HEAVY NP SHIFT IS DISPREFERRED, BUT NOT THE PASER'S LAST RESORT

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Unlike filler-gap dependencies which have been shown to be processed predictively (e.g., "active gap-filling" [1-3]), it has been suggested that comprehenders pursue a heavy NP shift analysis (a gap-filler dependency) only when no other grammatical options are available (the heavy-NP-shift-as-last-resort hypothesis, [4]). However, since this previous work examined heavy NP shift sentences in which no alternative analysis is available (e.g., "John {watched / praised} from the stands his daughter's attempt to shoot a basket."), existing evidence may simply be taken to show that, when the verb can be used intransitively, a heavy NP shift analysis is less preferred and constructed at a later time point than when the verb is obligatorily transitive. To provide a stronger test of the heavy-NP-shift-as-last-resort hypothesis, we asked whether comprehenders would avoid positing a heavy NP shift when an alternative analysis is available. Crucially, we found that while comprehenders are less likely to analyze a shifted NP as the direct object of an optionally transitive verb, heavy NP shift is *not* the parser's last resort.

In **Experiment 1** (n=24) we recorded comprehenders' reading eye-movements in sentences like (1a-d), where we fully crossed Order (adverb-first vs. adverb-second) with Ambiguity (comma vs. no comma). An optionally transitive verb (e.g., "hunted") is used in the subordinate clause, and the ambiguous NP is always a plausible direct object to this verb. We expected a garden-path effect in the disambiguating region (e.g., "ran into") in the adverb-first sentences, and if comprehenders always pursue a transitive analysis in the adverb-second sentences as well (i.e., positing a heavy NP shift), we should observe a comparable garden-path effect (a main effect of ambiguity). Contrary to this prediction, we found a greatly reduced effect of ambiguity in total reading times in adverb-second sentences than in adverb-first sentences (Fig. 1), which suggests that participants do not always pursue a heavy NP shift analysis when an alternative analysis is available.

Adverb-first (adverb – optionally transitive verb – ambiguous NP):

(1a) While the man eagerly hunted the deer that was brown and graceful ran into the woods.

(1b) While the man eagerly hunted, the deer that was brown and graceful ran into the woods.

Adverb-second (optionally transitive verb – adverb – ambiguous NP):

(1c) While the man hunted eagerly the deer that was brown and graceful ran into the woods.

(1d) While the man hunted eagerly, the deer that was brown and graceful ran into the woods.

In **Experiment 2** (n=58) we used a sentence completion task to examine comprehenders' likelihood of pursuing a transitive analysis at three different points in adverb-second sentences like (1c): immediately following (i) the verb, (ii) the adverb, and (iii) the ambiguous NP. Surprisingly, we found that even though an intransitive continuation was highly likely following the adverb (~99%), participants were more likely to provide a transitive continuation than an intransitive one following the ambiguous NP (59% vs. 41%; Fig. 2). This suggests that comprehenders are likely to posit a heavy NP shift even when an alternative analysis is available, which goes against the heavy-NP-shift-as-last-resort hypothesis.

In **Experiment 3** (n=82) we directly compared adverb-first vs. adverb-second sentences in a sentence completion task to better understand the eye-tracking results in Experiment 1. Was the garden-path effect smaller in the adverb-second sentences because (i) an intransitive analysis was more readily available and thus rendered reanalysis easier, and/or (ii) comprehenders were less likely to pursue a transitive analysis and thus less likely to get garden-pathed to begin with? We found evidence for both explanations. Prior to the ambiguous NP, there were more intransitive continuations in the adverb-second items than in the adverb-first items (95% vs. 51%; Fig. 3), which may have made reanalysis easier in the adverb-second items. Meanwhile, following the ambiguous NP, there were significantly fewer transitive continuations in the adverb-second items than in the adverb-first items (75% vs. 98%), which showed that comprehenders were in fact less likely to analyze an NP as the direct object of an optionally transitive verb (and get garden-pathed) when the said NP has been displaced. Taken together, the present results suggest that while the parser is less likely to posit a transitive analysis when the verb is not immediately followed by an NP, heavy NP shift is *not* the parser's last resort.

Sample stimuli in Experiment 2

(2a) *(Verb-ending)* While the man hunted___.

(2b) *(Adverb-ending)* While the man hunted eagerly___.

(2c) *(Ambiguous-NP-ending)*While the man hunted eagerly the deer that was brown and graceful___.

Sample stimuli in Experiment 3

(3a) *(Adverb-first pre-NP)* While the skipper cautiously sailed_____.

(3b) *(Adverb-second pre-NP)* While the skipper sailed cautiously_____.

(3c) *(Adverb-first post-NP)* While the skipper cautiously sailed the boat that was small and leaky____.

(3d) *(Adverb-second post-NP)* While the skipper sailed cautiously the boat that was small and leaky_.

References: [1] Fodor (1978). LI, 9, 427-473. [2] Frazier & d'Arcais (1989). JML, 28, 331-344. [3] Stowe (1986). LCP, 1, 227-245. [4] Staub, Clifton & Frazier (2006). JML, 54, 389-406.

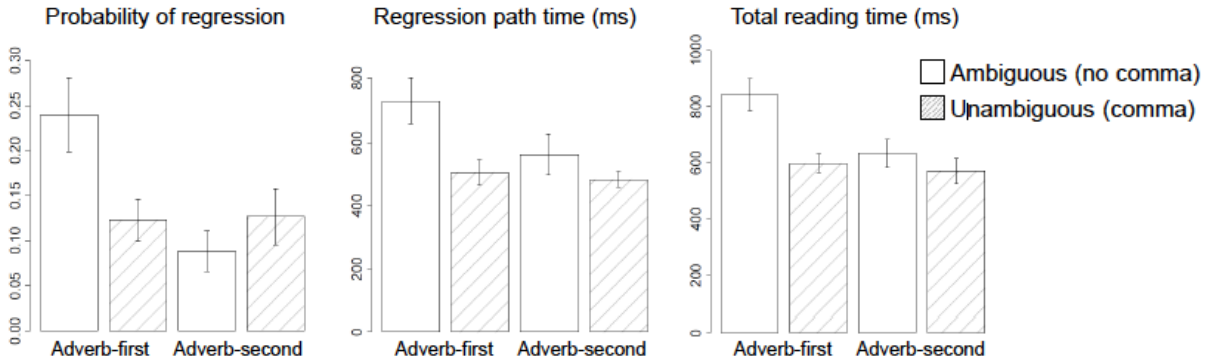

Figure 1. Probability of regression, regression path time and total reading time in the disambiguating region in Experiment 1.

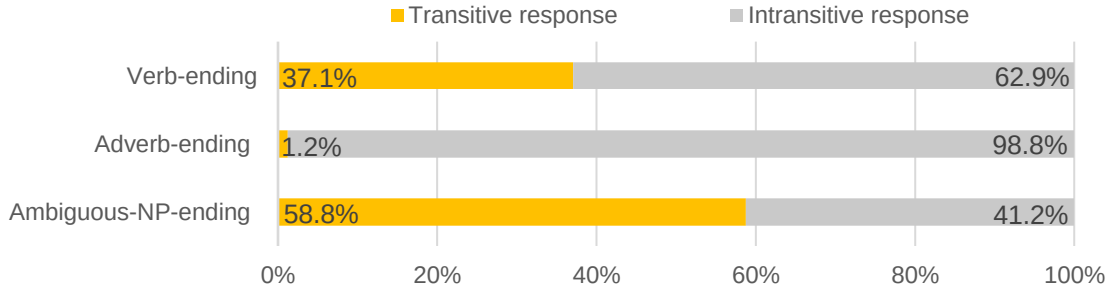

Figure 2. Distribution of transitive and intransitive responses in Experiment 2.

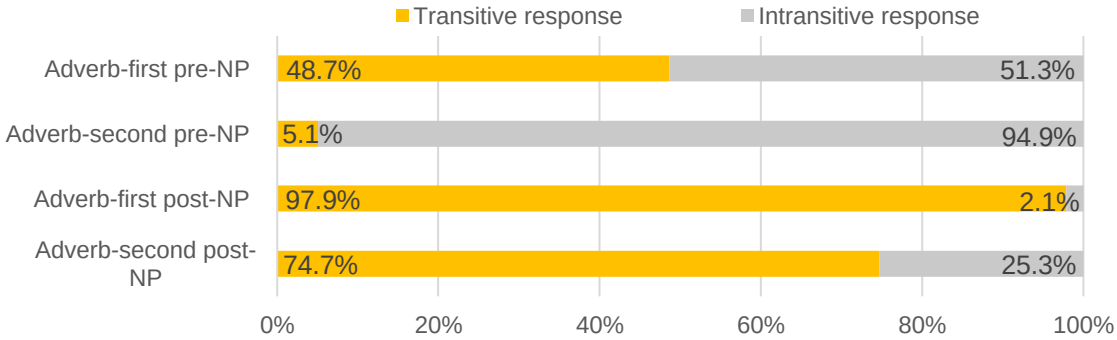

Figure 3. Distribution of transitive and intransitive responses in Experiment 3.