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Detection of duration differences in second-language learners and native speakers of a quantity language

Sari Nenonen[1 2], Anna Shestakova[1], Minna Huotilainen[1], and Risto Näätänen[1]
1: Cognitive Brain Research Unit, Department of Psychology, University of Helsinki, Finland
2: Department of Russian, University of Jyväskylä, Finland
sari.nenonen@cbru.helsinki.fi, anna.shestakova@cbru.helsinki.fi,
minna.huotilainen@cbru.helsinki.fi, risto.naatanen@cbru.helsinki.fi

The accuracy in processing of duration changes in speech and non-speech sounds was investigated in school-aged native speakers and advanced second-language learners of a quantity language (Finnish). A quantity language is a language in which the opposition of a short and a long sound is linguistically significant. At the acoustical level, quantity degrees are separated by sound duration, which makes duration a very relevant feature in speech perception of quantity languages.

Accuracy in detecting duration changes was studied by means of mismatch negativity (MMN, see Näätänen 2001 for a review), a component of the auditory event-related potential (ERP), recorded with EEG. MMN reflects the preattentive detection of acoustic changes, including acoustical-categorical changes. Furthermore, its amplitude has been found to closely follow the accuracy in perception of the changes responsible for its elicitation. The speech stimulus used in the present study was a CV-syllable /ka/, pronounced by a native speaker of Finnish, and the non-speech stimulus was a complex tone (components: 500 Hz, 1000 Hz, and 1500 Hz). For both stimulus types, stimulus series consisted of 200-ms standard stimuli and 150-ms deviant stimuli. Deviant stimuli randomly occurred, at 15% probability, among standard stimuli. ERPs to standard stimuli were subtracted from ERPs to deviant stimuli to assess the MMN amplitude.

Statistical analysis (ANOVA) indicated a significant group x stimulus type interaction, $F(1,21) = 4.9$, $p < 0.05$. Post hoc tests further revealed that, for speech-sounds, the MMN amplitude was significantly ($p < 0.05$) higher in native speakers than in language learners, indicating that duration-change detection for this particular stimulus category was more accurate in native speakers. For non-speech sounds, no differences between the groups were observed, implying that the basic ability to detect duration differences was similar in both groups. Consistently, the MMN amplitude for speech sounds was significantly ($p < 0.05$) higher than the amplitude for non-speech sounds only in native speakers. Together, these results indicate that the detection of changes in duration of speech sounds was attuned only in native speakers of a quantity language. Thus, attuning in the detection of speech-sound duration seems to be language-specific.

Näätänen, R. (2001) The perception of speech sounds by human brain as reflected by the mismatch negativity (MMN) and its magnetic equivalent (MMNm). *Presidential address, 1999, Psychophysiology* 8, 1-21.