Journal of Safety Research 49 (2014) 1

Contents lists available at ScienceDirect

Journal of Safety Research

journal homepage: www.elsevier.com/locate/jsr

Editorial

Letter from the Editors

The *Journal of Safety Research* is pleased to publish in this special issue the proceedings of several papers presented at the 4th International Conference on Road Safety and Simulation convened at Roma Tre University in Rome, Italy, October 2013. This conference serves as an interdisciplinary forum for the exchange of ideas, methodologies, research, and applications aimed at improving road safety globally.

Conference proceedings provide the opportunity for research in its formative stages to be shared, allowing our readers to gain early insights in the type of work currently being conducted and for the researchers to receive valuable feedback to help inform ongoing activities. This conference in particular offers an array of research topics not often covered by this journal from researchers practicing in over 11 countries. As is common with publishing conference proceedings, the papers published in this issue did not go through the normal *JSR* review process. Each paper included in this issue did meet the Road Safety and Simulation conference review requirements. They reflect varying degrees of scientific rigor, methodological design, and groundbreaking application.

The proceedings published in this special issue of *JSR* draw from the following road safety research sectors represented at the conference: driving simulation, crash causality, naturalistic driving, and new research methods.

It is our hope that the publication of these important proceedings will stimulate vigorous dialogue, rigorous research, and continuing innovative initiatives and applications, leading, ultimately, to fewer traffic fatalities, injuries, and crashes.

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18 February 2014

http://dx.doi.org/10.1016/j.jsr.2014.02.001

Journal of Safety Research 49 (2014) 61–68

Contents lists available at ScienceDirect

Journal of Safety Research

journal homepage: www.elsevier.com/locate/jsr

Enhancement of road delineation can *reduce* safety

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ARTICLE INFO

Article history:
Received 28 November 2013
Accepted 25 February 2014
Available online 24 April 2014

Keywords:
Driving safety
Roadway delineation
Driving simulation

ABSTRACT

Background: New in-vehicle technologies often outpace the scientific support for their value. In lieu of valid and consistent scientific support, common wisdom is used, as in the assumption that enhanced roadway delineation improves driving safety. *Objective:* To evaluate the effects of a Visibility Enhancement System that selectively improves lane markers' visibility on driving safety. *Method:* A simulation experiment assessed the effects of an in-car lane Visibility Enhancement System (VES) that highlights the edges of the road ahead on driver's behavior and overall safety, under normal and reduced visibility conditions. Thirty drivers drove in a fix-based simulator through a winding rural road, while attempting to avoid un-enhanced and unexpected obstacles that appeared on the driving lane from time to time. The simulated VES highlighted the road edges up to a distance of 90 m with two alternative configurations: two continuous red lines or a series of red crosses. The effects of the two VES configurations on performance were measured during night and fog driving. Performance measures included speed, lane keeping behavior, eye scanning pattern, reaction time (RT) and collisions with the un-enhanced unexpected obstacles. Subjective measures included confidence and stress. *Results*: With the VES, drivers were more confident, less stressed, and drove faster, but had almost twice as many collisions with the unexpected obstacles. Also, steering/braking RT to the obstacles was longer with the VES than without it by nearly 44 msec. *Conclusions:* The results are consistent with Lebowitz's theory (1977). While the VES enhanced spatial orientation, it fooled the drivers into assuming that the visibility of obstacles on the road was also improved, and thus actually reduced safety. Practical Applications: When visibility is an issue in nighttime crashes, the site-specific crashes should be investigated, in cases of collision with objects-on-the-road, improved delineation should be ruled out.

1. Introduction

The common wisdom is that roadway delineation is a critical feature in driving safety. In general, such enhancement of the visibility of lane delineation is considered a positive safety feature and is incorporated into best practices (the U.S. Manual on Uniform Traffic Control Devices, 2009). Consequently enhancing lane and road delineation has often been sought in the pursuit of designing safer roads. The advent of new materials for roadway signs and paints and in-vehicle technologies has also made possible the selective enhancement of various features of the roadway environment, such as displays of various traffic signs (speed limits, stop signs), general luminance (e.g., night vision displays), and roadway delineation (either with on-road enhancement or through the use of a Head-Up Display — HUD). For example, a conformal HUD of the lane delineation superimposed on the windscreen right above the instrument panel, can provide drivers with important information about the roadway geometry — without the need to shift the eyes off the road (Goesh, 1990; Parkers, Ward, & Bossi, 1995; Tufano, 1997). Thus, graphic symbols can highlight critical elements in the driving scene such as road edges, creating an effect of virtual lane markings that can be perceived much farther away than the markings illuminated by the car's headlamps. The advantage of HUD in driving has been demonstrated in detecting cues in the road scene (Sojourner & Antin, 1990), and in responding to hazardous events (Horrey & Wickens, 2004).

Despite these advantages of selective visual enhancement systems, there is research to suggest that at least in some specific contexts they may have some shortcomings to the point of being counter-productive. Kallberg (1993) analyzed Finnish crash data and found an increase in the number of accidents on roads that had reflector posts installed. Specifically, the effect was found only on roads with relatively low geometric standards and 80 km/h speed limit, and not on main highways (i.e., on winding roads that are not lit at night). Shinar and Fell (1990), in an analysis of the U.S. Fatal Analysis Reporting System data, were unable to show that raised lane markers reduce the likelihood of fatal crashes. Thus, it seems that the net effect of lane markers on safety is dubious at best. Bahar, Mollett, Persaud, et al. (2004) in a comprehensive review of the safety benefits of permanent raised pavement markings also noted mixed results showing that in some cases the enhancement of the delineation actually raised the accident rates. Finally, on the basis

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http://dx.doi.org/10.1016/j.jsr.2014.02.011
0022-4375/