The feedback-related negativity during performance on the Halstead Category Test

A. R. Teixeira[a,b], I. M. Santos[c], , A. M. Tomé[a,e], A. T. Pereira[c,d], P. Rodrigues[f,g],
P. Vagos[h], J. Costa[f], M. L. Carrito[c,d], B. Oliveira[c,d], N. DeFilippis[i], C. F. Silva[c]

[a]IEETA, University of Aveiro, Portugal
[b]ESEC, Polytechnic Institute of Coimbra, Portugal
[c]Center for Health Technology and Services Research (CINTESIS), Department of Education, University of Aveiro, Portugal
[d]IBILI, Faculty of Medicine, University of Coimbra, Portugal
[e]DETI, University of Aveiro, Portugal
[f]University of Beira Interior, Portugal
[g]CICS, Research Center in Health Sciences
[h]CINEICC, Cognitive and Behavioural Center for Research and Intervention, Faculty of Psychology and Educational Sciences, University of Coimbra, Portugal
[i]Georgia School of Professional Psychology at Argosy University, Atlanta, USA

The aim of this work was to study the electrophysiological correlates of performance on the Halstead Category Test (HCT), a neuropsychological test that measures a person's ability to formulate abstract principles. Performance must be adjusted based on feedback after each trial and errors are common until the underlying rules are discovered. Event-related potential (ERP) studies associated with the HCT are lacking. This paper demonstrates the use of a methodology inspired on Singular Spectrum Analysis (SSA) applied to EEG signals, to remove high amplitude artifacts resultant from ocular movements during performance on the test. This filtering technique introduces no phase or latency distortions, with minimum loss of relevant EEG information. After signal treatment, we were able to successfully identify a frontocentral ERP wave related to error-processing: the feedback-related negativity (FRN), peaking around 250 ms, after feedback. As expected, errors elicited more negative amplitudes on that potential than correct responses. Results are discussed in terms of the functional significance of the FRN potential as an electrophysiological correlate of performance on the HCT. The FRN identified during this test can then be used as an electrophysiological marker of feedback processing, which allows it to be used with different pathologies that might show impairments at this level

Keywords: feedback-related negativity (FRN), Halstead Category Test, Singular Spectrum Analysis (SSA), event-related potentials (ERP), feedback processing