Training the older driver

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Abstract

This special issue reports on papers presented at a simulation user group meeting on Training the Older Driver held at Université Laval in Québec, Canada. The meeting attracted a little more than 50 attendees from 5 different countries.

This special issue includes six papers covering a wide range of research topics. The first paper considers the relationship between intersection design and simulated driving performance shows the increasing role of virtual environment for testing and improving roadway design. This is a topic of utmost interest that will contribute to increasing road safety in the future. Two papers address the important issue of how dual-task demands can challenge driving performance which is an important topic for road safety considering the ever increasing number and complexity of in-vehicle devices. The association between heart rate reactivity and driving performance under dual task demands in late middle age drivers describes a sensitive measure of driving stress. Another paper takes a novel look into the use of a driving simulator to study eyewitness accuracy. Finally, a paper describes the challenge TBI (traumatic brain injury) patients find in the driving environment.

1. Introduction

This is the fifth special issue devoted to driving simulation research and application concerning driver behavior and transportation system safety. The first special issue in 2004 resulted from papers given at a conference in San Diego, California, USA [1].

The theme of the first conference was "New Directions in Driving Simulation Research." Three more symposia have been held and reported on in the last three years:

"Multidisciplinary new approaches to old problems: an overview of driving simulation research" held in Stuttgart, Germany in September 2005 [2];

"New approaches to simulation and the older operator" held at the Massachusetts Institute of Technology in October of 2006 22[3]; and

"Application of driving simulation to road safety," [4] held in Rome in 2007 as an adjunct to the Road Safety and Simulation 2007 conference [5]. For this meeting, the diversity of the research was remarkable and speaks out for the increasing role of simulation in studying road safety. Two keynote speakers (Elin Schold-Davis, head of the American Occupational Therapy Association's Older Driver Initiative; Michel Bédard, Canada Research Chair in Aging and Health, Lakehead University) addressed the implication of simulators for training and rehabilitation of the older driver. Several presentations also addressed this important issue.

Other categories of drivers were also considered. As an example, Arvid Harmsen (A&A bv) nicely presented the controversial consequences of the EU directive for initial qualification and periodic training of professional truck drivers [7] and Wade Allen (Systems Technology Inc.) presented data from a longitudinal study showing how simulator training can reduce the number of accidents in novice drivers (e.g. [8]). The contribution and use of the simulator for pharmacological research and cognitive based research was featured in several presentations as well. More technical presentations aimed at improving the virtual environment or developing scenarios contributed to the diversity and quality of the meeting; an Excel-based programming tool (Bruce Weaver, Lakehead University), implementing an analog speedometer in STISIM Drive (Jean-François Tessier, Université Laval) and the clever technique for developing roundabout scenarios (Steve Markham, Valentine Technologies Ltd) all captured the interest of attendees. Although not all presentations are part of this special issue, proceedings of the meeting and Power Point presentations are available on request [6].

2. Contributions

"The impact of roadway intersection design on simulated driving performance of younger and older adults during recovery from a turn"

This paper describes a study of older driver reaction to intersection design using a high fidelity simulator. Specifically whether improved design features as recommended by the US Federal Highway Administration are effective during recovery from a turn in 4 pairs of intersections involving unimproved versus improved designs. The results showed that one of the intersections benefitted from the design improvements, and that the improvement was equivalent for both younger and older drivers. However, younger drivers did exhibit higher speeds during the recovery phase of three left turn intersections. The findings of the present study may provide critical information for enhancing safe driving to those involved in roadway design, such as engineers, planners, and policy makers.

"The initial development of a low-cost method for predicting the disruption of glances towards in-vehicle information systems"

This paper describes an important technique for evaluating automotive displays in terms of their distraction value. This evaluation technique is particularly relevant with the trend towards sophisticated in-vehicle information systems (IVIS). This is a relevant example of the application of driving simulation for evaluating potential driver risk in connection with new in-vehicle technology.

"Older driver performance on a simulator: associations between simulated tasks and cognition"

This study considers the relationship between standard cognitive tasks and driving and whether performance on different driving tasks is correlated. The results indicate there was little correlation in performance among driving tasks, suggesting that they involve independent skill sets. This result highlights the importance of assessing seniors' performance on a range of driving tasks. Cognitive task performance was also predictive of driving task performance. The lack of correlation in performance among the three driving tasks, and the correlations found between different cognitive tests and the driving tasks, suggest that the driving tasks involve different driving abilities and cognitive constructs. This adds further evidence to the extant literature in support of researchers' and driving evaluators' use of a range of performance and driving tasks that assess different driving domains.

"The use of a driving simulator to study eyewitness accuracy for three different types of collision"

This is a fairly unique application of simulation to investigate the reliability of eye witness testimony regarding vehicle collisions. Despite high self reported confidence ratings the results indicated that recall was poor, although recall was better for collisions where the drivers and passengers were directly involved. No significant recall differences were found between drivers and passengers, but recall was better for collisions where the driver and passengers were directly involved as opposed to situations involving other vehicles. Also, heart rate was higher for collisions where the participants were directly involved suggesting that arousal may improve recall of traffic events. This simulator application may have bearing on the forensic analysis of traffic incidents.

"The association between heart rate reactivity and driving performance under dual task demands in late middle age drivers"

In this study heart rate responses were compared during a variety of dual task conditions along with driving and task performance data. During two of the tasks in which younger participants showed significant heart rate acceleration, older drivers, as a group, showed little or no change in heart rate. During a portion of the simulation consisting of highway driving, a continuous performance task (CPT) was presented as a secondary task to increase workload. Heart rate response did not correlate with performance on the CPT in the younger subjects. In the older subjects, however, the heart rate acceleration group scored significantly higher on the CPT than those who did not exhibit a pattern of heart rate acceleration. In addition to lower performance on the CPT task, older adults in the non-acceleration group showed a significant drop in driving speed, which is generally interpreted as a compensatory response employed to manage total workload. This study shows the utility of including psychophysiological response as a measurement and looking for responses under dual task conditions.

"Examination of traumatic brain injured drivers' behavioural reactions to simulated complex roadway events"

This study examines the behavioural reactions of highly functional TBI (Traumatic Brain Injury) drivers in response to simulated driving obstacles in comparison to matched controls. Both tactical and operational levels of driver behaviour were investigated. Longitudinal acceleration, longitudinal velocity, lateral velocity and lane position were recorded during four separate surprising encounters with road obstacles for both TBI patients and normal controls. Results indicated that TBIs were slower to respond, swerved less, and were more cautious immediately after the obstacle had passed. TBI drivers also drove slower overall. Because of the potential driving risk incurred by TBI patients, this paper provides a potential useful simulator assessment example which might also apply to other at risk clinical populations.

"A novice driver transfer of training experiment"

Fidelity and validity are critical issues in the application of driving simulators. This paper presents a study that represents one form of validation that is appropriate for training simulators. The study concludes that simulator training with higher fidelity simulators can reduce novice driver crash rates.

"Implementing an analog speedometer in STISIM Drive using Parallax BSTAMP microcontroller"

This paper describes the integration of a physical speedometer into a simulation using a microcontroller. This simple, low cost approach provides a more realistic instrument panel and provides better integrations with other actual instruments and controls.

3. Summary

There are a range of useful driving simulator applications that relate to roadway safety. These applications all have the common advantage that they can investigate hazardous driving conditions in the safety of a simulated driving environment. Hazards and risks can arise due to many factors associated with the driver, vehicle and roadway environment. The logistics of studying these circumstances in real world, behind the wheel driving can be difficult if not impossible. In the case of roadway designs, the desired conditions may not exist in the real world, but can be created in the simulation virtual world. This is also true of vehicle designs including advanced in-vehicle systems that may make demands on the driver's attention. Finally, various driver conditions including a range of impairments that increase risk of crashes cannot be tested safely in the real world. The capability of simulation to produce realistic virtual worlds is continually expanding, and the cost of achieving these conditions is continually falling, and therefore the application of driving simulation is becoming more appealing to a wide range of researchers in various disciplines. We see this trend continuing in the near future.

Acknowledgements

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