



Grammatical Faithfulness in Processing of Multiple Dependencies?

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INTRODUCTION

- When multiple syntactic dependencies are processed simultaneously (e.g. in center-embedding sentences), the parser demonstrates “unusual” behaviors due to large storage costs [1,2].
- Even when lexical information favors a reduced relative continuation, the parser adopts an analysis without an additional syntactic dependency [3]
- In processing doubly nested sentences, the parser ‘forgets’ the second VP, seemingly constructing ungrammatical representations [4,5]. Other studies also suggest that constraints on working memory lead the parser to entertain ungrammatical representations [6, cf. 7]

Research Questions

We used sentences in which 3 syntactic dependencies are processed simultaneously:

1) Main clause prediction, 2) gap prediction, and 3) antecedent prediction

- Does the parser prioritize early dependency completion over grammar?
 - The parser may take a “short-cut” and complete a dependency in a syntactically illicit position to reduce the storage costs
- Are dependencies actively deleted from memory?
 - Because maintaining predictions is difficult, parser may remove a dependency from memory when overburdened (as in VP forgetting)

EXPERIMENT 1: SELF-PACED READING

Participants: 38 native English speakers from the JHU community

Stimuli: 3 manipulations generated 32 sets of sentences (8 conditions / set):

- Plausibility** – the *wh*-phrases were either possible objects of the first verb (a/b & e/f) or impossible objects (c/d & g/h)
- Island** – the first verb was inside a relative clause island (e-h) or not (a-d)
- Gender** – the gender of the subject of the main clause either matched the gender of the pronoun (a/c/e/g) or mismatched (b/d/f/h)

Predictions:

Are island constraints violated due to multiple dependencies?

- No violation* = no difference at the verb based on plausibility in island conditions, because a gap cannot be generated within an island.
- Island violation* = slowdown at the verb in all plausibility mismatch conditions (regardless of island status, active-gap filling [8,9])

Are dependencies deleted to reduce memory cost?

- Backward anaphora may be deleted from memory (weakest prediction)
- If the prediction is maintained, we expect a slowdown at the main clause subject region in gender mismatch conditions

EXPERIMENT 1: EXAMPLE SET

Because ³ *she* knew [which computer] the expert *who* wrote frequently praised ² ___ in various publications, ¹ *Kate* also bought her brother one as a gift.

a./b. No Island, Plausibility Match, Gender Match/Mismatch

Because *she/he* knew [which book] the expert wrote frequently about ___ in various publications, *Kate* also bought her brother one as a gift.

c./d. No Island, Plausibility Mismatch, Gender Match/Mismatch

Because *she/he* knew [which computer] the expert wrote frequently about ___ in various publications, *Kate* also bought her brother one as a gift.

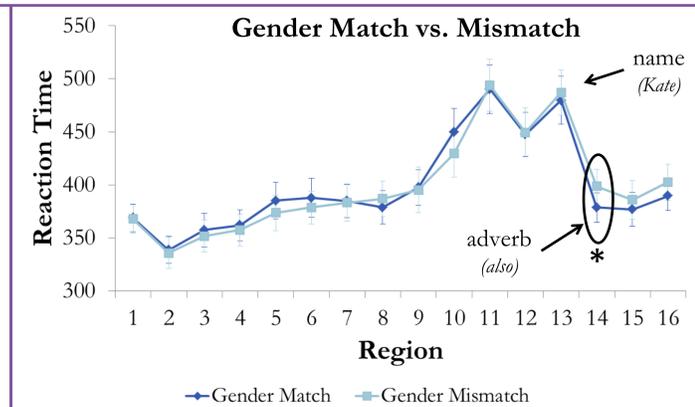
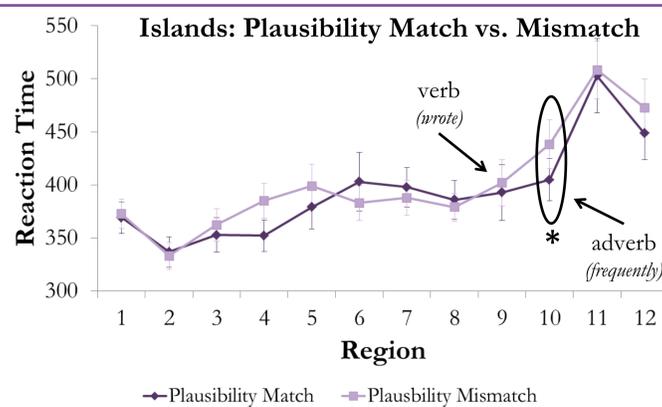
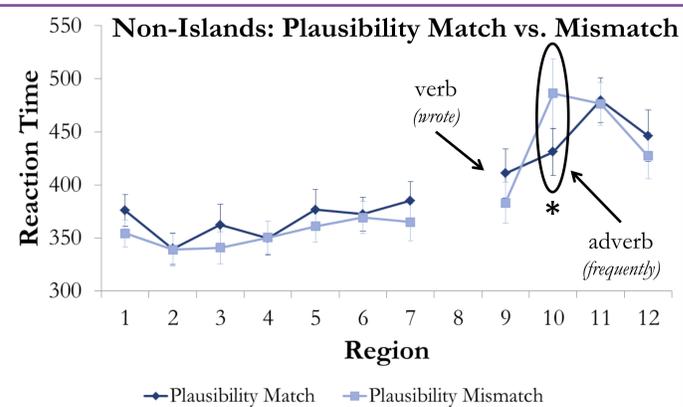
e./f. Island, Plausibility Match, Gender Match/Mismatch

Because *she/he* knew [which book] the expert *who* wrote frequently praised ___ in various publications, *Kate* also bought her brother one as a gift.

g./h. Island, Plausibility Mismatch, Gender Match/Mismatch

Because *she/he* knew [which computer] the expert *who* wrote frequently praised ___ in various publications, *Kate* also bought her brother one as a gift.

EXPERIMENT 1: RESULTS

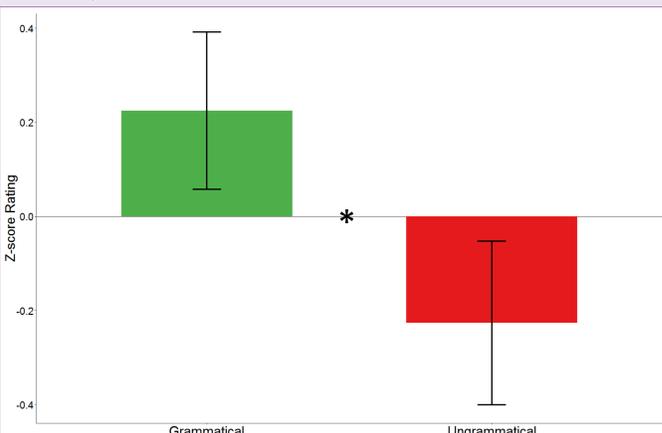


EXP 2: ACCEPTABILITY JUDGEMENT

In offline acceptability judgment task, participants distinguished grammatical sentences from ungrammatical sentences with island violations. This suggests that the island insensitivity is due to the temporary storage of multiple dependencies.

Grammatical: When she forgot which topic the anthropologist [island who taught enthusiastically] discussed ___ in the museum, Rachel ...

Ungrammatical: When she forgot which topic the anthropologist [island who taught about ___] enthusiastically discussed in the museum, Rachel ...



DISCUSSION & CONCLUSION

Summary

- These results suggest that the parser may strategically violate island constraints in order to reduce the dependencies stored in memory. This is consistent with previous observations that the parser may construct ungrammatical representations due to constraints on working memory [4-6].
- Next step (in progress): Manipulate the number of dependencies within a single experiment (1 dependency vs. 3 dependency conditions)

Implications for theory of islands

- If islands can be violated when the parser is overwhelmed with the maintenance of multiple dependencies, this challenges the resource-limitation theory of island constraints [10,11], which attribute the absence of gap filling inside islands to the cost of processing island structures themselves, e.g. relative clauses (but see below).

Sentence Processing & Perceptual Noise

- The large memory cost may have increased perceptual noise, and affected the accuracy of input encoding [12,13]. If noisier-than-usual perception led to mis-coding of the relative clause island (e.g. omission of ‘who’), then active gap-filling is no longer a violation of island constraints, because there is no island under that encoding.

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