Evidence for lingering structural prediction in either-or structures.

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Introduction. Recent work has addressed the extent to which the language parser is predictive, typically concentrating on the anticipation of a single word in highly constraining contexts (DeLong, Troyer, & Kutas, 2014; Staub, 2015). A major open question is whether the parser also predicts structure ahead of the input. A particularly good case study is the either-or construction, as the correlative adverb either nearly guarantees a following disjunction or. We propose not only that the processor generates fine-grained structural predictions about upcoming structure, but that such predictions may also linger in memory if the input disobeys structural constraints or preferences.

Background. Several studies report general facilitation for or following either (Staub & Clifton, 2006; Staub, 2007; Yoshida et al., 2013), as well as reduced penalties for NP/S garden-path sentences (Staub & Clifton, 2006). Following Staub (2007) and others, we assume a global preference for either to transparently mark the syntax of a disjunction, i.e., disjuncts of the same syntactic category. Consequently, the parser should anticipate a disjunction that is parallel in form from the position of either. Yet, the position of either doesn’t completely determine the disjunction type (Larson, 1985). For example, either may transparently mark the scope of an NP disjunction before the first NP (John ate either [sp rice] or [sp beans]), or non-transparently appearing leftward of the disjunction (John either ate [sp rice] or [sp beans]). However, non-transparent marking is grammatically constrained: placing it before the entire sentence is highly marked (*Either John ate [sp rice] or [sp beans]), unless it coordinates clauses (Either [s John ate rice] or [s he ate beans]). Thus, a transparent clausal disjunction should be highly predictable when either appears in pre-clausal position.

Previous studies have concentrated on cases of transparent scope marking leaving open how the parser might revise its predictions when encountering evidence for non-transparent scope marking. We entertained two possibilities regarding non-transparent marking: In an effort to prioritize the input, (A) the parser might quickly dispense with the prediction in the face of contrary evidence. Alternatively, (B) the predicted, but potentially erroneous, disjunction might linger in memory (Christianson, et al., 2001), improving access to the predicted structure when needed downstream (Staub, 2007). We expected that the parser would maintain the prediction for a (transparent) clausal disjunction when either appeared above the clause, even when it encountered evidence for a disjunction of a smaller size (B).

Reading experiments. 16 quartets like (1) were constructed, crossing the Scope of either (HS: High scope, LS: Low scope) with the type of coordinator (And, Or) appearing between two nouns in the first clause, e.g., a popsicle {and/or} an ice cream cone. The critical region was the clausal disjunction (or that Bobby), identical across conditions. All results were modeled as (G)LMERs. We first explored whether the abandoned prediction facilitated processing clausal disjunctions in two online reading studies. If (A) is correct, readers should experience a processing benefit on the Or conditions regardless of Scope, and a slight penalty for HS-Or compared to LS-Or, as a result of violating transparency. Crucially, we would expect no differences at the critical clausal disjunction. However, if (B) is correct, the processor has preemptively constructed a clausal interpretation of either in HS conditions, and would therefore show a differential interactive advantage on the clausal disjunction (or that Bobby) in the HS-And condition. A self-paced reading study (N=60) confirmed the central predicted interaction of (B): On the clausal disjunction, there was an advantage for HS-And conditions and a penalty for LS-Or conditions, $t = -2.63, p < 0.05$. In an eye tracking follow up (N=56), a qualitatively similar interaction was confirmed in multiple measures (first pass, regression-path, and right-bounded times; $p’s < 0.05$). There was also a cost for LS-And compared to LS-Or on the first coordinator region (or an ice cream cone), which did not appear in HS contexts (first pass, total times, and right-bounded times), suggesting that readers may have been waiting for a clausal disjunct, despite evidence for an NP-disjunction, violating structural constraints (den Dikken, 2006).

Summary. Although various scope configurations for either are grammatically possible, we conclude that (i) the sentence processor predictively anticipates the category of an upcoming disjunct on the basis of the position of either as permitted by the grammar of the language, and that this prediction (ii) facilitates integration of the anticipated structure even in the face of initially mismatching input.
Materials.
(1) Sample quartet from SPR and ET experiments. Spill over (before dinner) in ET study only.
/ Evidently, / the babysitter said / …

<table>
<thead>
<tr>
<th>Coordinator</th>
<th>Either placement</th>
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<tbody>
<tr>
<td></td>
<td>High Scope (HS) either</td>
</tr>
<tr>
<td>Disjunction</td>
<td>either that Britt ate / a popsicle or an ice cream cone</td>
</tr>
<tr>
<td>Coordination</td>
<td>either that Britt ate / a popsicle and an ice cream cone</td>
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… / before dinner, /Clausal-disjunction or that Bobby / also wanted / something sweet.

Offline study. In a sentence completion study (N=23), subjects accepted NP coordination with either in clausal position. They completed fragments with shorter NP-coordination (70%), regardless of the scope of either (2), and rarely filled in the blank with or at a clausal boundary (9%), even when either was positioned above the entire clause (3). If subjects posited a clausal coordination structure, they abandoned it for smaller disjuncts, perhaps due to a task-driven preference for short completions.

(2) The babysitter said (either) that Britt (either) ate (either) a popsicle or _______________________.
(3) The babysitter said (either) that Britt ate (either) a popsicle {or/and} an ice cream cone, _______ that Bobby also wanted something sweet.

Figures. Interactions for right-bounded times on coordinator regions in eye tracking: an advantage for NP disjunctions with Low Scope either (Left panel), and an advantage for previous NP-disjunctions on the following clausal disjunction (Right panel). NB. Right bounded times correspond to the time spent on a region before moving past it, excluding time on previous regions.

Selected references.