



Go High or Go Low: Adaptation to Different Error Distributions in Sentence Processing

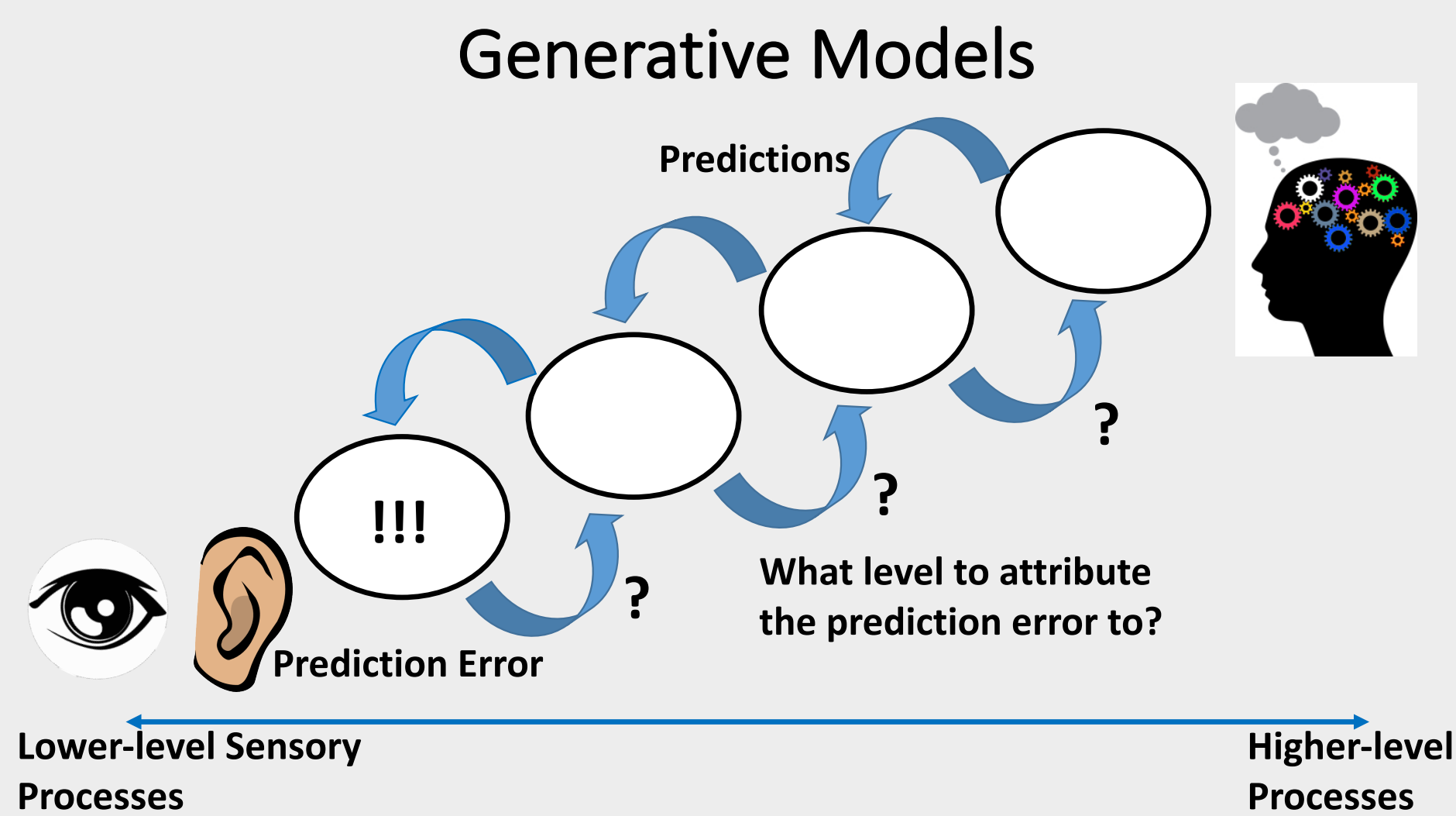
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Background & Question

- Processing draws on expectations based on previous experience (for review, see Kuperberg & Jaeger, 2016).
- When violated by the input, these expectations seem to be adaptable (Dell & Chang, 2013; Jaeger & Snider, 2013), e.g., reflected in lexical (Brown-Schmidt, 2009; Creel et al, 2008) and syntactic processing (Fine et al, 2013; Kaschak & Glenberg, 2004; Ryskin et al., 2017).
- But what determines to what level of the predictive process an unexpected observation is attributed?



Adaptation to Garden-path Sentences

Garden-path Sentences: Longer reading times for the disambiguation region when it does not confirm the expected parse (e.g. a **Relative Clause** parse when expecting a **Main Verb**)

- a) The experienced soldiers warned about the dangers **before the midnight** raid. (MV / Ambiguous)
- b) The experienced soldiers warned about the dangers **conducted the midnight** raid. (RC / Ambiguous)
- c) The experienced soldiers spoke about the dangers **before the midnight** raid. (MV / Unambiguous)
- d) The experienced soldiers who were warned about the dangers **conducted the midnight** raid. (RC / Unambiguous)

Garden-path (GP) Effect: Structure (MV vs. RC) * Ambiguity (Ambiguous vs. Unambiguous)

Adaptation in Garden-path Sentence Processing: With increasing exposure to RCs, the GP effect on RCs decreases.

Adaptation Effect: GP Effect * Item Order (number of critical trials read so far)

Predictions

Question: Do only syntactic expectations change or can comprehenders condition lexical expectations on these adapted syntactic expectations?

Exp. 1:

- Critical sentence (MV or RC) disambiguated with **different** words so that prediction error can only lead to adjustment at the level of syntactic processing.

Prediction:

- Adaptation will more likely occur for second-pass but not first-pass reading times.

Exp. 2&3:

- Critical sentences (MV or RC) disambiguated with **same** words ('and' & 'became' in 2; 'before' & 'became', in 3).

Prediction:

- If comprehenders can adapt syntactically-conditioned lexical expectations → adaptation of first- and second-pass reading times
- If not → only adaptation of second-pass reading times

Discussion

- Replicated (three times) syntactic adaptation during natural reading → **syntactic adaptation not artifact of self-paced reading**
- Even when prediction error informative about lexical statistics → **no adaptation of first-pass reading times**
- Why?
 - First-pass measures less malleable (but see Yan & Farmer, 2015);
 - Lexical expectations are not adaptive (unlikely: Creel et al, 2008, Yan & Farmer, 2015)
 - Syntactically-conditioned lexical expectations are not adaptive either because
 - There are limits to adaptation (tractability)
 - The utility of such adaptation is low (low informativity, or variance in informativity, of syntactically-conditioned lexical expectation)
- Future directions:** will increase in the need to rely on top-down predictions (e.g. with degraded stimuli) lead to adaptation in lexical/pre-lexical processing emerge with the same paradigm?

Exp. 1: Not Repeating Words of Disambiguation

The experienced soldiers ...

- ... (a variety of lexicalization)... (MV / Ambiguous)
- ... (a variety of lexicalization)... (RC / Ambiguous)
- ... (a variety of lexicalization)... (MV / Unambiguous)
- ... (a variety of lexicalization)... (RC / Unambiguous)

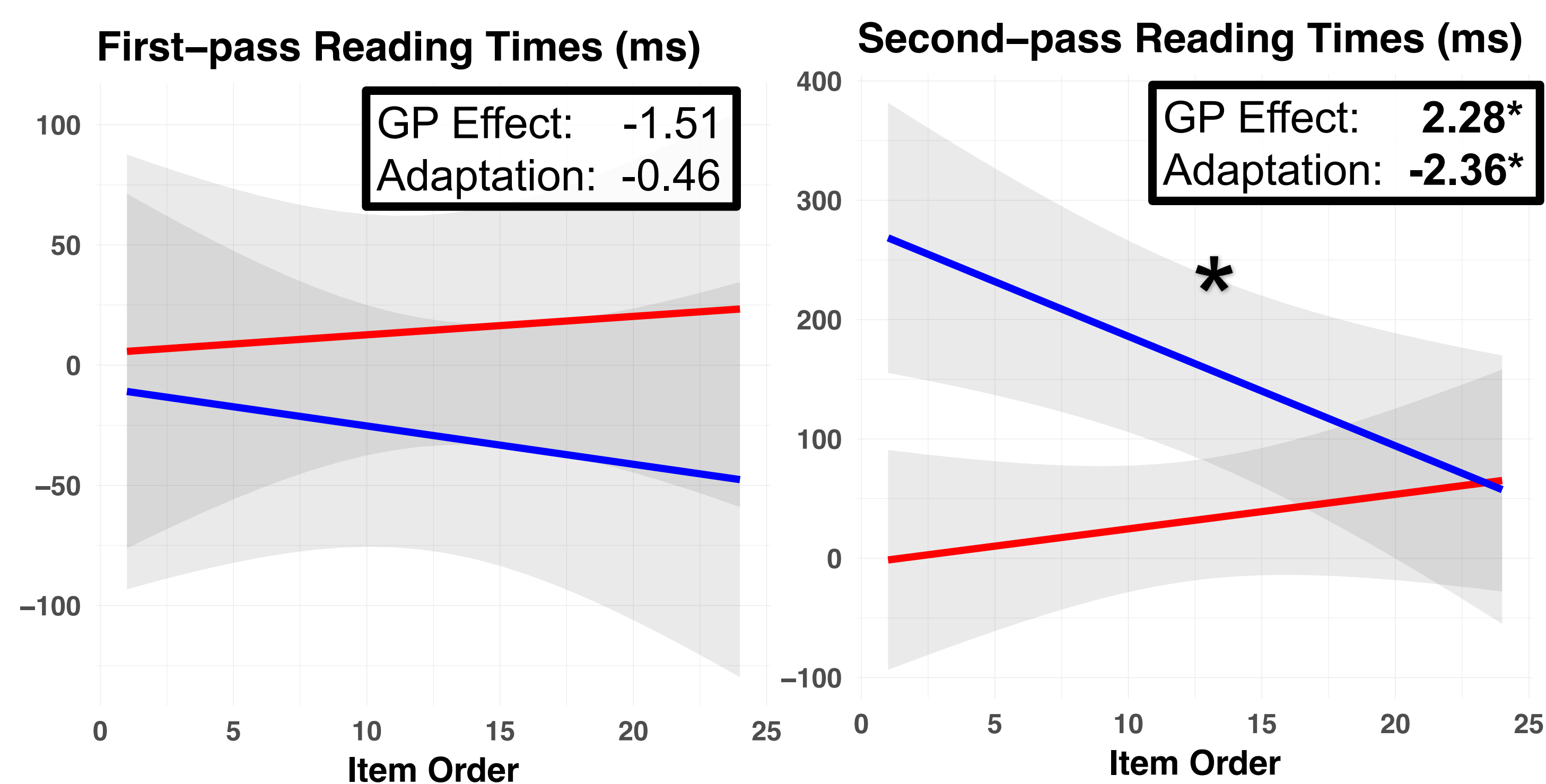


Figure 1: Ambiguity effect on disambiguation region by Structure as a function of Item Order (Adaptation effect). (*, p < .05, **, p < .01). Analyses on words of disambiguation exhibit the same pattern.

Exp. 2: Repeating Words of Disambiguation ('became' & 'and')

The experienced soldiers ...

- ... **and** returned to camp. (MV / Ambiguous)
- ... **became** worried about them. (RC / Ambiguous)
- ... **and** returned to camp. (MV / Unambiguous)
- ... **became** worried about them. (RC / Unambiguous)

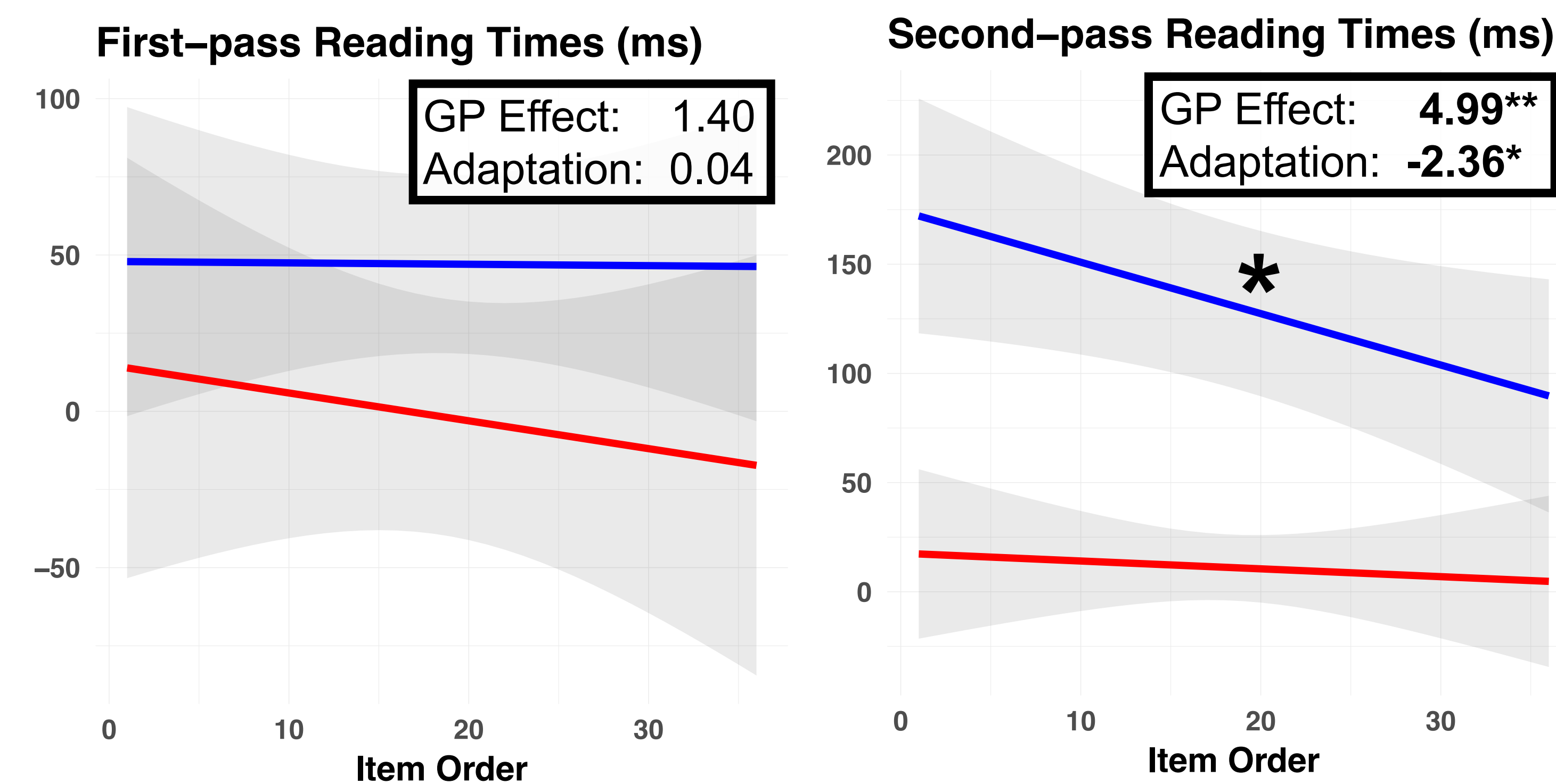


Figure 2: Ambiguity effect on words of disambiguation ('became' & 'and') by Structure as a function of Item Order (Adaptation effect). (*, p < .05, **, p < .01).

Exp. 3: Repeating Words of Disambiguation ('became' & 'before')

The experienced soldiers ...

- ... **before** the midnight raid. (MV / Ambiguous)
- ... **became** worried about them. (RC / Ambiguous)
- ... **before** the midnight raid. (MV / Unambiguous)
- ... **became** worried about them. (RC / Unambiguous)

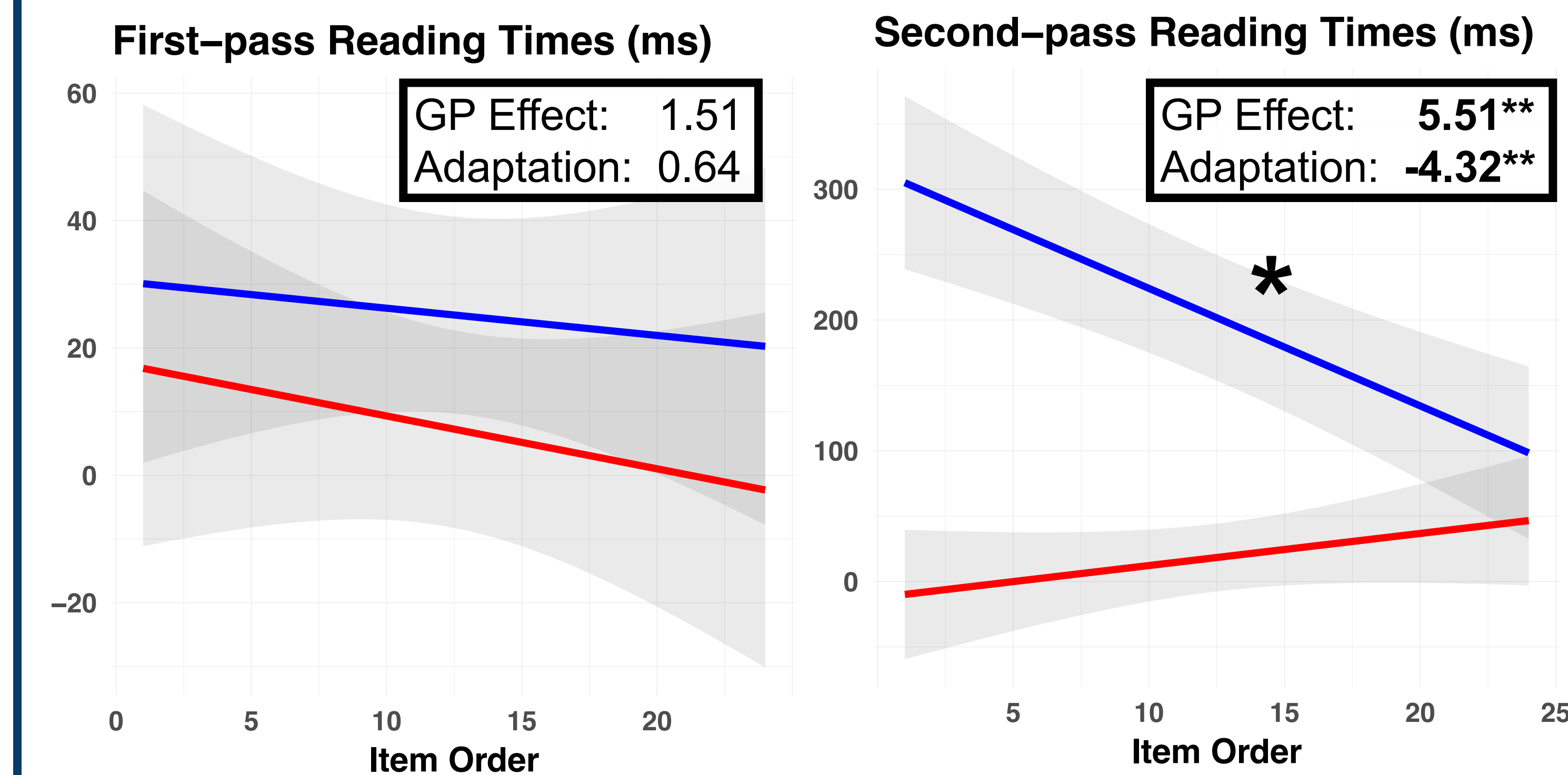


Figure 3: Ambiguity effect on words of disambiguation ('became' & 'before') by Structure as a function of Item Order (Adaptation effect). (*, p < .05, **, p < .01).

24 Critical Trials, 72 Fillers, 93 Subjects

Main Verb

Relative Clause