Representation of driver's mental workload in EEG data

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Abstract

Prior researches indicate that driver overload is one of the most important contributors to traffic accidents. The present study outlines the contribution of driving speed to driver's mental workload. A standardized Lane Change Task (LCT) was used as driving task. Participants were asked to perform the lane change task at different speed levels which induced different levels of task load.

Electroencephalography (EEG) technique was used to record the electrophysiological response invoked by LCT from 30 participants. The recorded data were divided into epochs related to the lane change commands and the analysis of Event Related Potentials (ERP) revealed that LCT evoked cognitive response with CNV, P2, N2, P3b, etc. Additionally, statistical analysis showed that the amplitude of P3b decreased with the task load. This finding indicates that the amplitude of ERP component could be used for representing driver's mental workload.

Introduction

In the last decades, a large number of researches have been conducted to investigate driver workload using different methods, such as subjective measurement (Pauzié & Pachiaudi 1997), performance measurement (De Waard, 1996), as well as physiological parameters, such as Electroencephalography (EEG) or Electrocardiography (ECG, Wilson et al., 1988; Piechulla et al., 2003; Chen et al., 2005). EEG as the measurement of brain electrical activity recorded from electrodes placed on the scalp provides a promising way for driver mental workload monitoring. Characteristic changes in the EEG and event related potentials (ERPs) that reflect levels of mental workload have been identified (Wilson et al., 1988; Gevins et al., 1998; Raabe et al., 2005). Raabe et al. (2005) revealed a decline of the amplitude of P300 evoked by a secondary oddball task when the primary task load or task difficulty increased. Other researchers calculated the power spectral density of EEG signals using fast Fourier transform (FFT) to examine the change of frequency characteristics. Such an approach allows understanding how the ratio of a specific frequency band (i.e. alpha band) changes when the mental work level changes (Gevins, et al., 1998).

In D. de Waard, J. Godthelp, F.L. Kooi, and K.A. Brookhuis (Eds.) (2009). *Human Factors, Security and Safety* (pp. 285 - 294). Maastricht, the Netherlands: Shaker Publishing.