

Effects of workload and time-on-task effects on eye fixation related brain potentials in a simulated air traffic control task

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Abstract

The goal of this study was to explore the usability of eye fixation related potentials (EFRP) to measure workload and time-on-task in a simulated air traffic control (ATC) task. EFRPs were obtained by averaging the EEG locked to the point in time of maximum velocity of saccadic eye movements, derived from the EOG. During the ATC-task, participants (n=20) had to safely guide aircraft to the runway, while maintaining a minimal distance and preventing crashes. Workload was manipulated by varying traffic density and time-on-task effects were studied by comparing the first with the second hour of the task performance. Furthermore, Event Related Potentials (ERPs) on a secondary auditory oddball tasks were derived to provide an additional measure of workload using the P300 component. The P300 amplitude in the secondary oddball task was smaller with high workload and time-on-task, as expected. Both lambda response and P150 component of the EFRP in the ATC task had larger amplitudes with conditions of higher mental workload induced by traffic density. No time-on-task effects for the lambda response or the P150 were found. It is argued that EFRP was suitable for measuring mental workload effects in this study, while the results for time-on-task effects were less convincing.

Introduction

In this research the usability of eye fixation related potentials to measure workload and time-on-task effects in a simulated Air Traffic Control (ATC) task is explored. Since there are growing concerns that increased air traffic density may overwhelm air traffic controllers while compromising safety, more attention has been given to ATC workload and increase of automation in ATC (Danaher, 1985). Several psychophysiological measures have been developed which were shown to be sensitive to the cognitive requirements of complex task performance. An important source of information for measures of mental workload and time-on-task is the

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