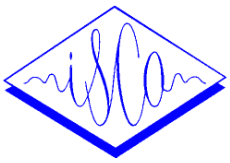

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The processing of slow and fast temporal changes in tri-syllabic consonant vowel pairs and the influence of task effects: Evidence from ERPs

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The auditory detection mechanisms can make use of a high variability of slow and fast changes in envelope, frequency and periodicity in sound encoding. Our aim is to test the sensory and cognitive capabilities in temporal integration and/or segregation of fluent speech by measuring event-related brain potentials (ERPs). We investigated monomorphemic consonant vowel items (CVCVCV) while preserving the naturalness of the human voice. Slow temporal variations in the general envelope were realized through different metrical stress patterns which were produced in relation to initially, medially and finally stressed German nouns. Fast variations in voice-onset were realized by the voicing of the stop consonant beginning a syllable: either a voiced /da/ or an unvoiced /ta/. Onset voicing was the same throughout each item: either /dadada/ or /tatata/. All stimuli were presented binaurally through headphones in an oddball paradigm where the initially stressed item with /da/ served as the “standard” (80% of the sounds) and the stimulus to be compared, the “deviant” (20%), took one of three possible forms: either it was the /da/ item, but with either the medial or the final syllable stressed; or it was the /ta/ item, with the same initial-syllable stress as the standard. That is, the standard and the deviant stimuli differed either in which syllable was stressed (slow variation), or in the voicing of the syllable onsets (fast variation). The task of the subject was either to ignore the sounds (passive) or to count the deviants in mind (active).

The results of the passive condition indicate that the metrical change from initially to medially stressed item (with the first syllable being shorter and the second syllable longer) elicited an enhanced negative ERP in the time window between 200-400 ms after stimulus onset. The metrical change to the finally stressed item, where the first and second syllable remain constant in standard and deviant, elicited no significant effect. The phoneme change alone induced an early negative ERP between 100 and 200 ms after stimulus onset and additionally an enhanced negativity in the time window between 200-400 ms. In the active presentation a large positivity around 300 ms (P300) was observed. This P300, indicating the active discrimination of the stimuli, occured earlier for the fast phoneme change than for the slow metrical change.

In sum, we found that both slow and fast temporal changes influenced auditory processing as indexed by the ERPs. The comparison of the initially vs. medially stressed related potentials seems to reflect the neural representation of differing metrical sequences. Additionally the ERPs reflect the phoneme change in the passive (early negativity) and active condition (faster P300). These findings contribute to current research on searching for the sensory and cognitive ability to disentangle segmental and suprasegmental properties of fluent speech.