

What are they Thinking? A Bio and Neurofeedback Approach to Understanding Driver Attention and Responsiveness

Abstract

Safety professionals focus on driver, vehicle or roadway (environment) factors in assessing safety and countermeasure effectiveness. The focus of this paper is on the driver given that driver error is a significant factor leading to roadway crashes. Much driver research is objective in that it is based on observations of the driver by an “observer”, and not from the perspective of the driver. When the driver's perspective is considered, often this has involved self-reporting of driver state. This paper discusses an alternative approach that considers driver's physiological responses to stimuli as an indicator of not only roadway vehicle conditions but also of the driver's attention and ability to respond to changing conditions.

In this study, raw Electroencephalogram (EEG) and Electrodermal Response (EDR) data are collected and used to assess driver attention and perception of roadway hazards and conditions. The correlations between changes in EEG and EDR with changes in the observed crash rate are estimated. Previous studies have shown EDR and crash rate to be highly correlated. A positive but less strong correlation between EDR and crash rate is found in this study. Similar correlations between changes in driver alertness and attention with changes in crash rate are also found. These findings suggest that safety may be improved by increasing the driver's ability to quickly switch between levels of low and high attention. The potential to use neurofeedback to train drivers to improve their attention response is then examined to determine the amount of training required to improve attention response and the longevity of training effectiveness. The study shows that providing drivers with relatively short periods of neurofeedback training can be an effective means to improve driver's ability to move into and out of highly focused mental states and their ability to react to rapidly changing conditions. These benefits are long-lived and can persist with little or no additional training. This research suggests that providing in-car systems to monitor driver attention and provide inattentiveness alerts could help train drivers to maintain focus and improve their safety.