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Time-frequency PCA of event-related EEG changes in the orienting reflex

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Abstract

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Time-frequency PCA of event-related EEG changes in the orienting reflex

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We recently reported electrodermal and EEG data from an auditory habituation study with counterbalanced indifferent and significant (counting) instructions. For the EEG, we used a time-frequency approach to process our EOG-corrected EEG data. We aimed to explore the amplitude and timing of event-related increases/decreases in four classic EEG bands. Thus we used standard frequency ranges (delta, theta, alpha and beta) and selected arbitrary time epochs, based on apparent EEG amplitude changes. For the initial event-related synchronisation (ERS) in delta and theta, the epoch was 500 ms, and for alpha and beta, it was 250 ms. The remainder of the 2000 ms poststimulus period was used for event-related desynchronisation (ERD) assessment. We found substantial decrement over trials for the ERS in delta, theta, and alpha, and subsequent ERD in theta, alpha, and beta, but few effects of task significance. The current study used Principal Components Analysis (PCA) of those time-frequency data. This allowed exploration of the natural frequency/time combinations involved in the processing of stimulus novelty and significance in this paradigm. In a 700 ms poststimulus epoch we found four ERS and four ERD time-frequency components. Five of these showed substantial novelty effects, with decrement over trials. Four showed main effects of significance (Count > NoTask), and six showed trial by significance interactions. This PCA approach was straight-forward to employ, and the data-determined time/frequency]";“hotspots]";” provided increased sensitivity compared with the traditional arbitrary frequency and epoch selections. These outcomes encourage the wider use of the PCA approach with time-frequency data.