

In a nutshell

Question: Is the Late Positive Component (LPC) an index of **phonotactic rule learning** or is it dependent on semantic information?

Results: We do not find any LPC found in previous studies of phonotactic rule learning.

Conclusion: Pure phonotactic rule learning (no semantic information) does **not** elicit an LPC.

Theoretical Background

Artificial grammar learning (AGL) studies have been widely used for testing the learnability of phonological agreement patterns.

Domahs et al. (2009) and Moore-Cantwell et al. (forthcoming) reported a higher amplitude Late Positive Component (LPC) to novel words that violated a learned phonotactic constraint than novel words that satisfied it.

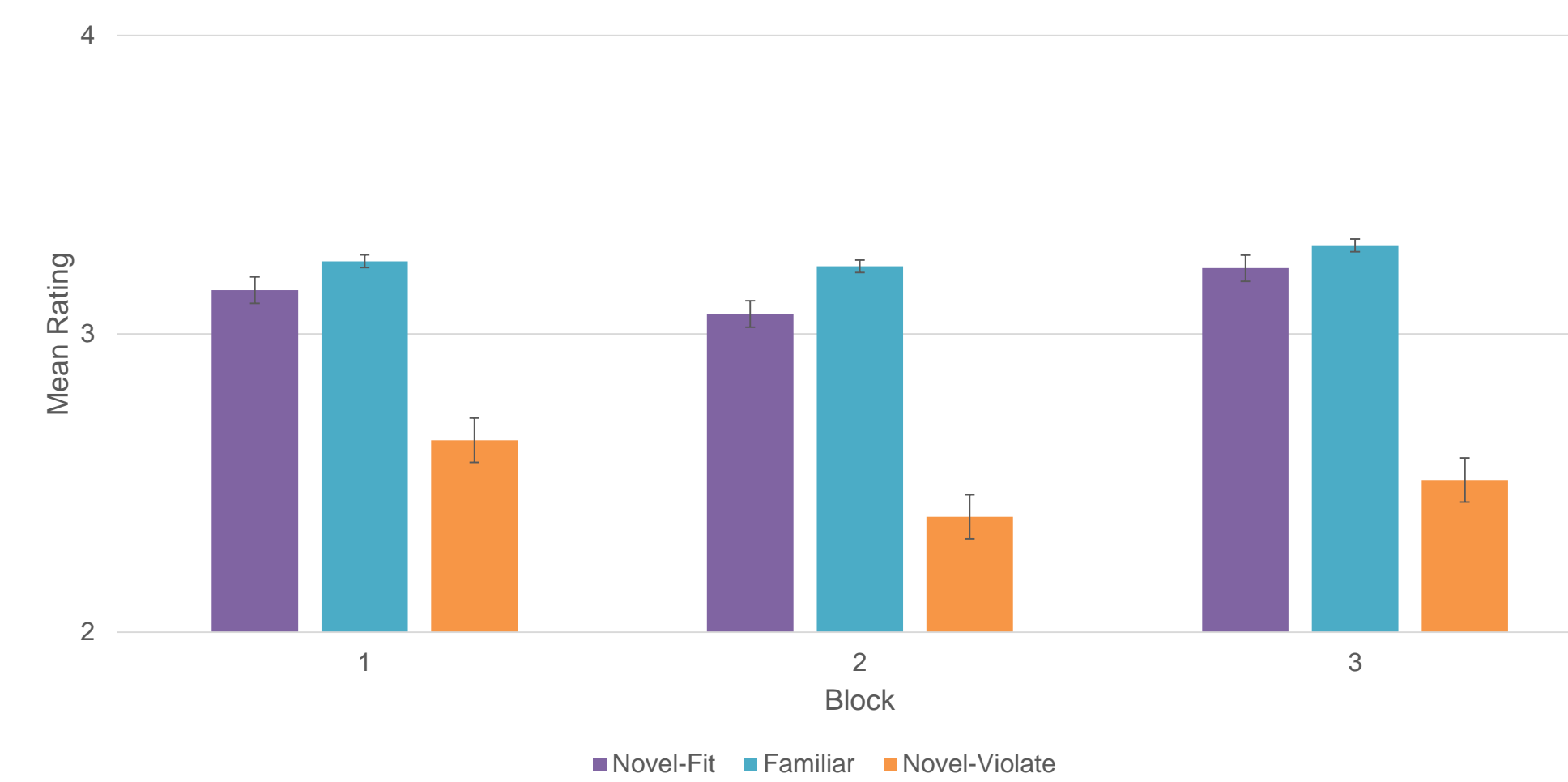
The LPC has been reported in response to violations of many kinds of long-distance sequencing rules, both syntactic and phonotactic.

However, previous AGL studies have conflated long-distance rules with semantic information.

Study Aim: To observe an LPC to a phonotactic rule violation in the absence of semantic information

Results

Judgement Task

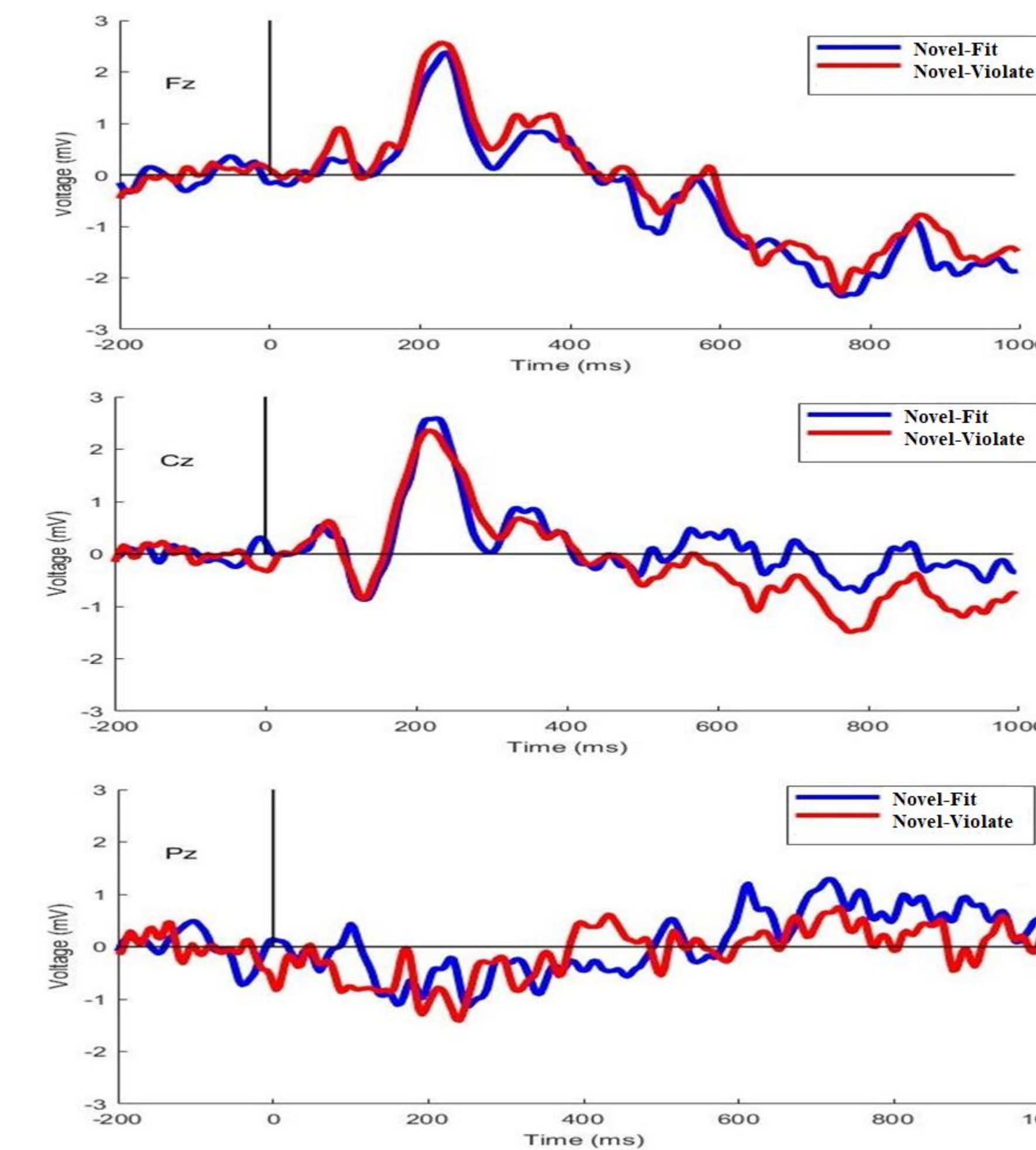


Mean values were compared in a repeated-measures analysis of variance (ANOVA) with the two factors: Block (three levels: 1,2,3) and Type (three levels: Familiar, Novel-Fit, and Novel-Violate).

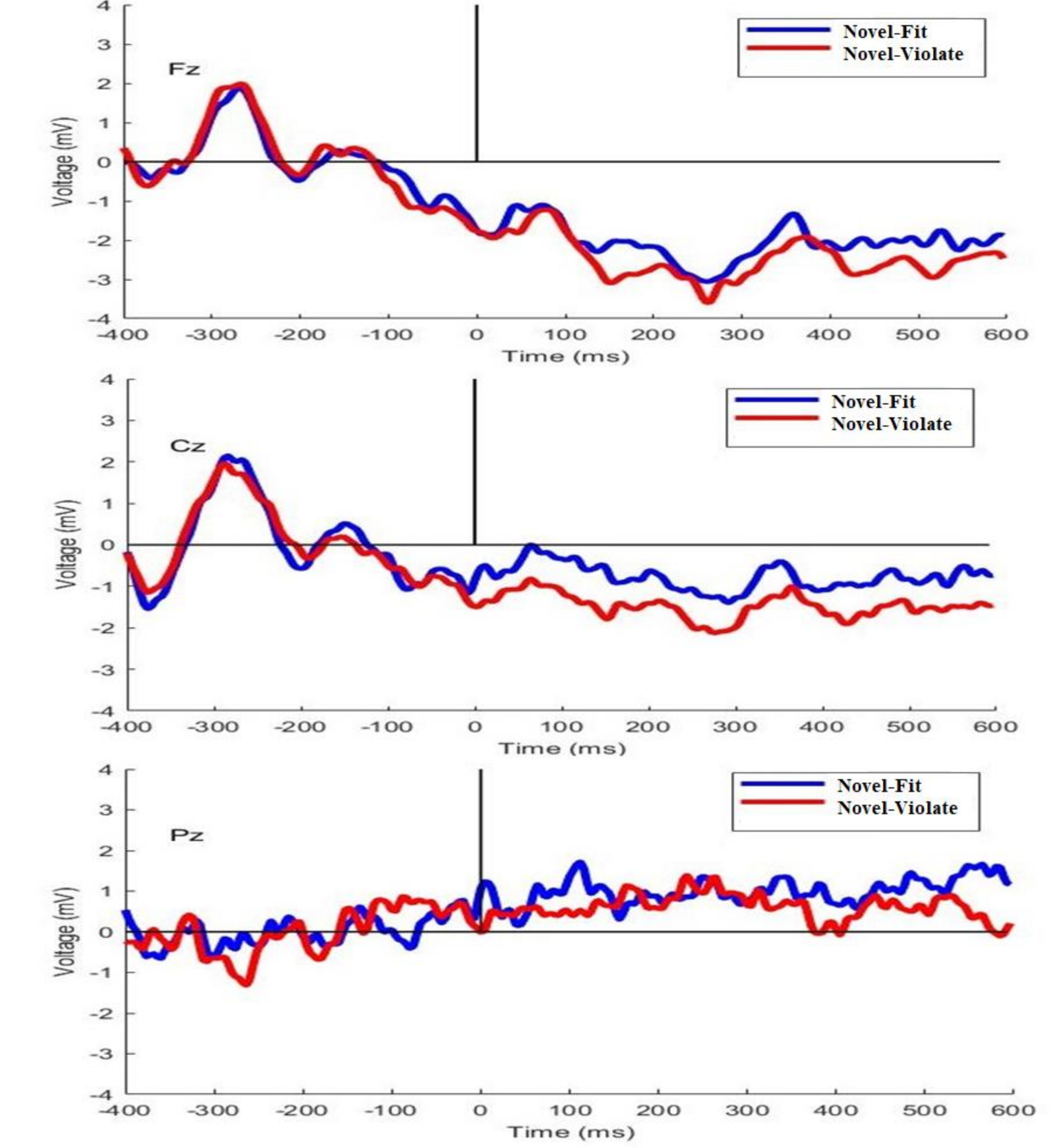
ANOVA results showed that mean ratings were significantly affected by the Block, $F(1,14)=5.521, p=.018, 1-\beta=0.756$; and significantly affected by the Type, $F(1,14)=10.294, p=.002, 1-\beta=0.958$.

Pair-wise comparisons revealed **significant differences** in ratings of novel-fit words ($3.144, SE=.089$) vs. novel-violate words ($2.513, SE=.117, p=.007$); and familiar words ($3.256, SE=.083$) vs. novel-violate words, $p=.002$.

Stimulus-Locked



Violation-Locked



We used difference waves as the input to the PCA, in order to focus on the temporal and spatial fluctuations of each wave form. Results have shown that there was **no significant amplitude difference** between novel-fit and novel-violate words, $t(14)=0.474, p>0.05, d=0.122, 1-\beta=0.11$.

Artificial Grammar Learning: Methods

Subjects: 15 native English speakers

Stimuli: CV.kV.CVC.

- C: [s, j]
- V: [a, e, o, i, u]
- Ex: *sakisos, sakifos*

Procedure: Experimental condition consists of two phases: Training and Testing.

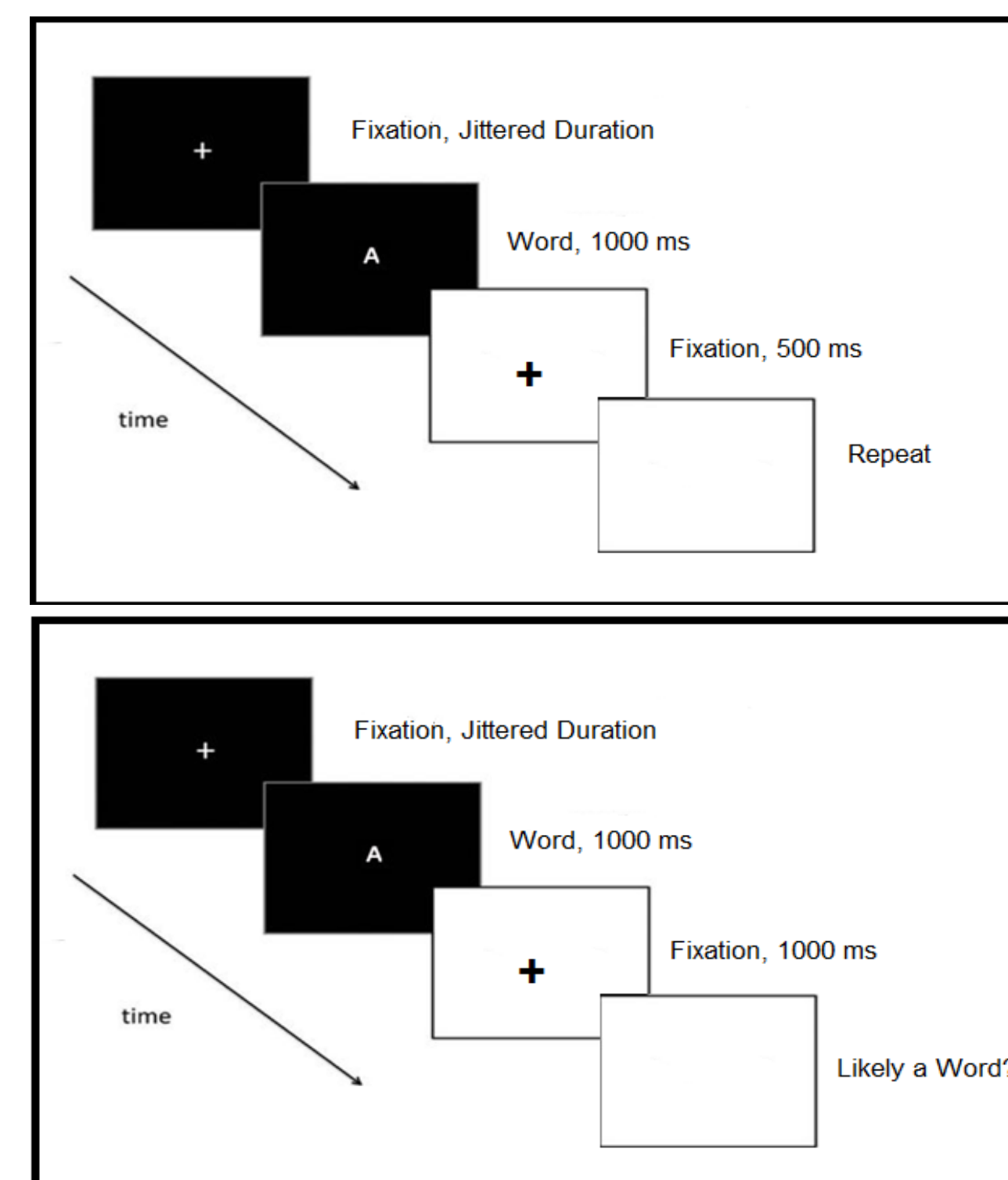
Training:

- Listen and Repeat.
- 40 words presented 5 times each in random order (200 trials).
- Duration: 15 mins

Testing:

- Rate how likely it is that each word is part of the language they were learning.
- 60 words (20 each of Familiar, Novel-Fit, and Novel-Violate) presented in random order.
- Duration: 5 mins

Training block – test block sequence was repeated 3 times for a total of 600 training trials and 180 test trials (60 of each type).



Apparatus:

- E-Prime v. 2.0.10.356
- Geodesic Hydrocel 128
- EGI Net Station software v.4.5

Data Acquisition:

- Segment: -200ms to 1000ms, time-locked to stimulus onset and violation point
- Electrode impedances: 50 kΩ
- Sampling: 250 Hz
- Reference: linked mastoids
- Filter: 0.3-40 Hz band-pass

Post-processing:

Artifact corrected and averaged in Dien's ERP PCA toolbox.

Discussion & Conclusion

We aimed to observe an LPC to a phonotactic rule violation in the absence of semantic information. Our behavioral results show that participants were able to make a distinction between novel-fit and novel-violate words.

However, once syntactic and semantic components are excluded from training, the LPC is not elicited in response to novel words violating the phonotactic pattern. In fact, a late positive component was entirely absent from the data.

The results indicate LPC is NOT purely a response to violations of phonotactic (non-local sequencing) rules, it depends on semantic integration.

References

- Domahs, Ulrike, W. Kehrein, J. Kraus, R. Wiese, and M. Schlesewsky. (2009). Event-related potentials reflecting the processing of phonological constraint violations. *Language and Speech* 52: 415–435.
- Moore-Cantwell, Claire, J. Pater, R. Staubs, B. Zobel and L. Sanders. (forthcoming). Event-related potential evidence of abstract phonological learning in the laboratory.