

Testing the independence of the semantic analyzer: An ERP study

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Introduction: Models of combinatory processing largely maintain a syntacto-centric view, in which syntactic analysis precedes and guides semantic interpretations (Altmann & Steedman, 1988; Trueswell et al., 1994). When the syntactic structure is unambiguous, the semantic analyzer is thought to be incapable of making the first commitments to combinatory processing (Frazier, 1987, Rayner et al., 1983). The syntacto-centric view has been supported by the elicitation of a P600 for syntactic-related phenomena. Constraint-based models of combinatory processing haven't entirely underestimated the role of the semantic analyzer, in that they assume that semantics can override syntactic cues when they are ambiguous. If a model of combinatory processing were to propose that the semantic analyzer can override the syntactic interpretation, even when the syntax is unambiguous, would mean that multiple, separate analyses are being carried out by the parser for a single input-- a proposal which would have widespread implications for models of language processing in the field of psycholinguistics (Stroud, 2009).

Kim & Osterhout (2005) found that *semantic attraction* (i.e., plausible thematic relationship between a noun phrase and verb) drives combinatory processing despite unambiguous syntax. Kim & Osterhout compared sentences with a semantic attraction violation (e.g., *the hearty meal was devouring...*) with passive control sentences (e.g., *the hearty meal was devoured*) where the inflection on the verb is likely the predicted form, given that the inanimate noun phrase elicits a Theme reading. To determine whether semantic attraction was the cause of the semantic P600, they included a no-attraction violation condition (e.g., *The dusty tabletops were devouring*), in which the inanimate noun phrase is not semantically associated with the verb *devour*. In this comparison, they found an N400, the language component most often elicited by semantic anomaly. They interpreted these findings as evidence that role reversals between agent and theme which share close semantic attraction can override licit syntax, resulting in a semantic-thematic P600, while role reversals with poor semantic attraction elicit the typical ERP component associated with semantic violation, the N400.

Aim of this study: The current study was conducted in efforts to contribute to our understanding of the semantic P600 through a direct replication of Kim & Osterhout (2005). The replication crisis has received recent attention in the event-related potential ('ERP') literature on language processing (i.e., replication by Nieuwland et al., 2017, response by DeLong, Urbach, and Kutas, 2017, and rebuttal by Ito, Martin, Nieuwland, 2017). In our efforts to contribute to the eradication of the replication problem in the

language processing literature, we investigated the P600 which arises from a strong semantic attraction.

Results: We replicated Kim & Osterhout's (2005) centroparietal P600 for the attraction violation condition (e.g., *the hearty meal was devouring...*) when compared to the passive control (e.g., *the hearty meal was devoured*) and N400 for the no-attraction violation condition (e.g., *the dusty tabletops were devouring*). We also found a centroparietal P600 for the no-attraction violation.

Discussion: In the no-attraction violation condition, syntactic restructuring in the form of changing the inflection of the verb (e.g., *the dusty tabletops were devoured*) creates a syntactically well-formed sentence, but semantically implausible relation between the Theme *dusty tabletops* and the verb *devour*. Reassigning thematic roles in the no-attraction violation condition should be more difficult than in the attraction violation condition, and when comparing amplitudes, Kuperberg (2006) argues that the P600 is modulated by this reassignment difficulty in that sentences which are difficult to repair via reassignment of thematic roles have larger amplitude than those which are easy to repair, which we found in our study. That a cost is incurred for changing the inflection to a syntactically licit structure (P600) and semantic role reassignment (N400) in the no-attraction case does not provide evidence *against* an independent semantic analyzer, and thus does not detract from the replication of the semantic P600 elicited by the attraction violation condition (i.e., *the hearty meal was devouring*). Altogether, our replication provides further evidence for an independent semantic analyzer.

Selected Refereces

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