

## Impact of learning setting on phoneme processing in multilinguals: an ERP study

**Keywords:** event-related potentials (ERP), mismatch negativity (MMN), phonology, speech perception, L3 acquisition

Several ERP studies have manifested that phoneme discrimination is less accurate in non-native when compared with native languages (e.g., Diaz et al., 2016; Liang & Chen, 2022; Peltola et al., 2012; Winkler et al., 1999). However, no study to date has examined the differences in pre-attentive phonological processing between the first foreign language (L2) and the additional one(s) (L3/Ln). In order to bridge this gap, we conducted two event-related brain potentials oddball studies with native Polish learners of English (L2) and Norwegian (L3/Ln). While the first study involved formal L2 and L3/Ln learners, the other one was conducted among naturalistic language learners. This mirror design enabled us to investigate the influence of learning setting (instantiated as formal or naturalistic) on non-native phoneme perception.

We examined the mismatch negativity (MMN) component which is assumed to reflect ease of phonemic discrimination (Näätänen et al., 1997) to test potential differences in the two non-native language phoneme perception as opposed to L1 as well as in the L3/Ln as opposed to L2. Importantly, we compared the effects in formal and naturalistic learning settings. Language-specific vowel contrasts were used in each of the investigated languages: /i/-/ɛ/ in L1 Polish, /ɪ/-/ʊ/ in L2 English and /i/-/ʏ/ in L3/Ln Norwegian.

A linear mixed effects analysis revealed a statistically significant three-way interaction between language (L1/L2/L3), sound (standard/deviant) and learning setting (formal/naturalistic) ( $\chi^2(7) = 101.91; p < .001$ ). In the case of formal learners, we observed a graded amplitude of the mismatch negativity (MMN): the effect was the largest in L1 Polish, smaller in L2 English, and the smallest in L3/Ln Norwegian. In the case of naturalistic learners, however, no statistically significant difference was observed between L1 Polish and L2 English ( $p = .0521$ ), with the remaining between-language comparisons yielding statistically significant results (all  $p$ -values  $< .01$ ). Such findings suggest that foreign language status (operationalized as L2 vs. L3/Ln) may modulate early auditory processing and that learning setting should be considered a crucial factor influencing the pre-attentive perception of phonemic contrasts.

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