

SYNTAX FIRST MEANS CONTEXT COMES LATER: AN ERP STUDY OF THE TIME COURSE OF N400 EFFECTS

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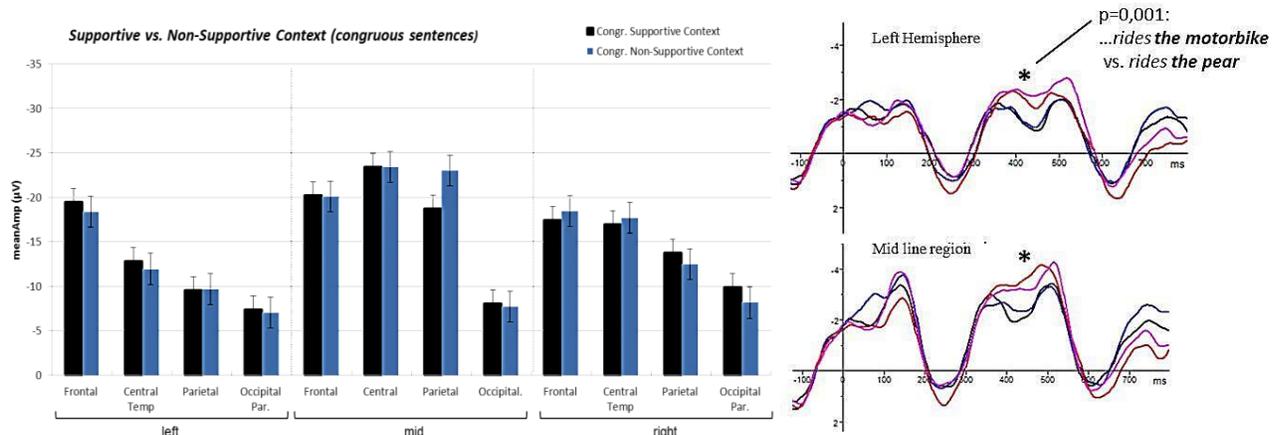
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In this study we address the time course of underlying cognitive functions of the Event Related Potential (ERP) component known as N400, a negative amplitude measured 400ms after target word presentation onset in sentence contexts. According to the N400 literature, this ERP signature may reflect difficult or facilitated integration of the target word into preceding context, given that semantically anomalous targets elicit higher N400 amplitudes (e.g. *cabin* in *John drank the cabin* (FRANÇA *et al*, 2004)), whereas contextually predictable targets (e.g. *palms* in *They wanted to make the hotel look more like a tropical resort. So along the driveway they planted rows of palms*) elicit comparably reduced amplitudes (FEDERMEIER & KUTAS, 1999; HAGOORT, 2004). Context modulated N400 effects may involve both discourse and world knowledge, which has led some authors to conclude that integration processes are the result of some kind of cognitive-general modal-free semantic processing (KUTAS, 2011). However, in these studies, crucially, presentation rates are slow (300ms per word, with a 100ms interval) compared to natural fast speech rates. This allows subjects ample time to incrementally process targets in a syntax first fashion and integrate it with world or conceptual knowledge later on. Seen in this light, the N400 effects in these studies, specifically, may reflect posterior post-syntactic processes. This is also confirmed by eye tracking studies, which show that discourse and world knowledge in garden path sentences only benefit ambiguity resolution in posterior reanalysis stages (RAYNOR, CARLSON & FRAZIER, 1983; RAYNOR, GARROD & PERFETTI, 1992).

Therefore, we argue that strictly linguistic combinatory processes, such as verb-complement merge, underlie early N400 effects. Using fast presentation rates (200ms per word, with a 100ms interval) that emulate natural processing speeds, we presented plausible and implausible target words in Brazilian Portuguese sentences in which all was maintained constant except for predictive and non-predictive contexts contained in preceding adjuncts, such as, respectively, *Even without a helmet* vs. *Every day, ...John rides **the motorbike** vs. **pear**.*

Indeed, our data show that at these rates, N400 effects are modulated by information present within the scope of the verb phrase only, but *not* by preceding predictive context. That is, we obtained a robust incongruence effect (...rides **the motorbike** vs. **pear**), ($F(1,18)=17,157$, $p=0,001$) (see Graph 1), but *no* significance for context ($F(1,18)=0,419$, $p=0,526$) (see Figure 1).

Thus, we have been able to capture a subtle firsthand computation integrating the verb and its complement as the structural basis on which to subsequently pose accessory or contextual elements contained in an adjunct - even when placed prior to the verb in the surface sequence of the sentence.



Left: **Graph 1**: Mean amplitudes for 12 Regions of Interest (ROIs) for congruous sentences comparing predictive (in black) and non-predictive context (in blue) (e.g. *Even without a helmet vs. Every day, Jake drives↑ the motorcycle like a crazy man.*); Right: **Figure 1**: Averaged ERPs for ROIs for central and temporal electrodes comparing congruous sentences with predictive (in black, CSC) and non-predictive context (in blue, CNSC), and incongruous sentences with predictive (in red, ICSC) and non-predictive context (in pink, INSC).

Keywords: N400, syntax, ERP, context

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