References

- [1] Almor (1999). *Psychological Review*, 106, 748-765.
- [2] Camblin et al. (in press). *Brain Research*.
- [3] Gordon & Searce (1995). *Memory and Cognition*, 23, 313-323.
- [4] Ledoux et al. (in press). *Memory and Cognition*.
- [5] Swaab, Camblin, & Gordon (2004). *Journal of Cognitive Neuroscience*, 16, 657-671

### Acknowledgements

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