

The effect of P300 brain-computer interface matrix size on performance and gaze behavior

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Brain-computer interfaces provide to user an opportunity to communicate solely by brain signals without activation of peripheral neural system. In brain-computer interface based on P300 visual evoked potential (P300 BCI) commands are represented by the matrix of stimuli, rows and columns of which flash in pseudorandom order. We studied a potential effect of different matrix sizes on system performance, namely the typing accuracy and P300 amplitude and latency, as well as on various features of gaze behavior. To estimate the effect of matrix size we designed five different P300 matrices where the stimuli size and spacing varied from 1.22 and 0.73 to 2.43 and 1.45 degrees of visual angle. It was found that the typing accuracy and P300 amplitude and latency are not significantly affected by the stimuli size or spacing. However, particular features of the gaze, specifically the fixation proportion, total dwell duration, mean dwell duration, and mean fixation duration on target stimulus do depend on matrix stimuli size, in a way that smaller stimuli attract longer and more compact fixations, but shorter dwells while larger stimuli attract shorter and more scattered fixations, but longer dwells. These findings can be used for the development of the efficient visual environments for P300 BCI.