

Syntactic priming in noun vs. verb attachment ambiguities: Evidence from ERPs and eye-tracking

Traxler, M. J., Boudewyn, M. A., Zirnstein, M., & Swaab, T. Y. (University of California, Davis)
mjtraxler@ucdavis.edu

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In comprehension, syntactic priming involves facilitation of sentence processing when a sentence of a particular structure follows a sentence containing some of the same structural elements (Pickering & Ferreira, 2009; Tooley & Traxler, 2010). In eye-tracking, syntactic priming effects manifest as reduced reading times for the repeated structure, while ERP studies typically reveal a reduced P600 (Ledoux et al., 2007; Tooley et al., 2009). To date, studies of syntactic priming in comprehension have focused on reduced relatives (Traxler & Tooley, 2008), datives (Arai et al., 2007), and modifier-goal ambiguities (Traxler, 2008). It is unknown whether priming extends to other sentence types, and, if so, whether it would reflect the same kinds of underlying mental operations.

In this study, participants read sentences containing verb/noun attachment ambiguities, such as (1) and (2) below. In isolation, sentences like (1) are easier to process than (2), because readers attach the prepositional phrase *with the stick* to the preceding verb (*hit*), as opposed to the preceding noun (*boy*). The prepositional phrase in sentences like (2) can only be plausibly attached to the noun (*man*). Accounts differ as to whether the greater difficulty of (2) reflects syntactic structure preferences (e.g., Rayner et al., 1982) or referential constraints (e.g., Altmann & Steedman, 1988). Our main research question is whether the difficulty associated with noun-attachment can be reduced when a noun-attached target sentence follows a noun-attached prime sentence.

In Experiment 1 (eye-tracking), 44 participants read noun-attached targets that appeared after either a noun-attached (e.g., 2) or verb-attached (e.g., 1) prime sentence. Noun-attached targets following verb-attached primes evoked a greater number of regressions than noun-attached targets following noun-attached primes. In addition, total reading time for noun-attached targets in the noun-phrase (e.g., *the man*) and prepositional-phrase regions (e.g., *with the mustache*) was lower than for noun-attached primes (NP: $t_1 p=0.01$, $t_2 p=0.01$; PP: $t_1 p=0.07$, $t_2 p=0.05$).

In Experiment 2 (ERPs), 20 participants read noun- and verb-attached sentences like (1) and (2) below, in order to determine the ERP correlates of the difficulty associated with noun- compared to verb-attachment outside of a priming paradigm. We found a reduction in N400 amplitude for verb-attached critical words (e.g. *stick*) compared to noun-attached critical words (e.g. *mustache*) ($p<0.05$).

In Experiment 3 (ERPs), 23 participants read noun-attached target sentences that appeared after noun-attached primes, such as (2). We found reduced positivities (P600s) during processing of the words following the disambiguating noun phrase in target sentences after noun-attached primes (e.g. *earlier today* in (2)) ($p<0.05$).

These results show, for the first time, that priming effects in comprehension extend to sentences containing noun-attached prepositional phrases. In addition, the ERP findings from Experiment 2 suggest that, unlike reduced relatives, facilitated processing of verb- vs. noun-attachment may primarily reflect semantic processes. We interpret these results with respect to the referential theory of modifier processing (Altmann & Steedman, 1988; Ni, Crain, & Shankweiler, 1996).

Examples:

- (1) The girl hit the boy with the stick last night. (verb-attached/ambiguous)
- (2) The officer hit the man with the mustache earlier today. (noun-attached)