

# Feedback processing during performance on the Halstead Category Test and its relation to externalizing behavior

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

<sup>a</sup>*Center for Health Technology and Services Research (CINTESIS), Department of Education,  
University of Aveiro, Portugal*

<sup>b</sup>*IEETA, University of Aveiro, Portugal*

<sup>c</sup>*ESEC, Polytechnic Institute of Coimbra, Portugal*

<sup>d</sup>*IBILI, Faculty of Medicine, University of Coimbra, Portugal*

<sup>e</sup>*DETI, University of Aveiro, Portugal*

<sup>f</sup>*University of Beira Interior, Portugal*

<sup>g</sup>*CICS, Research Center in Health Sciences*

<sup>h</sup>*CINEICC, Cognitive and Behavioural Center for Research and Intervention, Faculty of  
Psychology and Educational Sciences, University of Coimbra, Portugal*

<sup>i</sup>*Georgia School of Professional Psychology at Argosy University, Atlanta, USA*

The Halstead Category Test (HCT) is a neuropsychological test commonly used in the assessment of executive cognitive function. Performance on the test depends on the person's ability to extract abstract principles and adjust behavior as a function of positive or negative feedback to their previous response. Studies investigating the electrophysiological correlates of performance on the HCT are lacking. It has been established that the externalizing dimension of personality is a high-risk factor for antisocial and violent behavior and psychopathy. A common behavioral pattern of externalizing is an apparent failure to learn from experience, which suggests that it may involve a deficit in executive functioning, specifically in the ability to self-monitor ongoing behavior for errors. The present study examined the ERP correlates of feedback processing during the HCT in a sample of 58 participants varying in their level of externalization (20 low, 20 medium and 18 high externalizers). A positive deflection approximately 500 ms after feedback onset was observed, with maximal amplitude at medial locations, encompassing frontal-parietal regions. Significant differences between correct and incorrect feedback trials were observed at frontal and fronto-central locations, with errors eliciting globally higher amplitudes than correct responses. Significant differences between externalization groups were also observed at bilateral parieto-occipital and occipital regions, and marginally significant differences at left central and parietal regions. Generally, amplitudes were lower for the high externalizing group than for the medium group, with high and low groups not differing significantly. These results suggest differences in feedback processing associated with externalizing behavior.

*Funding:* The present study was funded by a Bial Foundation research grant.