Illicit syntactic representations in garden-path reanalysis: New evidence from reflexives

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Misinterpretation effects in garden-path sentences raise the possibility that reanalysis is incomplete (Christianson, et al. 2001). Two hypotheses have been suggested to account for misinterpretations: 1) incorrect syntactic representation, such that the parser ultimately adopts an illicit syntactic analysis, or 2) fallible memory processes, where incorrect but temporarily licensed interpretations fail to be removed from memory. Slattery et al. (2013) and Huang & Ferreira (2021) investigated these two possibilities using gender mismatch effects on reflexives to probe what main clause subject the parser ultimately adopts during reanalysis. Reflexives has been found to precisely target their antecedent subject features, generally respecting grammatical constraints in English (Sturt, 2003), and both studies reported longer reading times (RTs) on the reflexive in gender mismatch conditions. They argued that their results are consistent with an account in which reanalysis forms fully licit syntactic representations, and that misinterpretations arise from fallible memory processes that allow temporarily licensed interpretations to linger in memory.

We revisited this question, noting that reanalysis may also involve fallible memory processes during the reanalysis process itself. Disambiguation in NP/Z garden-paths is triggered by a verb that is missing its subject NP (Fodor & Inoue, 1994). Searching for this NP may rely on a direct parallel cue-based search process that finds both the subordinate subject NP as well as the ambiguous but ultimately correct NP. We investigated whether the parser sometimes considers the subordinate subject NP to be the main clause subject due to this noisy search process, even though such a representation is syntactically illicit. To do this, we investigated an additional condition within Slattery et al.'s (2013) and Huang & Ferreira's (2021) design, where the reflexive's number mismatched the ambiguous NP, but matched the subordinate subject NP.

Method. 30 English speakers from Prolific participated in a word-by-word self-paced reading study consisting of 36 NP/Z garden-path sentences and 72 fillers. We manipulated number marking on NP1, the irrelevant subordinate subject (*painter*), and NP2, the (temporarily ambiguous) main clause subject (*model*), to (mis)match with a singular reflexive (*herself*) in a 2 (Garden-path, Control) by 3 (Grammatical Match [pl, sg], Ungrammatical Match [sg, pl], Ungrammatical Mismatch [pl, pl]) design, shown in (1). Disambiguation had no number agreement. The Ungrammatical Match condition was added to the Grammatical Match/Ungrammatical Mismatch conditions to conceptually replicate Slattery et al. (2013) and Huang & Ferreira (2021). We report a linear mixed effect model on first spillover RTs (*unmoving*), sum-coding Structure (Control vs. Garden-Path) and two agreement contrasts: Grammaticality (Grammatical Match vs. Ungrammatical Mismatch) and Matching (Grammatical Match vs. Ungrammatical Match).

Results. Analysis revealed a Grammaticality effect and an interaction of Structure:Matching (see Table 1). Planned comparisons via *emmeans* revealed that both Ungrammatical Mismatch (Est.=-0.074, *t*=-2.783, *p*=.015) and Ungrammatical Match (Est.=-0.056, *t*=-2.094, *p*=.092) were slower than Grammatical Match in Control structures, while only Ungrammatical Mismatch (Est.=-0.058, *t*=-2.203, *p*=.071) was slower than Grammatical Match in Garden-paths. Ungrammatical Match (Est.=0.011, *t*=0.412, *p*=.911) was about as fast as Grammatical Match in Garden-paths.

Discussion. While RTs on reflexives in control sentences consistently showed a number mismatch effect regardless of NP1's number, reflexives in garden-path sentences only showed a number mismatch when both NP1 and NP2 were number mismatched. No number mismatch effect emerged when just NP1's number matched the reflexive. While it is possible that reflexives may have suffered illusions of grammaticality when retrieving their antecedents, understanding why this effect only emerged in garden-path sentences would require special explanation. Instead, we suggest that the parser may have considered NP1 as a possible main clause subject during reanalysis. Such an analysis is, however, syntactically illicit. This raises the possibility that noisy memory retrieval processes that are used when under pressure to reparse structural ambiguities can sometimes cause the parser to stray from its grammatical bounds.

Example Stimuli. NP1 (*painter*) and NP2 (*model*) are underlined, disambiguating verb italicized (*become*), singular reflexive (*herself*) in bold.

(1) Grammatical Match	While the <u>painters</u> studied(,) the <u>model</u> who had been very famous *became* drained and kept **herself** unmoving for a long time.
Ungrammatical Match	While the <u>painter</u> studied(,) the <u>models</u> who had been very famous *became* drained and kept **herself** unmoving for a long time.
Ungrammatical Mismatch	While the <u>painters</u> studied(,) the <u>models</u> who had been very famous *became* drained and kept **herself** unmoving for a long time.

Table 1. Fixed effects for the first spillover region.

	Est.	Std. Err.	t	p
Structure	-0.002	0.015	-0.153	.878
Grammaticality	0.073	0.022	3.379	.001
Matching	-0.014	0.022	-0.659	.510
Structure:Grammaticality	0.023	0.043	0.539	.590
Structure:Matching	-0.078	0.043	-1.803	.072

Figure 1. Average reading times for (A) Control and (B) Garden-path sentences. Planed comparisons are shown for each contrast.
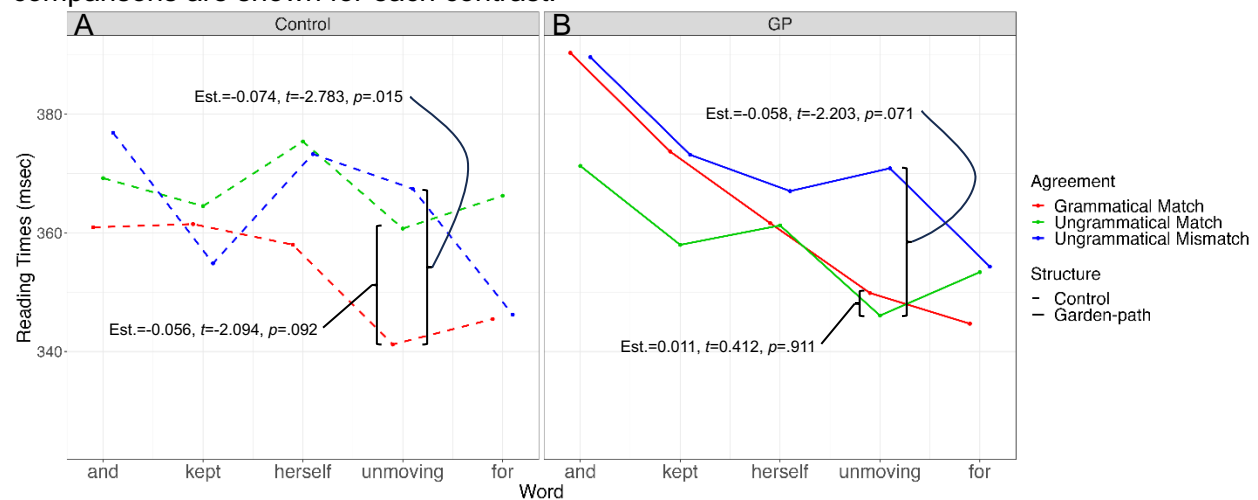
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