Perceptual load effects on pre-attentive processing in everyday activities: MMN assessment using mobile EEG

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Studies of selective attention in natural settings have found relatively attenuated ERP components during natural walking in comparison to seated conditions (e.g. Debener, Minow, Emkes, Gandras, & de Vos, 2012). However, some lab-based studies of treadmill walking have found no modulation in ERPs elicited specifically related to walking (e.g. De Sanctis, Butler, Green, Snyder, & Foxe, 2012). Together, such studies indicate that this apparent attenuation is not attributable to walking alone. Based on the perceptual load theory (Lavie, 2010), we propose that this discrepancy between real-world and lab studies is the consequence of greater perceptual load induced by naturalistic surroundings. To test the extent of perceptual load effects, we examined the mismatch negativity (MMN) in typical daily activities in three typical postures; seated, standing and walking in natural settings. This was performed in two experiments, (1) active distraction (goal-oriented), and (2) passive distraction (no-goal). In each, 12 participants had EEG recorded using the mobile SMARTING system (mBrainTrain, Belgrade, Serbia) and were instructed to ignore a two-tone auditory stream while engaged in (1) active tasks (focused attention, high processing load) or (2) passive tasks (observing a video/surroundings, low processing load). Analysis of variance of the MMN was examined within conditions (seated/standing/walking) and between experiments (active/passive). Results found attenuated MMN amplitudes while walking compared to seated conditions, but no variance between experiments. MMN peak latency was earlier under active distraction in comparison to passive distraction, with no differences between conditions. Neither analysis found any interaction of condition and experiment. Collectively, data suggest that perceptual load effects on pre-attentive processing are more pronounced when walking, and are delayed under low loads. These findings demonstrate that mobile EEG can effectively capture cognitive processes during natural navigation, and further lends support for the idea that walking in natural environments induces perceptual load on information processing.

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