Event-Related Potential Correlates of the Amplitude Modulation of Pure Tones: Testing the P-center hypothesis

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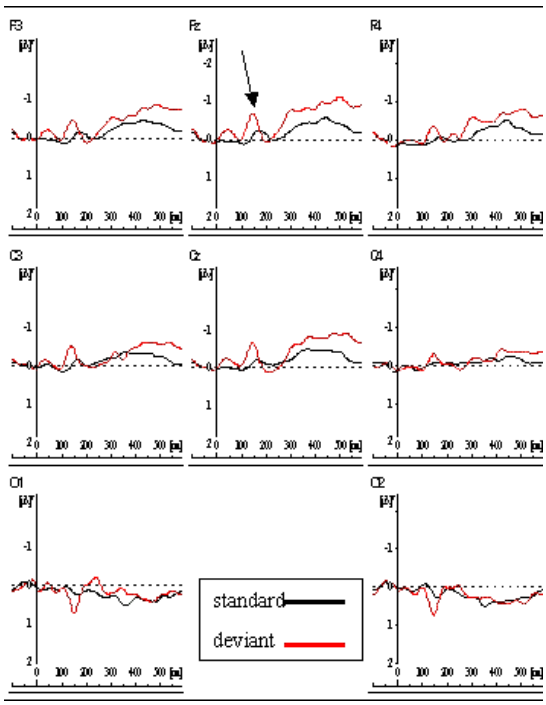
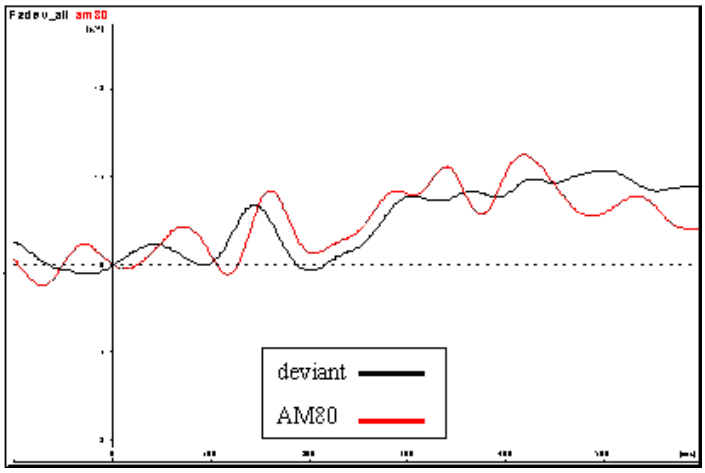
The current study used event-related brain potentials (ERPs) to investigate the neural mechanisms underlying the rise time detection of slow rate amplitude modulation (AM). Goswami et al. (2002) argued that in developmental dyslexia, one of the core difficulties is an inaccurate phonological awareness to rhythmical features of speech. Goswami, based on empirical results, emphasizes the role of the onset-rime, and considers it analogous to the perceptual centers (P-center) of acoustical signs. The P-center hypothesis of developmental dyslexia is the following: the cause of the phonological deficit in DL is the inaccurate perception of the fast changing of onset spectral energy. Goswami developed a model for the perception of P-center: she used amplitude modulated (AM) pure tones, with different onset rise times, and in a study she found that dyslexic children perceive these changing of rise time ("AM beats") significantly less accurately than normal readers.

The aim of our present study was to examine the ERP correlates of the same AM beats. To our best knowledge, there still hasn't been any electrophysiological study on the perception of changing rise time, although this seems to be crucial in detecting onset rimes. The only evidences (see Eggermont, 2001, Wang et al, 2002) are about the depth of AM, or use short and high frequency AM. In contrast, in the our paradigm we use long and low frequency AM tones, which are only modified in their rise times.

We used a pre-attentive discrimination paradigm in which subjects (18 Ss, 6 male, 12 female, mean age: 22 years) listened to a continuous sound pattern consisting of two type of stimulus: one with a rise time of 300 ms (standard), and another with 80 ms (deviant). The deviant stimuli elicited a fronto-central negativity, which was maximal at 150ms after stimulus onset (see figure)



Given the huge between subject variability of the elicited response (in amplitude and in latency) we ran a second study in which we examined the ERP correlates of several AM rise. The results show that the stimuli with a rise time of 80 ms elicited a very similar response to that of the first experiment. That is, in the discrimination paradigm the elicited negativity was not a response to the mismatch of stimuli, but an enhancement of the exogenous ERP components.



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