

Using ERPs to investigate the comprehension of passive versus active sentences in English

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Behavioral research shows that adult native English speakers have greater difficulty comprehending passive than active sentences, because in passive sentences the subject does not play the prototypical “agent” role (e.g., Ferreira, 2003). However, less is known about the cognitive and neural mechanisms that underlie the processing of passives, as previous studies have not compared active and passive sentences directly, focusing instead on the processing of semantic and syntactic anomalies within passive constructions (e.g., Kim & Osterhout, 2005; Kuperberg, 2007). In two experiments, we address this gap by comparing ERP responses for active versus passive sentences among college-aged monolingual English speakers in two visual event-related potential (ERP) experiments. We also investigated whether the presence of ungrammatical filler items changes ERP responses to a grammatical—yet less-preferred—structure (i.e., passives). In Experiment 1, we presented active and passive sentences alongside ungrammatical filler items, while in Experiment 2, all fillers were grammatical. In Experiment 1, 25 participants read 36 sentences in conditions (1) – (4), along with 72 additional filler items. (1) The man was annoying the lady in the grocery store. (active) (2) The man was annoyed by the lady in the grocery store. (passive) (3) The nurse should confront the friend who lied to her. (grammatical filler) (4) The nurse should confronting the friend who lied to her. (ungrammatical filler). Thus, 20% of all sentences involved passive constructions. Y/N comprehension questions followed one-third of the sentences, with eight passive and eight active questions focusing on thematic-role assignment (e.g., Did the man annoy the lady?). Comprehension accuracy was higher for active than passive sentences (88.0% vs. 73.0%). ERPs time-locked to the thematic verb (e.g., annoying/annoyed) revealed a frontal positivity in the 500-700 ms time window for passive versus active sentences. This late frontal positivity contrasted with the posterior-distributed P600 effect (500-700ms time window) for ungrammatical versus grammatical fillers, replicating the typical P600 effect obtained in previous research (e.g., Osterhout & Nicol, 1999). In Experiment 2, 22 participants read the same sentences, but ungrammatical filler sentences were replaced with their corresponding grammatical version. Comprehension accuracy was again higher for active than passive sentences (85.8% vs. 78.4%). ERPs revealed a positivity (500-700ms time window) for passive versus active sentences that was strongest in the left hemisphere, and descriptively stronger in frontal versus posterior electrodes. Comparing effect sizes across experiments revealed smaller effect sizes for ERP responses to passive sentences in Experiment 2 versus Experiment 1, and smaller effect sizes for passive

sentences in both experiments than ungrammatical fillers in Experiment 1. Together, these results reveal ERP response profiles for passive versus active sentences that are similar in size and distribution to frontal positivities associated with the revision of previous expectations when confronted with unexpected input (e.g., Federmeier, 2007), and that are markedly different from P600 effects traditionally associated with processes of syntactic reanalysis (e.g., Osterhout & Holcomb, 1992). Further, differences across experiments raise important methodological issues regarding the ways in which ERP responses to grammatical sentences are modulated by the experimental design and stimulus list composition.