

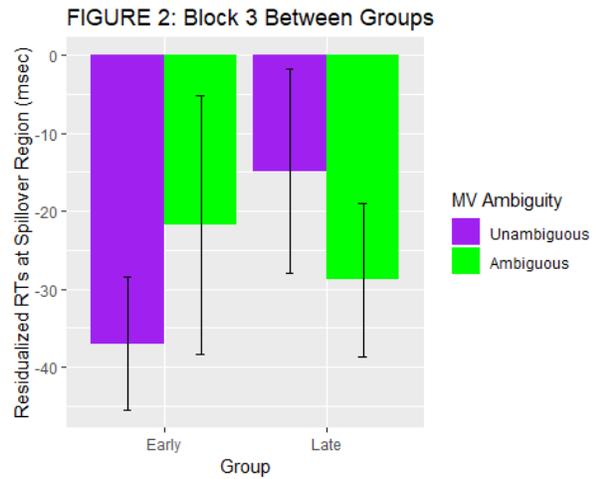
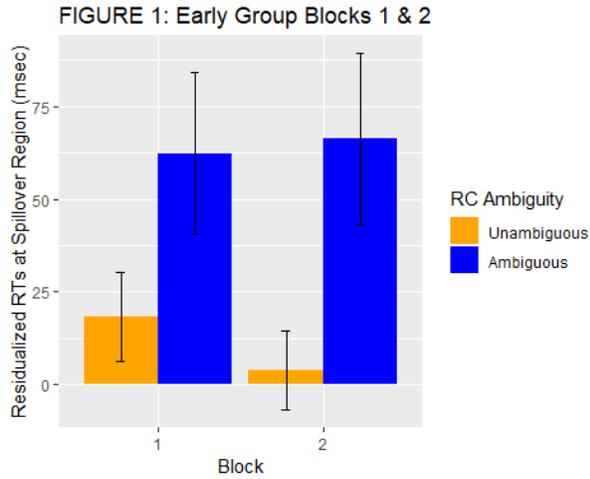
## Convergent probabilistic cues do not trigger syntactic adaptation

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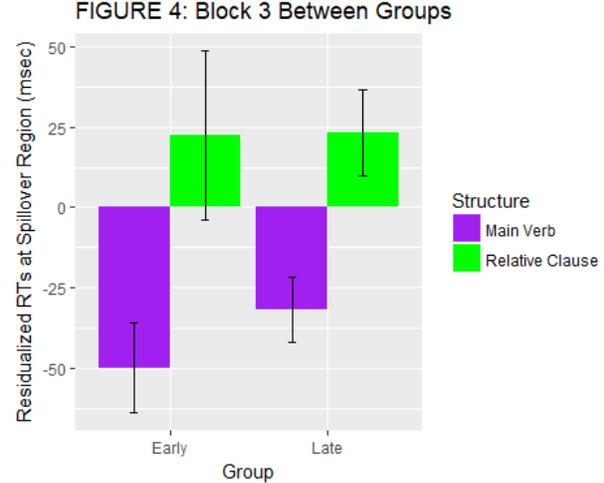
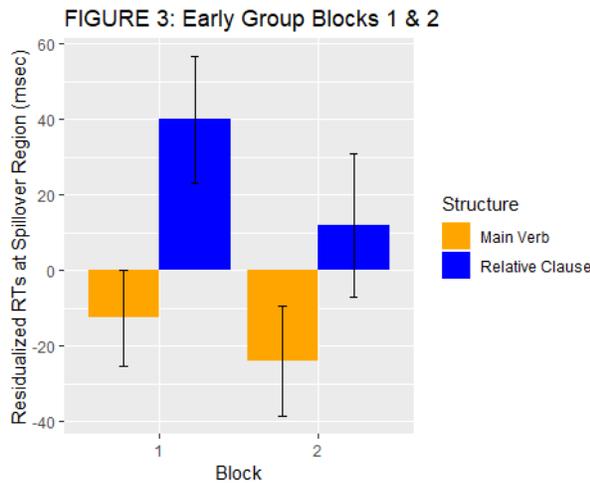
Fine, Jaeger, Farmer, & Qian (2013) published a widely-cited paper reporting the results of two self-paced reading experiments which ostensibly showed that readers rapidly adjust their syntactic expectations about upcoming text if they are exposed to statistically unbalanced input. Using reduced-relative clause (RC) vs. main verb (MV) garden-path sentences (*The soldiers warned about the raid lost the battle*), their data showed participants exposed to a high frequency of RC items progressively exhibited faster syntactic repair times, and, critically, that subsequent *a priori* more frequent MV items caused slowdowns in reading. However, recent attempts to replicate this work have fallen short of finding facilitation of syntactic repair times over the course of an experiment (c.f. Harrington-Stack, James, & Watson, 2018). Assuming frequency manipulations of garden-path disambiguations do not yield an adaptation effect in the course of an experimental session (Harrington-Stack et al., 2018), the possibility remains that other co-occurrence cues may lead to rapid adaptation of difficult syntactic structures. Repeated exposure to cues that form salient co-occurrences with a certain syntactic construction (e.g. intrasentential semantic category cues co-occurring with garden path structures) should lead to higher expectations of said construction after encountering the co-occurring cue. Therefore, from a Bayesian theoretical approach to statistical learning in language, it remains possible that the parser uses all available linguistic, and possibly extralinguistic, information available in the input to rapidly update context-dependent binary syntactic frequency distributions (i.e. RC/MV garden path disambiguations).

To test this, we ran three self-paced reading quasi-replication experiments using slightly adapted stimuli from Fine et al.'s second experiment. In Experiment 1, participants either viewed exclusively RC sentences or filler sentences in the first block ('early' and 'late' groups respectively). In Block 2, both groups read an equal number of filler and RC sentences, and in Block 3, both groups read MV continuations of sentences using the same verbs as the RC sentences from earlier blocks. After all items, comprehension questions explicitly probed the agenthood of either the reduced verb (for RC sentences) or the main verb (for MV and filler sentences) to test for offline adaptation effects (*Did the soldiers do the warning?*). The data did not replicate Fine et al. (2013) in that the early group exhibited neither faster syntactic repair times in the second block (Fig.1) nor difficulty with MV sentences in the third block (Fig.2). Experiment 2 investigated whether semantic co-occurrence cues in the form of categorically salient adjectives in the subject NP could cue readers to adapt to RC disambiguations. We kept the blocked design from Experiment 1 but gave the early exposure group an equal number of RC and MV items in Block 1 while the late group read fillers. Both groups received equal numbers RC and MV items in Block 2 and in Block 3 and answered comprehension questions explicitly probing agenthood. Crucially, all RC items in Blocks 1 & 2 had a nationality adjective in the subject NP while MV items had a different adjective, and all MV items in Block 3 had a nationality adjective while RC items had a different adjective. No adaptation effects were found. Experiment 3 mirrored experiment 2's design but employed a different cue (red font) associated first with RC continuations in the first two blocks and then with MV continuations in Block 3, but also yielded no adaptation effects. No offline adaptation effects were found in any experiment. Using Bayes factor and posterior predictive checking, follow up analyses confirmed all null effects. These findings suggest an inability to rapidly overcome highly expected disambiguations of garden-path sentences given increased frequencies for the disfavored continuation, even with additional linguistic or extralinguistic cues. The possibility remains that less polarized ambiguity pairs may be more flexible to rapid expectation adaptation; our results show an inability to overcome strong *a priori* expectations, not a general inability to adapt to probabilistic input.

Experiment 1 (Frequency) – No interaction of block/structure in first two blocks (relative clause facilitation FIG.1) or interaction of group/structure after cue reversal (main verb penalty FIG.2).



Experiment 2 (NP Adj.) – No interaction of block/structure in first two blocks (relative clause facilitation FIG.3) or interaction of group/structure after cue reversal (main verb penalty FIG.4).



Experiment 3 (Color) – No interaction of block/structure in first two blocks (relative clause facilitation FIG.5) or interaction of group/structure after cue reversal (main verb penalty FIG.6).

