

L2 accent effect in the processing of grammatical and phonological errors: A German-Polish ERP study

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Recent ERP studies revealed reduced neurocognitive responses towards language incongruencies embedded in L2 accented speech, e.g. [1, 2, 3]. Although the L2 accent's impact on the processing of grammatical and phonological violations has been investigated, no ERP study, to the best of our knowledge, has incorporated both violation types in a single experiment. Behavioral evidence suggests a difference in their impact on the perceived accent strength [4, 5]. Such differences might also be reflected in the EEG signal. The current study focuses on the P600 component, which is assumed to reflect late processes of language analysis and repair usually reported for morpho-syntactic violations [6, 7], and sporadically for violations of phonotactic rules [8] or unexpected phonology [9]. We investigate potential differences between grammatical and phonological violations in this time window. Based on current research, we predict a less pronounced P600 effect for grammatical violations when embedded in L2 accented speech. The influence of L2 accent on the processing of phonological substitutions might be different.

To test our predictions, we conducted two same-structured experiments for German and Polish. Sentences were produced by bilingual speakers (L1 German/L2 Polish, L1 Polish/L2 German). Stimuli of the L2 condition were marked by subtle accentual variation across the whole utterance. On top of that, stimuli of both accent types contained (i) well-formed sentences, (ii) sentences with a grammatical violation, and (iii) sentences with a phonological vowel substitution. All violations included were typical for the respective group of L2 learners. German stimuli of violation type (iii) contained the substitutions /e/→[ɛ], /o/→[ɔ], and /y/→[i]. For Polish sentences, /ɛ/→[e], /ɔ/→[o], and /i/→[y] were introduced. All stimuli were of comparable lengths and followed the same syntactic structure, see Example 1 and 2. Participants (28 German, 27 Polish) listened to sentences and performed a grammaticality judgment task. Here, we narrow our focus to the P600 time window, which was set to 800-1200 ms after critical vowel onset, where divergent effects for the two violation types may occur. The inconsistency between the determiner and noun (ii) becomes apparent starting from the onset of the noun. We adjusted the trigger to align with the critical vowel onset, ensuring its consistency across all conditions. We fitted mixed-effects regression models [10] with the mean EEG amplitude (averaged within the time window) as a dependent variable. Fixed effects consisted of Accent (L1, L2), Sentence Type (well-formed, grammatical, phonological), ROI (frontal, central, parietal) and Experiment Half (first, second), and all interactions between them. Random structure was added as well. Significant interactions were investigated using planned contrasts [11].

In the German experiment, the results indicate a significant interaction between all fixed factors ($W(2)=9.813$, $p=.007$) for the P600 window. An increased positivity was produced by both grammatical ($z=-2.906$, $p=.003$) and phonological ($z=-2.749$, $p=.006$) violations in the L1. The effect emerged only in the second experiment half and only over the parietal ROI. It disappeared for L2 accented speech (Fig. 1). For Polish we found a significant interaction between Sentence Type, Accent, and Experiment Half ($W(2)=6.998$, $p=.03$). Contrasts revealed a significant effect of grammatical ($z=-2.134$, $p=.033$), but not phonological violation in the L1 accented condition. The effect was present only in the first half of the experiment (Fig. 2). No other contrast was significant for the P600 window.

In summary, our results indicate that a P600 effect was elicited by both phonological and grammatical violations in the German experiment (second half), but only by grammatical errors in the Polish experiment (first half). In both experiments, the effect was absent when violations appeared within L2 accented speech, which is consistent with previous studies on grammatical violations [1, 2, 3], and points to potentially reduced error sensitivity and limited repair processes in L2 speech. Furthermore, our results point to a divergent processing of phonological errors between the languages. Potential explanations include that German participants might have more experience with segmental variation (dialects, sociolects, and ethnolects). Another possibility lies in the distinct patterns of vowel substitutions (tense-lax, lax-tense) between the languages.

Example 1. Example of a German sentence triple: “Lena befragt die Lehrerin zu ihrem Fehler in der Klausur.” (“Lena asks her teacher about her mistake in the exam.”)

- | | | |
|---|--|---|
| (i) well-formed | (ii) grammatical violation | (iii) phonological substitution |
| ... zu ihrem Fehler ... | ... zu ihrer Fehler ... | ... zu ihrem F[e]ler ... |
| about her _[masc] mistake _[masc] | about her _[fem] mistake _[masc] | about her _[masc] mistake _[masc] |

Example 2. Example of a Polish sentence triple: “Zbigniew opowiada anegdoty o swoim szefie w trakcie spotkania.” (“Zbigniew tells anecdotes about his boss in the course of the meeting.”)

- | | | |
|--|---|--|
| (i) well-formed | (ii) grammatical violation | (iii) phonological substitution |
| ... o swoim szefie ... | ... o swojej szefie ... | ... o swoim sz[e:]fie ... |
| about his _[masc] boss _[masc] | about his _[fem] boss _[masc] | about his _[masc] boss _[masc] |

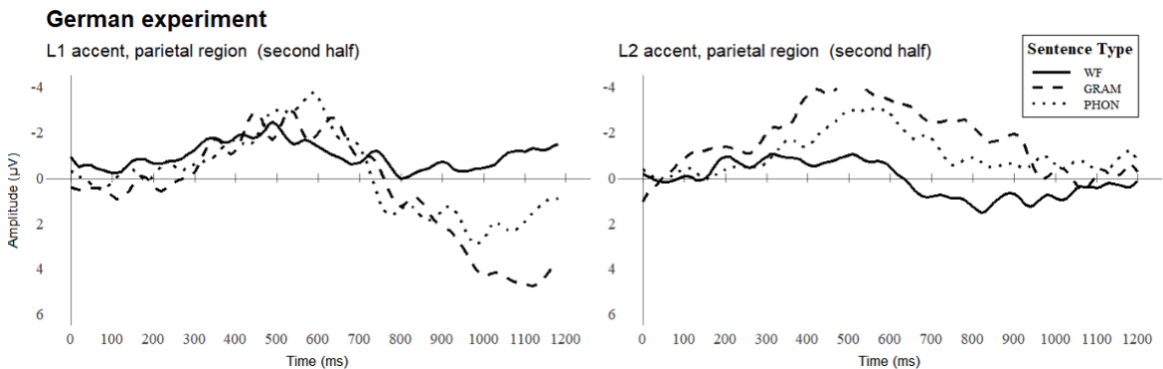


Fig. 1. Grand average plot (parietal ROI)

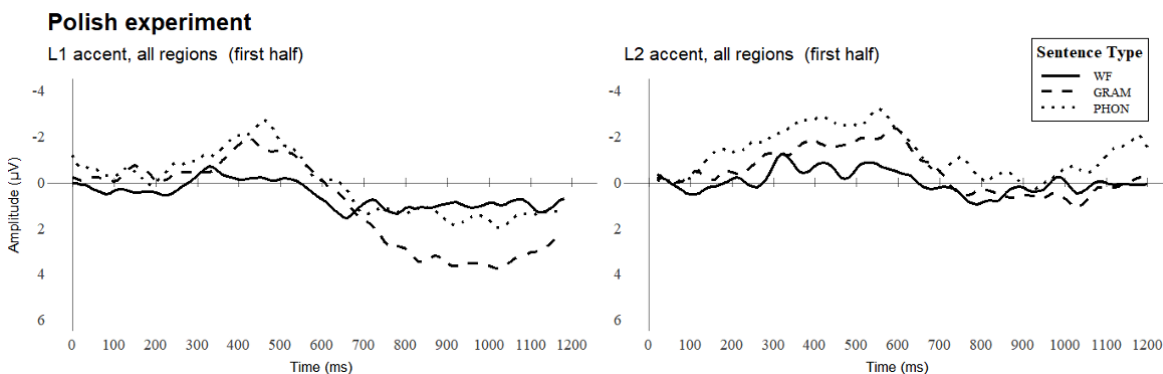


Fig. 2. Grand average plot (all ROIs)

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