The (non-) satiation of P600/SPS effects to distinct grammatical violations

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In a nutshell

We find no evidence of complete satiation in the heterogeneous design, though there may be evidence of a subtle "weakening" of the P600/SPS effects over the course of the experiment. This suggests that the reanalysis processes to distinct violations are at least partially violation-specific, and that the P600/SPS is not just an index of "general" reanalysis.

Introduction

- The P600/SPS has historically been interpreted as an index of reanalysis.
- Hahne & Friederici (1999) have shown that P600/SPS effects disappear with extreme repetition (a "satiation" effect), specifically 80% violation and 20% non-violation in the experiment, but only with a single violation type.
- Gouvea et al. (2010) have shown that P600s to distinct types of reanalysis show subtle differences in latency and scalp distribution.
- We want to know if distinct violation types will satiate one another in an experiment with 80% heterogeneous violations. We test phrase structure violations, agreement violations, and semantic P600 violations.

Materials & Method

Violation Type	Example
Phrase Structure	*The boys enjoyed Ed's about stories the battle.
Agreement—Type 1	*The agents discovers Fred's tobacco from Cuba.
Semantic P600	*The hearty meal was devouring by the kids.

- We focused on three distinct violation types, each taken from the P600/SPS literature (Neville et al. 1991, Newman et al. 2007, and Kim & Osterhout 2005, respectively).
- Our overall goal of the design was to have **80% violation** at every "time block" in the experiment.

	Time Block 1	Time Block 2	Time Block 3	Total Items
No. of Phrase Structure	**30**		**30**	**60**
No. of Agreement – Type 1	**6**	**18**	**6**	**30**
No. of Semantic P600		**24**	**8**	**32**
No. of Case	6	18	6	30
No. of Subjacency	6	18	6	30
No. of Agreement – Type 2		66		66
No. of *Controls* for Phrase Structure/Agreement – Type 1	12	12	6	30
No. of *Controls* for Semantic P600		24	8	30
Total No. of Test Items	60	180	70	310
No. of Violations	48	144	56	248
No. of Controls	12	36	14	62
Ratio of Violations to Control	**80%/20%**	**80%/20%**	**80%/20%**	**80%/20%**

Pre/Pose design for the phrase structure violations:
- Of the 60 total phrase structure violation items, the first half of the items were concentrated at the beginning of the experiment (i.e. Time Block 1) and the latter half were at the end (i.e. Time Block 3).
  - Time Block 2 contained violations and filler items that were *not* phrase structure violations.
- **If satiation occurred** for the phrase structure violations and was maintained throughout the experiment, we should expect to see no P600/SPS-like effects for the phrase structure violations in Time Block 3 when compared to the phrase structure violations in Time Block 1.

Results

Complete satiation did not happen

- The plots below show difference waves between violations and their grammatical controls at Pz with 95% bootstrap confidence intervals (i.e. the shaded area).
- P600/SPS-like effects can be seen within the red box as a positive deflection after 600 ms.
- For the phrase structure violations, there are two difference waves for the first 30 items (in red) and the last 30 items (in blue).
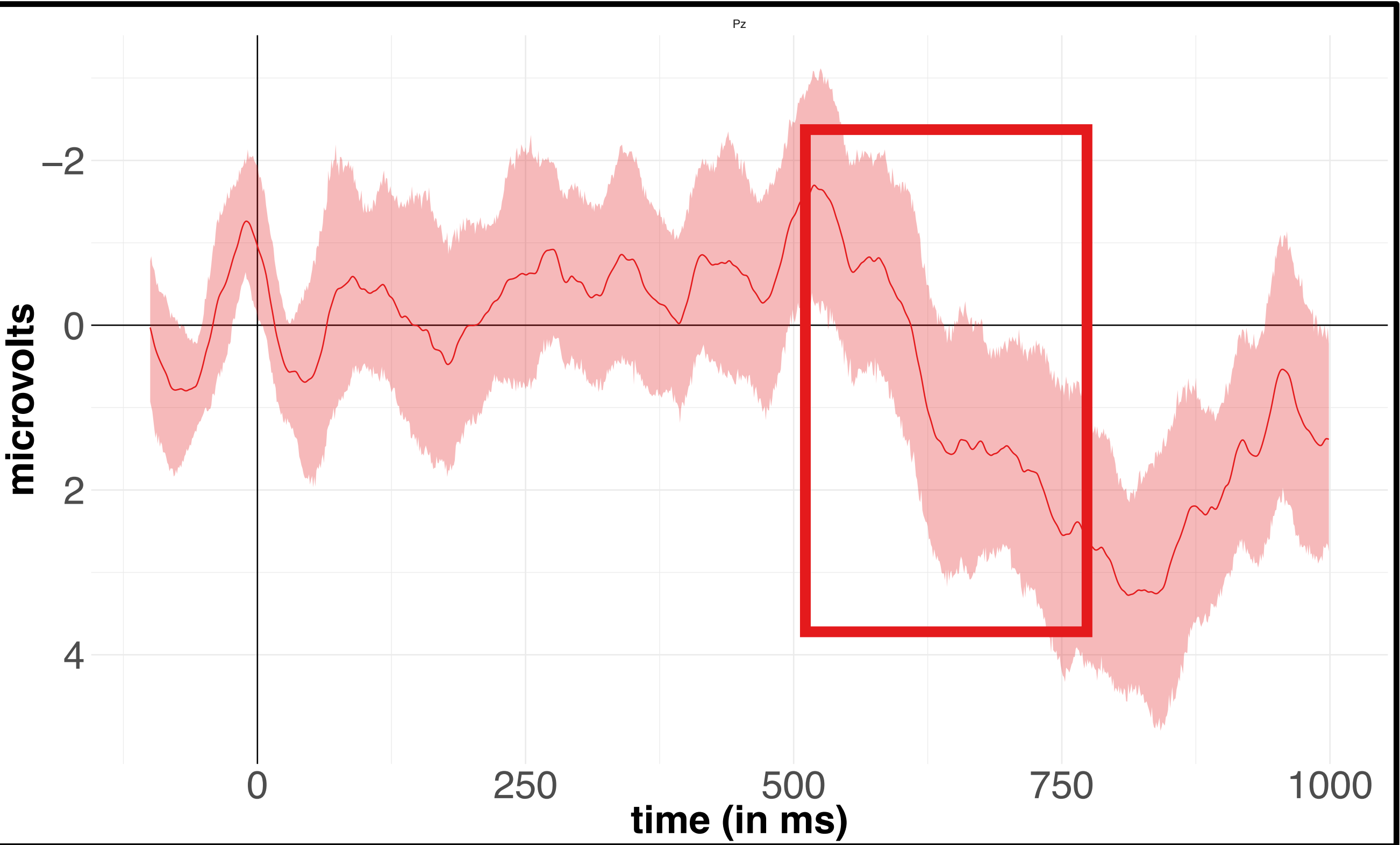 - Both difference waves show P600/SPS-like effects in the red box.
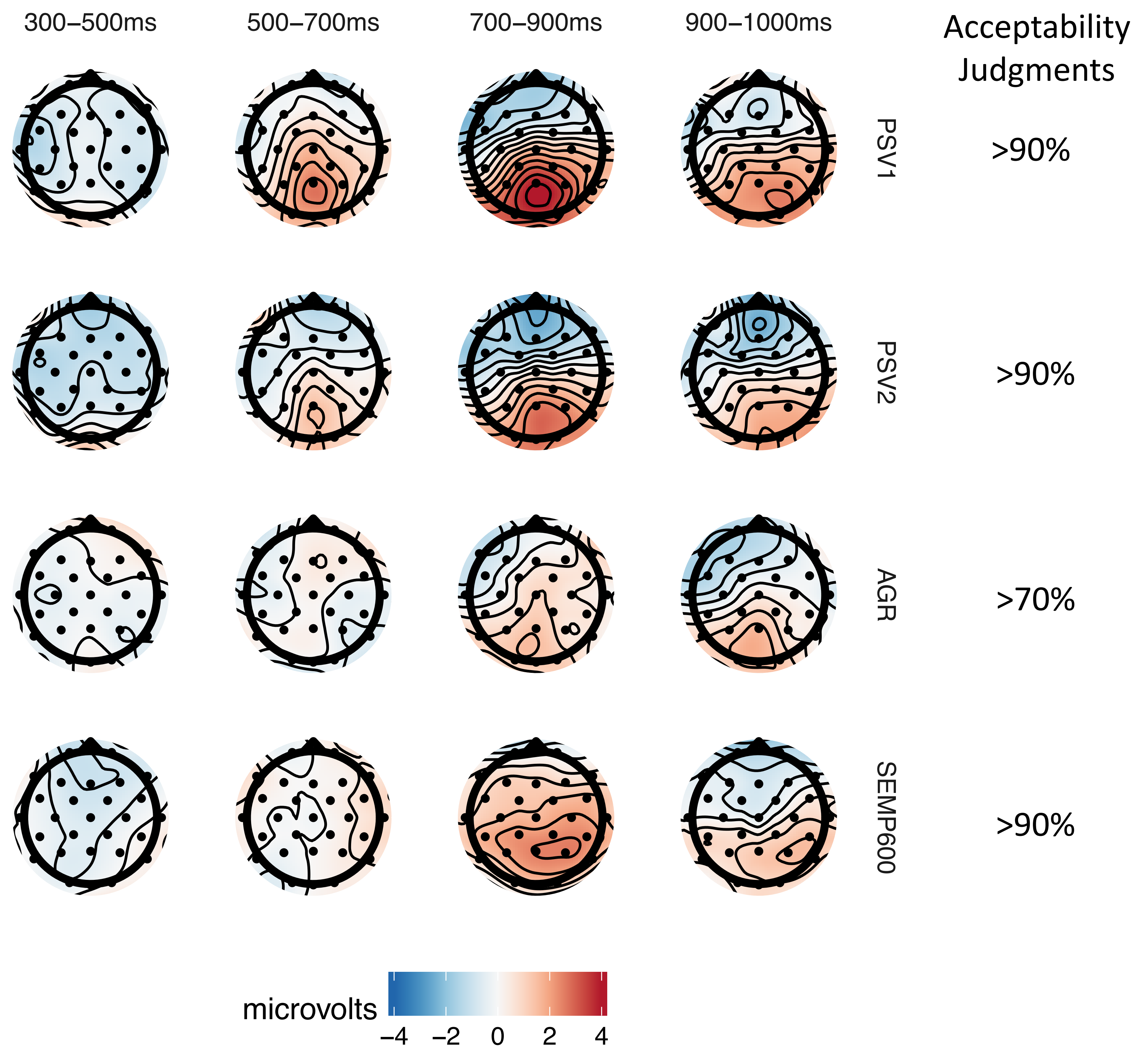
phrase structure violations
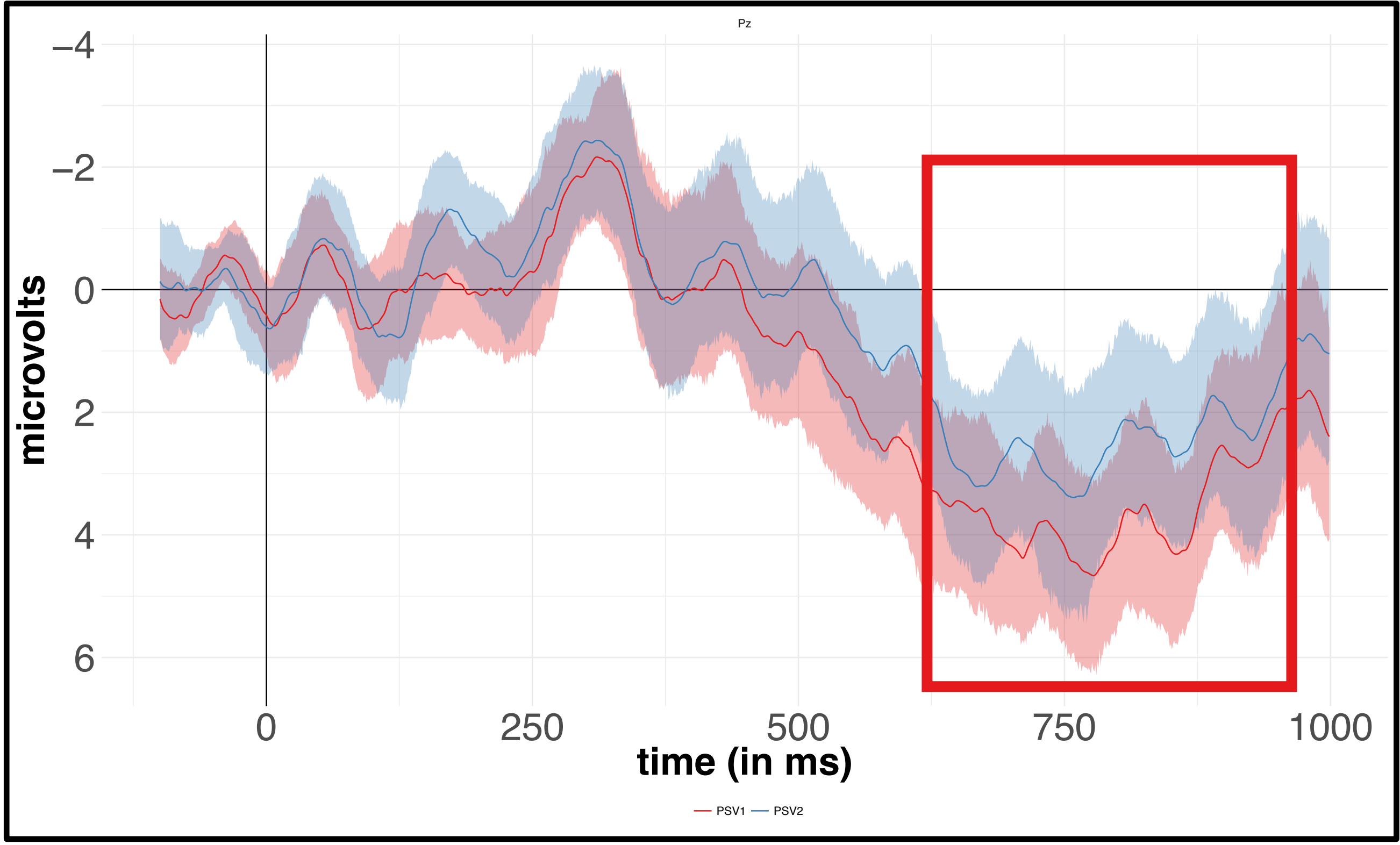
agreement violations
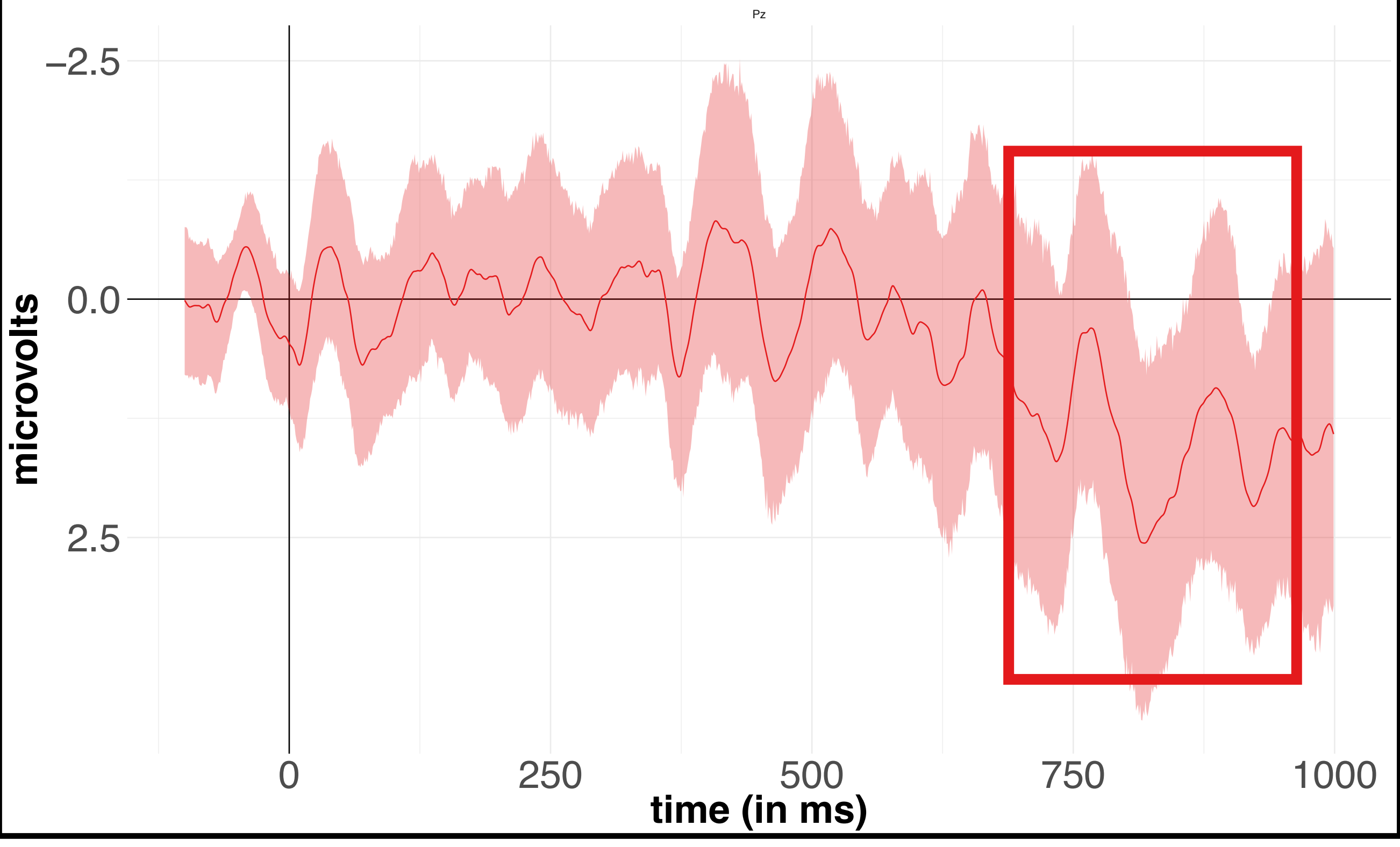
semantic P600 sentences

P600/SPS effects were distinct across conditions

- The figure above show scalp maps for the conditions of interest.
  - This is intended to compare the scalp distribution of the P600s.
- P600/SPS-like effects were observed for the phrase structure violations, agreement violations, and semantic P600 sentences.
  - Pre-test (PSV1) and post-test (PSV2) phrase structure violations have P600/SPS-like effects that are similar in latency and scalp distribution.
  - Semantic P600 sentences have P600/SPS-like effects that have a broader scalp distribution.
  - P600/SPS-like effects elicited from agreement violations appear weakest compared to the other violation types.
- Acceptability judgments were recorded for every test item and the percentage of correct responses are show to the right of the scalp maps.

General Discussion

- We found P600/SPS-like effects for all three violation types, suggesting that distinct violations do not satiate in a heterogeneous context.
- Also, these results suggest that the P600/SPS effects to phrase structure violations, agreement violations, and semantic P600 sentences are distinct in all possible dimensions: **satiation**, **latency**, and **scalp distribution**.

Conclusion

- If the P600 is an indicator of syntactic revision, then this is evidence for distinct violations triggering distinct reanalysis processes.
- Our methodology also shows that we can only use homogeneous designs to study satiation effects. This limits the ability to differentially satiate violations –e.g. potentially revealing semantic P600 sentences to be N400/P600 complexes.