

ERP evidence of early semantic access with a randomized semantic priming paradigm

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Introduction

We have shown that when words are presented in a semantically blocked order (e.g., all animals) in a lexical decision task, lexical semantic access affects the N1 component of the ERP between 150-200 ms [1], consistent with recent ERP and eye tracking studies [2, 3]. In addition, we found that semantic blocking of stimuli affected the P1 component (at around 100 ms), suggesting an early effect of a semantic expectation strategy. Since this effect was found for both words and nonwords, we considered it orthographic rather than lexical semantic.

Our Goal and Expectations

- To investigate timing of lexical semantic access with a randomized (not blocked) design, thus removing possibility of a semantic expectation strategy.
- With no expectation strategy, no semantic priming was expected in the P1, but possible in N1 (or later).

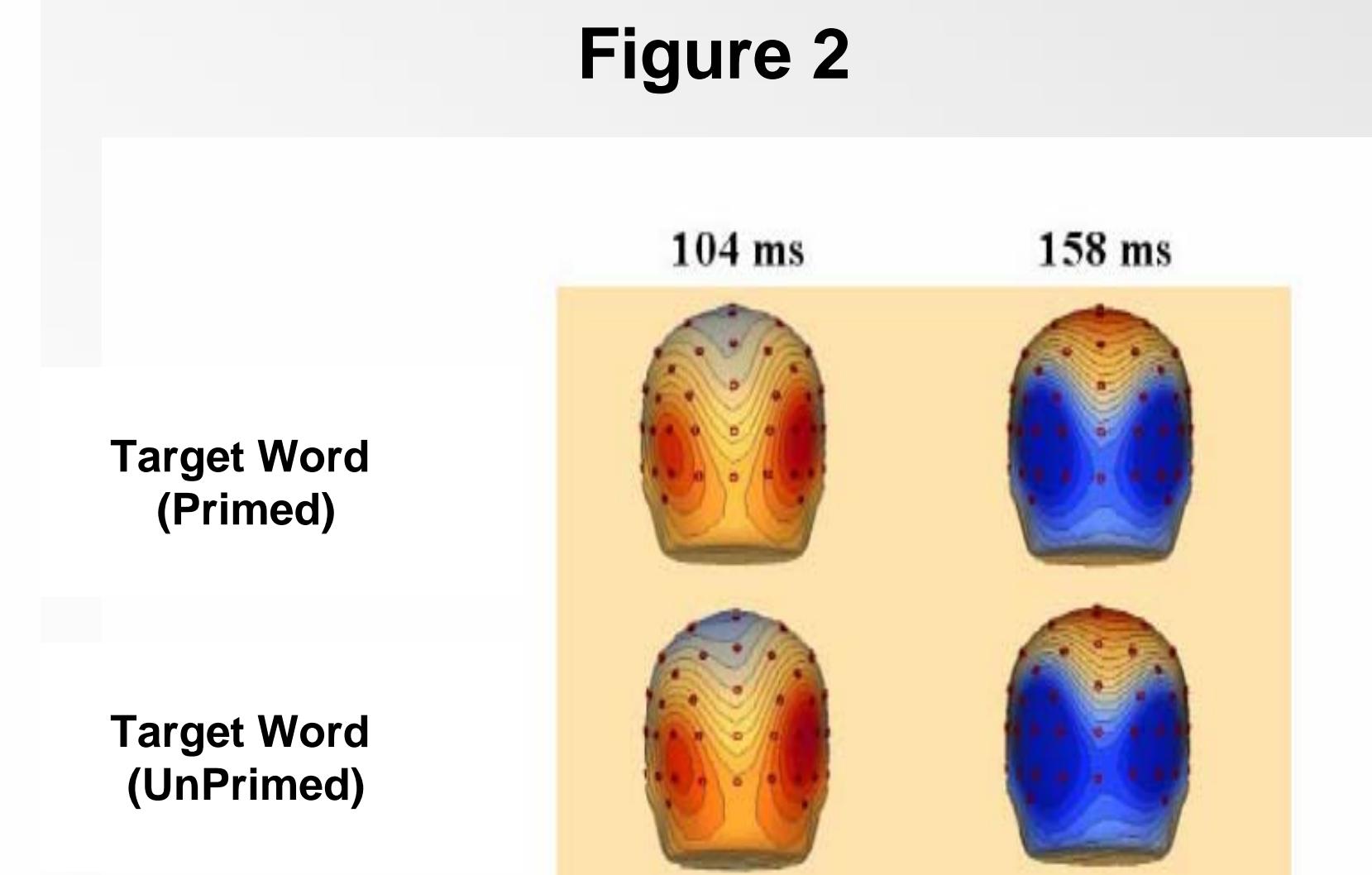
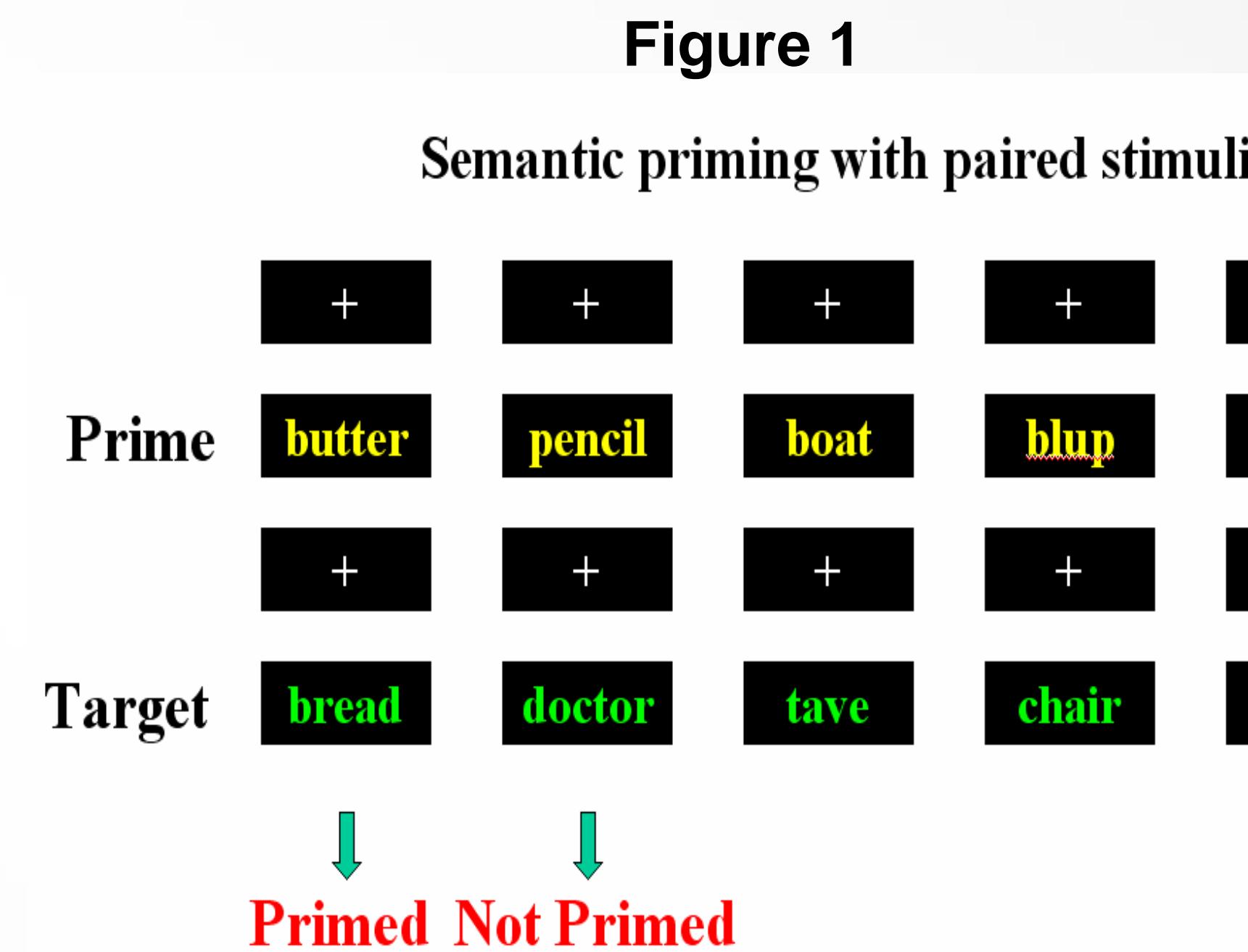
Method

Participants: 12 adults (7/5 F/M, Mean age = 19 y)

Stimuli: 400 words and 400 pseudowords (e.g. *klow*) were used in a primed/unprimed lexical decision task. The average word-length was 5.32 (3 – 11 letters). Word length and bigram frequency were matched for words and pseudowords.

Primed/UnPrimed Lexical Decision Task: For each trial, a pair of stimuli were presented in sequence. The first stimulus was the PRIME (in yellow font), and the second stimulus was the TARGET (in green font). The prime and the target could be either a word or a nonword (see Figure 1). When both were words, they could be either semantically related (primed) or unrelated (unprimed). Participants were instructed to make a lexical decision to the green target stimuli.

Stimuli and response-hand mapping were counterbalanced across participants.



Electrophysiological Recordings:

- 128-Channel EGI System, converted to 81 standard sites by spherical spline
- 500 Hz sampling rate, offline filtered 1 to 30 Hz. Impedances < 50 kΩ
- Epoch = 200 ms prestimulus, 800 poststimulus
- P1 amplitude averaged over scores from PO7, PO9, O9, O1 for the left, and PO8, PO10, O10, O2 for the right (Figure 2)
- N1 amplitude averaged over scores from P7, P9, PO7, and PO9 for the left, and P8, P10, PO8, and PO10 for the right.

Results

Behavioral data (Figure 3)

- Semantic priming effect:
- RT (primed) < RT (unprimed)
 $p = .024$.
 - No difference in Accuracy.

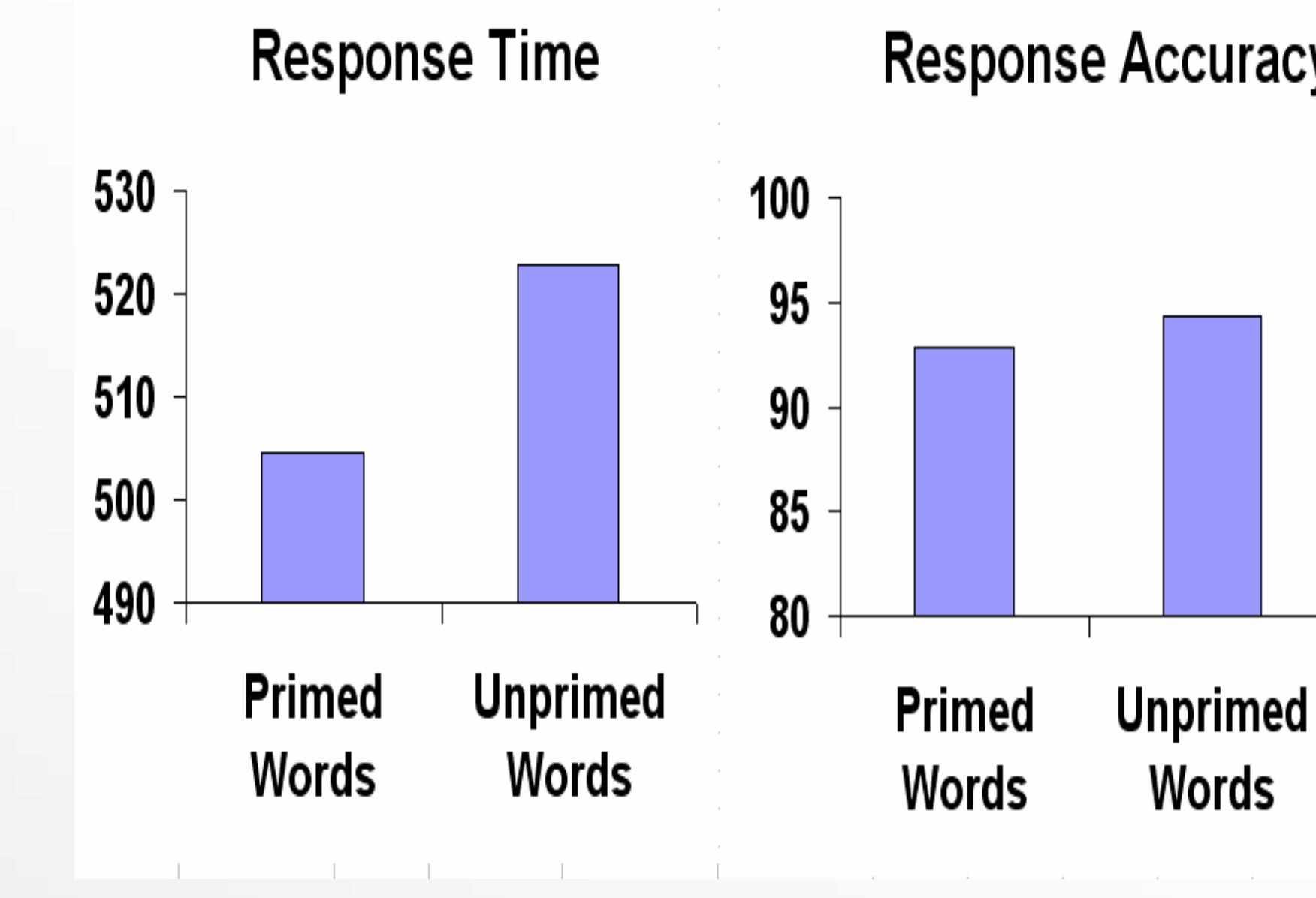


Figure 3

References

1. Segalowitz, S.J. & Zheng, X (2008). An ERP study of category priming: Evidence of early lexical semantic access. *Biological Psychology* (in press).
2. Sereno, S. C., Brewer, C. C., & O'Donnell, P. J. (2003). Context effects in word recognition: evidence for early interactive processing. *Psychol Sci*, 14(4), 328-333.
3. Sereno, S. C., Rayner, K., & Posner, M. I. (1998). Establishing a time-line of word recognition: Evidence from eye movements and event-related potentials. *NeuroReport*, 9(10), 2195-2200.

EEG data

The P1 component (94 – 114 ms) (Figure 4)

2 (Primed/Unprimed) x 2 (Left/Right) ANOVA

No semantic priming effect: Main effects: ns. Interaction: ns.

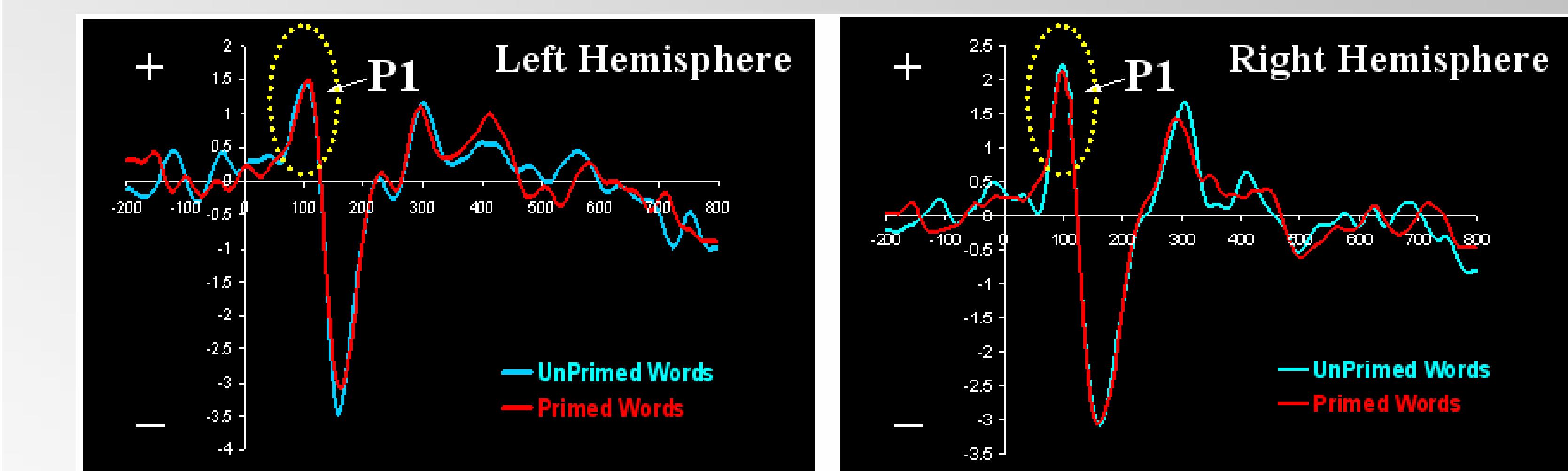


Figure 4

The N1 component (148 – 168 ms) (Figure 5)

Semantic priming effect:

- Left: Primed words < Unprimed words, $p = .036$
- Right: n.s.

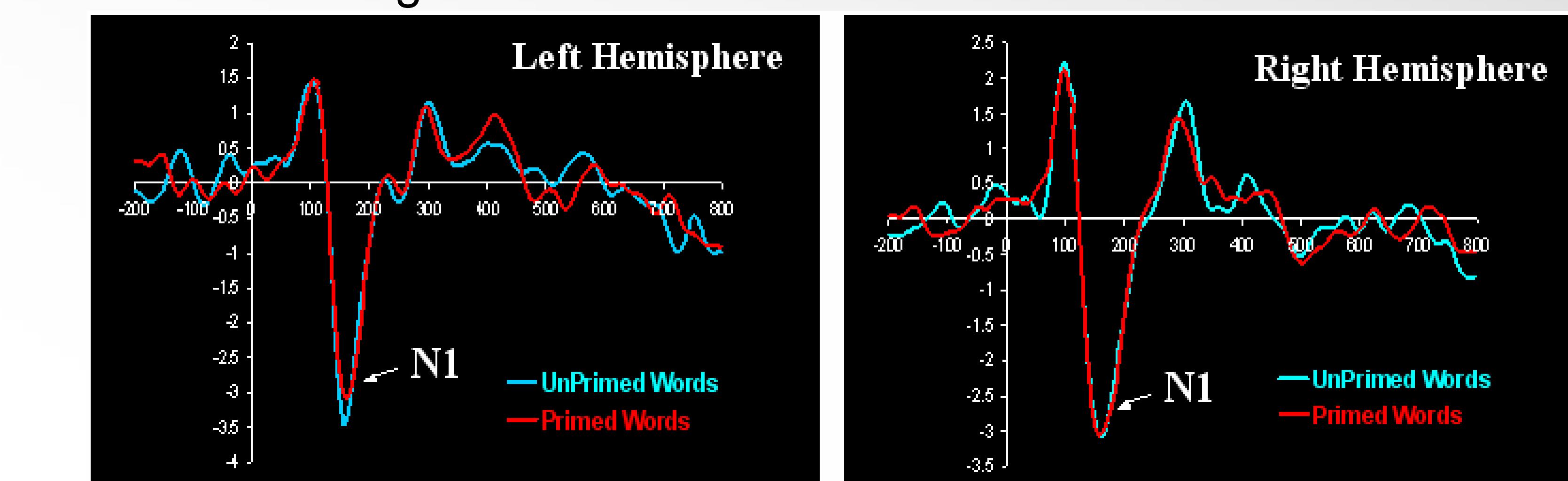


Figure 5

Conclusions

(1) N1 results confirmed (on left side) that lexical semantic access acts prior to 160 ms.

(2) Lexical semantic access does not affect the ERP in the P1 component (80 – 120 ms).

(3) P1 is likely affected by orthographic decoding factors that can be influenced by “top-down” expectation.