

Integration costs on auxiliaries: A self-paced reading study using WebExp

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Object relative clauses (as in 1b) are more difficult to process than subject relative clauses (1a) (King and Just, 1991). Dependency Locality Theory (DLT; Gibson, 2000) accounts for this effect in terms of long-distance dependencies: The integration cost at in (1a) is lower than at in (1b) because just one argument () needs to be integrated in (1a), whereas in (1b), two arguments (chairman and) need to be integrated, and the distance between and is larger in (1b).

Demberg and Keller (2008) evaluated DLT integration cost on an eye-tracked corpus of newspaper articles (Dundee Corpus; Kennedy and Pynte, 2005), and found that verbs which were preceded by nouns were read more slowly than verbs which were preceded by both auxiliaries and nouns. Demberg and Keller thus hypothesized that integration costs might not be incurred at the main verb (as predicted by DLT), but at the auxiliary, at which it should thus be possible to observe an integration cost effect. Most previous experimental studies on locality effects do not contain auxiliaries (with the exception of Warren and Gibson (2002), who found increased reading times on the auxiliary, adverb and verb in conditions with higher integration cost). The present study sought to directly investigate whether integration costs can be measured on auxiliaries.

We created 24 subject and object relative clauses with auxiliaries preceding the embedded verb, based on the experimental items from Staub (2010), see (1). We ran a self-paced reading experiment with 126 participants online, using WebExp, webexp.info, an experimental software that carries out psychological experiments over the internet.

On raw reading times, there was a significant effect of relative clause type on the determiner (SRC determiners are read more slowly than ORC determiners; a similar effect was found on the noun region in early reading time measures in Staub 2010; differences may be due to differences in SPR vs. eye-tracking), as well as significantly faster reading on the auxiliary and embedded verb of SRCs. The facilitation effect on SRC auxiliaries and difficulty effect on SRC determiners disappeared, however, when reading times were residualized with respect to the frequency of the preceding word, thus accounting for spill-over effects.

The contribution of this abstract is two-fold. We find that increased reading times on auxiliaries can be explained in terms of spill-over effects, thus not supporting the hypothesis of Demberg and Keller (2008), who suggested that integration costs might occur at auxiliaries and facilitate integration at the verb. Instead, our findings support the original predictions of Dependency Locality Theory (Gibson, 2000). Furthermore, we provide evidence for the validity of self-paced reading via WebExp, by replicating the established relative clause asymmetry result on the embedded verb. Initial evidence that timing using WebExp is sufficiently accurate for self-paced reading studies is presented in Keller et al. (2009). To the best of our knowledge, the present results are the first ones for word-by-word SPR using WebExp, as previous studies used much larger regions.

(1) a. The mathematician who [had] [visited] [the chairman] a solution to the problem.

b. The mathematician who [chairman] [] [] a solution to the problem.

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