Syntactic intervention cannot explain agreement attraction in English Wh-questions

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Prior work has demonstrated a robust subject-verb agreement attraction effect in Mainstream American English: when a non-subject noun phrase (*a local noun*) appears near the subject and verb, participants sometimes appear to mistakenly compute agreement between that non-subject noun phrase and the verb, both in production (Bock & Miller, 1991) and comprehension (Pearlmutter et al., 1999). Agreement attraction has been found to be sensitive to a variety of factors, including the syntactic position of the attractor with respect to the subject and verb (Franck et al., 2002). Agreement attraction's sensitivity to fine-grained syntactic information has led Franck, Lassi, Frauenfelder, and Rizzi (2006) to hypothesize that attraction arises only in cases where the attractor intervenes on the agreement checking operation in a sentence's syntactic derivation. This hypothesis has two appealing properties: It assumes a strong correspondence between syntactic theory and online processing, and, consequently, can predict whether we should see attraction in a sentence given only that sentence's syntactic derivation.

In this work, we test the predictions of this hypothesis for D(iscourse)-linked Wh-questions (*Which tree(s) is the gardener planting?*). Under a standard syntactic analysis, the local noun never intervenes on the agreement relation in these sentences (see Fig. 1), and thus, if we accept the claims of Franck et al. (2006), we should see no attraction effects for these constructions. Dillon, Staub, Levy, and Clifton Jr (2017) found in an unspeeded acceptability judgement paradigm that ungrammatical sentences of this structure were judged better when the object's number mismatches with that of the subject, suggesting that attraction does emerge in these constructions. We attempt to find converging evidence by testing for attraction in these constructions during online, incremental processing.

Design: We modified 16 items from Dillon et al. (2017) for word-by-word self-paced reading, with additional material appended to account for spillover. We embed the questions so the inflected auxiliary verb appears after the subject (*Govinda wonders which tree the gardener is...* vs *Which tree is the gardener...*) in order to avoid the potential disambiguation of a garden path occurring at the verb. All items had only singular subjects and plural (ungrammatical) verbs to maximize statistical power. The object's number was varied across conditions.

Procedure & Analysis: Each participant was shown 8 critical items and 16 filler items in a word-by-word self-paced reading experiment conducted online. Each self-paced-reading trial was paired with a comprehension question to ensure participants were paying full attention to the experiment. Participants with less than 80% accuracy on comprehension questions and trials with reading times > 3000ms were excluded from further analyses. Our critical region consisted of the verb (where the ungrammaticality of agreement is revealed) and the following two words (to account for spillover). We conduct frequentist and Bayesian analyses over both raw and log-transformed reading times to evaluate the robustness of our findings. 320 participants were recruited, as a power analysis estimated this would result in over 80% power.

Results: All four analyses provided consistent results, so we present only the frequentist, raw RT analysis. We found agreement attraction effects at the first spillover word ($\beta = -15.12$, $p < 0.001$) and second spillover word ($\beta = -9.26$, $p < 0.001$), with a plural, mismatching local noun resulting in faster reading times at the verb (see Fig. 2).

Conclusions: Our results provide converging evidence that agreement attraction does occur in D-linked Wh-questions, counter to the predictions made by Franck et al. (2006). However, our evidence, along with that of Dillon et al. (2017), is only in comprehension, while the constraints inherent to generative syntax better matches those of production (i.e., derivations do not proceed in the incremental manner necessary for online comprehension). We see this as an opportunity to both test for attraction in these constructions in production and explore how the constraints inherent to comprehension and production surface in agreement attraction effects.
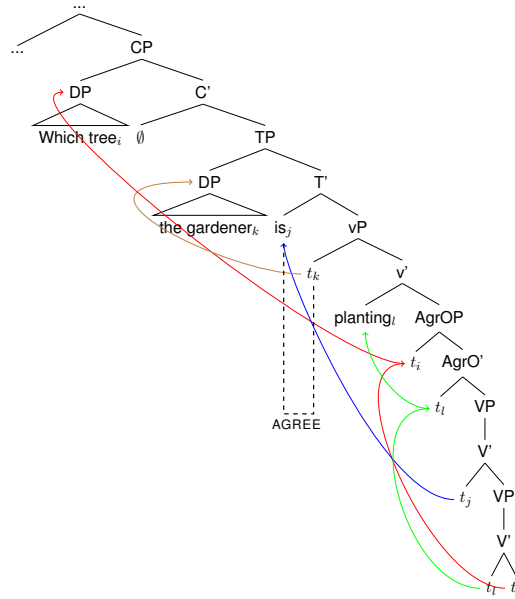
Figure 1: Our assumed analysis of the embedded clause of our items, following Pesetsky and Torrego (2001). Colored arrows represent the movement of a particular element during the derivation. Crucially, the local noun does not intervene on the AGREE relation, as the object (the red path) does not appear between the two agreeing elements (i.e., within the dashed lines).

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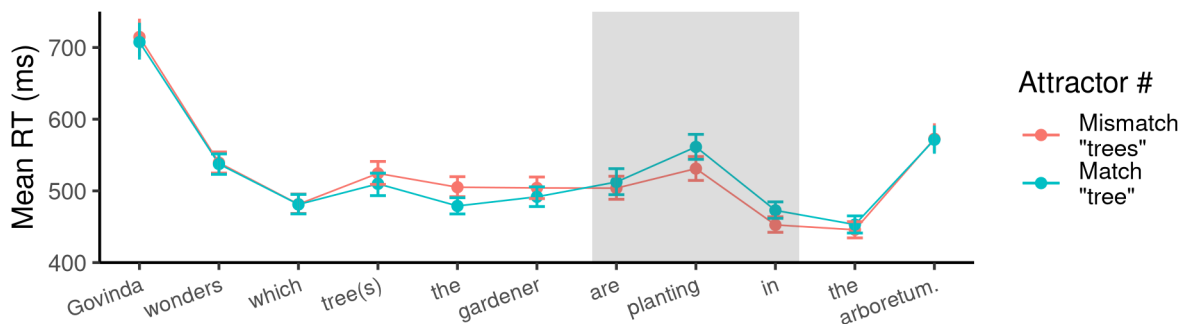
Figure 2: Word-by-word reading times from Experiment 1. Error bars indicate 95% confidence intervals. The shaded region presents reading times for the verb, which renders the sentence ungrammatical, and the following two words to capture spillover effects.