Accent adaptation through error-based learning

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The ability of listeners to adapt to native accented speech (e.g., Maye et al., 2008), as well as foreign-accented speech (Bradlow & Bent, 2008), points to a high degree of flexibility in our speech perception. While the ability to adapt may be evident, the question of how listeners are able to adapt to accents so rapidly is still largely unanswered. It has been suggested that top-down knowledge (e.g., lexical knowledge) can guide accent adaptation (e.g. Norris et al., 2003). However, in the absence of sufficient context or linguistic information, for example in short and isolated utterances, other mechanisms must be at play. Language users monitor their errors internally to correct them and decrease their occurrence in the future. Because accented sounds can deviate starkly from the norm, how they are perceived is challenging and prone to errors. We thus suggest that one form of accent adaptation can be understood as being the development of specific internal error monitoring. We examined if accent adaptation can be explained in terms of feedback-driven error-based learning.

We created a novel accent which shifted various vowels downward, and applied it to a list of monosyllabic, highly frequent Dutch words (e.g.,'blik' /blɪk/ sounded like 'bluk' /blʏk/). Dutch native participants listened to the resulting accented words as a part of a 2AFC task, which asked them to decide which word on screen matched the accented auditory stimulus. Visually presented items always included a target ('blik') and distractor ('bleek') that formed a minimal pair. The task comprised two types of trials: accented words were either non-words (training), or sounded like actual Dutch words (test). Furthermore, in a proportion of test trials, the distractor word on screen was identical to the form of the auditory stimulus, resulting in error-prone items that allowed us to test how well participants had adapted to the accent. The task included 3 rounds, each consisting of 2 blocks (training block and mixed block, presenting only training items, and all items respectively), and participants received explicit feedback on their performance, such that they could learn from their mistakes. Using EEG, we measured participants' error detection as reflected by the error-related negativity (ERN). The ERN reflects internal error monitoring (Gehring et al., 2012).

Participants responded faster and their performance improved quickly in the course of the experiment (see Figure 1). Test items generally triggered more errors than training items. Test items with a distractor identical to the auditory stimulus led to more errors only in the first block. Moreover, the electrophysiological results (see Figure 1) show that initially the difference between response-locked negativities for correct and incorrect responses (i.e., an ERN effect) was small but significant, and this increased in later rounds. The effect did not differ between training and test items.

This study provides further evidence for the speed and flexibility of accent adaptation. The presence of the ERN effect in the first round demonstrates that internal monitoring develops very rapidly within just a few trials. It also appears robust as it extends to words that mismatch with stored lexical representations (i.e., test items). Moreover, it suggests that its development can be driven by explicit feedback. Taken together our findings support the idea that error-based learning is a mechanism of accent adaptation.

References:

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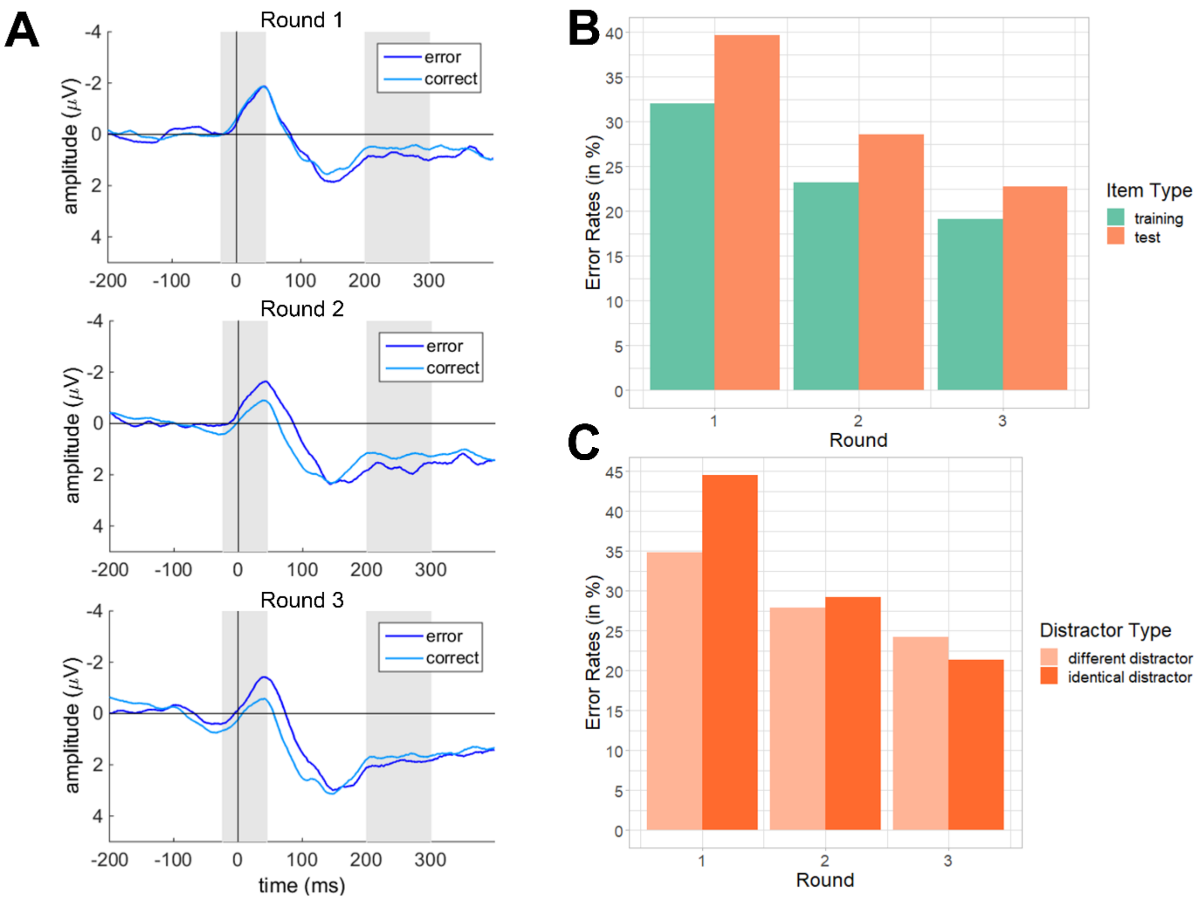

Figure 1. A) Response-locked data for error (ERN) and correct (CRN) responses across rounds at electrode location FCz. Grand averages for a subset of participants (n= 33). Shaded areas indicate the average latency of trough and peak (ERN) and the time window across which the PE was averaged. B) Comparison of error rates across rounds and item types (training vs. test). C) Error rates for test items are further split up to compare the two test item types (test items with distractors identical to the auditory stimulus vs. test items with a different distractor).