Inanimacy as a cue to derived subjects: Evidence from the development of the "semantic" P600

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While classically assumed to reflect structural processes, the P600 event-related potential (ERP) component has recently been argued to reflect semantic processes elicited by thematic reversibility violations (Kim & Osterhout, 2005; Kuperberg et al., 2003). These results have led to theories arguing that this semantic P600 is a response to two competing streams of information: a semantic stream which processes thematic relationships and a syntax stream which processes structural relationships (Kuperberg, 2007). Here, we propose and test an theory in which this “semantic” P600 is driven by the parser’s predictive use of inanimacy cues to build derived subject structures which later require structural reanalysis. We further test the hypothesis that cues to thematic role assignments, such as animacy, are less accessible to children, leading to weaker predictions and attenuated reanalysis processes.

Ambiguity is a pervasive problem for comprehension; even sentential subjects fall prey to ambiguities of thematic interpretation. Comprehenders are faced with a choice when parsing a subject: while sentential subjects are generally interpreted as agents (1), passive subjects, for instance, receive theme interpretations derived through underlying object positions (2). One possible cue to the presence of derived subjects is animacy. Inanimate subjects must be derived because agent interpretation requires an animate subject, while theme interpretation carries no such requirement (Dowty, 1991). Since animacy is known to affect the production and comprehension of derived subjects (Ferreira, 1994, 2000), rapid use of a subject’s inanimacy could cue the parser to predictively construct a derived subject structure which may later require revision. Interestingly, this mechanism appears to be late developing given children’s variable use of animacy (Drenhaus & Féry, 2008; MacWhinney, Bates, & Kliegl, 1984). Without a deep understanding of animacy cues, children may rely on the default agent-first strategy in which subjects are assigned agent interpretations (Townsend & Bever, 2001).

To determine whether adults and children use subject inanimacy to rapidly predict derived subjects, we recorded ERPs from 17 adults (18-22 years) and 17 children (7-9 years). Participants read sentences like (3) and (4) word-by-word. Results of two spatial-temporal principal components analyses revealed differences in ERP components elicited within conditions and between groups. Adults exhibited a P600 to critical verbs in which inanimacy cues erroneously predicted a derived subject, (3a) vs. (3b) (Figure 1). We argue this P600 in adults indexes a structural reanalysis that rejects the derived subject structure (initially triggered by the inanimate subject) as being incompatible with active verbal morphology. When animacy cues did not predict a derived subject, adults elicited an N400 and no P600, (4b) vs. (4a). We argue this N400 in adults indexes semantic integration costs of pursuing the agent-first strategy licensed by an animate subject. Since no structural revision was necessary, no P600 was elicited. In contrast to adults, children exhibited an N400 to critical verbs regardless of subject animacy, (3a) vs. (3b) and (4b) vs. (4a) (Figure 2). We argue these N400s in children index an indiscriminate use of the agent-first strategy regardless of subject animacy. Since children never predictively pursue derived subject structures, no structural revisions were necessary and no P600s were elicited.

These results have implications for child language/literacy development, and provides support for the view that the P600 indexes processes involved in conflict resolution given competing sources of bottom-up and top-down information during language processing.
Figure 1. Virtual ERPs and Spatial Distribution of the P600 effect for Adults: Active Controls (solid line) to Active Violations (dotted line)

![Graph showing ERP waveforms and spatial distribution](image1)

Figure 1. Virtual ERPs and Spatial Distribution of the N400 effect for Children: Active Controls (solid line) to Active Violations (dotted line)

![Graph showing ERP waveforms and spatial distribution](image2)


