Creating a Driving Workload Model and Identifying Best Practices

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Abstract

One major way to investigate distracted driving is to have drivers engage in a secondary task. Driving models are one way to better understand workload during driving which could result in safer driving. During this study, we create a driving model using cognitive task analysis software to analyze workload with N-Back tasks. N-Back task requires the driver to memorize and repeat numbers and letters. The result will help us determine if we can continue using this software in future research and analysis workload in a given scenario with secondary tasks by comparing it to other analysis software in the framework of Highway Traffic Safety Administration distraction guidelines and human subject data. We will also gain knowledge about the skill required for driving and incorporate those into our model.

Introduction

In the field of distracted driving, scholars want to understand how driving is affected by engaging in secondary tasks. One way to model this is through analyzing a robust driving model. The goal of this study is to see if we can accurately create a driving model with a scenario using a cognitive task analysis software program and comparing those results to another software in the framework of National Highway Traffic Safety Administration distraction guidelines.

Table 1. Computational Model Components

Segment Type	Steer	Speed	Situation Assessment
Left Curve	Left	Moderate Decrease	Minimum Increase
Right Curve	Right	Moderate Decrease	Minimum Increase
Straight (after curve)	Straight	Moderate Increase	Typical
Straight	Straight	Steady	Typical
Straight with Intersection	Straight	Minimum Decrease	Moderate Increase
Straight (after intersection)	Straight	Minimum Increase	Typical

Table 2. Maximum Workload Results Comparison

	N-0	N-2	Percent Change
MTAT	25.8	35.9	0.28
IMPRINT	25.8	35.9	0.28
Blink Rate-Eye Tracker	21.1	30.2	0.30

REFERENCES

Handley, H. & Thompson, D. (2021). Computational Models for Workload Analysis of Driving Tasks. *Proceedings of the 2021 Human Factors and Ergonomics Society 65th Annual Meeting,* Baltimore, MD

Yahoodik, S., Tahami, H., Unverricht, J., Yamani, Y., Handley, H. & Thompson, D. (2020). Blink Rate as a Measure of Driver Workload during Simulated Driving, *Proceedings of the Human Factors and Ergonomics Society 2020 Annual Meeting,*

Methods

We imported the data from a real scenario into Mission Task Analysis Tool (MTAT) as the cognitive task analysis software. Then, we ran a Monto Carlos analysis and Workload analysis report. For workload, we used visual, cognitive, auditory, and psychomotor as limited resources for the driver. In the original scenario, the participants were asked to repeat words, letters, and numbers as a part of a cognitive workload test known as N-Back. We incorporated the N-back tasks into the model and then compared the model to a blink rate captured from an eye-tracker in a driving simulator. Table 1 presents the scenario components of the modular approach of the computational model with the blink rate.

Discussion

Table 2 presents results of simulations using MTAT compared to those from a previous IMPRINT simulation (Handley & Thompson, 2021); the results from the two sets of simulation model are identical. Additionally, the results are compared to the blink rate captured from an eye-tracker in a driving simulator. For all three conditions, the percent change in workload from the low workload condition (n-0) to the high workload condition (n-2) is similar; percent change is used as the baseline comparison metric. Blink rate as a surrogate for workload is an area of active research (Yahoodik, et al. 2020). The result of this research indicates that the modeling method can be duplicated across different simulation tools.

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