



Evaluating driver distraction factors in urban motorways. A naturalistic study conducted in Attica Tollway, Greece

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Abstract

Over the last years, distracted driving possesses a leading position among accident causes and it constitutes an increasing road safety problem with disastrous results. Considering external factors of distraction as highly significant, they can be grouped in four categories: built roadway, situational entities, natural environment, and built environment. The fourth category, related to civil infrastructure and commercial land use, combined with high vehicle speeds that occur in motorways, might contribute to the creation of a very dangerous environment, increasing driver distraction and inattention. Through accurate research, solid results can emerge and traffic safety can be enhanced.

The present study deals with driver distraction caused by out-of-the-vehicle factors, as well as factors related to the driver, such as age, gender, driving experience etc. It covers the distraction of driver attention during driving due to external factors that are not related to the main task of driving, resulting in impairments to driver attention and decision-making ability and hence the driver's overall performance.

For this purpose, we assess the side effects of numerous road elements, such as information signs, roadside advertising, Variable Message Signs, toll buildings, noise barriers/panels etc. to driver attention. The study is based on a medium-scale experimental procedure which took place in Attica Tollway, the Ring Road of the Athens metropolitan area, which was part of a larger research project conducted by the University of Thessaly, Department of Civil Engineering in three urban freeways in Greece.

The gaze tracker FaceLab software was used on a sample of 87 drivers. Each participant drove 51 km on Attica Tollway, both in level terrain with 3 lanes and speed limit up to 120 km/h and in rolling terrain with 2 lanes and speed limit up to 80 km/h. The distraction of driver attention is evaluated via a continuous recording of the gaze, which acts as the main indicator regarding driver performance. The results of this procedure, analyzed via Captive software, are focused on the time that the driver's gaze remained on each of the road elements under research.

This study can be used as a tool that can help in understanding and limiting the use of roadside elements that are not related to the execution of the driving task, but that may serve as potential causes of distraction. The results of this type of research procedures are very useful in preventing the forthcoming pressure for more billboards and trademarks on the roads, as well as in encouraging the adaptation of more precise regulations relating to the road infrastructure, the placement of roadside elements, etc.

Keywords: Driver distraction, billboards, urban motorway, naturalistic study

1 Introduction

One major road safety issue for all those involved in road safety (researchers, vehicle industry, authorities etc.) is distraction of driver's attention. Due to its nature, driver distraction may be affected by a great number of factors, while it appears in a variety of forms. Thus, the study of distraction is a demanding procedure that needs to be handled in a very carefully designed way.

Both accident statistics and experimental studies conclude that distracted driving possesses a leading position among accident causes. Many naturalistic driving studies, conducted mostly on motorways where the presence of billboards is intense and distraction might cause a more serious accident due to higher speeds, conclude that glances that are not related with the task of driving and last more than a certain period of time are dangerous for road safety (Dingus et al., 2006; Klauer et al., 2006, Liang et al., 2012). The investigation of the main causes of distraction highlights two basic categories of distractor generators: those coming from the interior of the vehicle (internal factors) and those from the external environment (external factors) which can be grouped in four major subcategories: built roadway, situational entities, natural environment, and built environment (Horberrry & Edquist, 2008). The fourth subcategory, related to road infrastructure and commercial land use, combined with high vehicle speeds that occur in motorways, might contribute to the creation of a very dangerous environment, by increasing driver distraction and inattention.

Several studies focus on the external factors and the significant impact in driving task. A review of several accident databases resulted that external distractors are responsible for 10% of all accidents (Wallace, 2003). In Young et al. (2009) simulator study there is a tentative suggestion that more crashes occur when billboards are present. Accident statistics in many countries confirm the participation of distraction as a cause of road accidents. For example, accident data from United States show that the number of people injured during a crash which was caused due to distraction, was 515,000 or 22% of all injuries (NHTSA, 2009). Another study resulted that an object or an event is the main cause for 30% of the distraction generated accidents in USA (Tasca, 2005). In Greece, the official statistics published by the Greek Traffic Police for the year 2014 show that 43 (5.8%) of the total of 747 fatal accidents were due to driver's distraction while other causes or types, such as crash on roadside obstacle/equipment and mobile phone use, have a strong relationship with the distraction issue (Greek Traffic Police, 2015).

Regarding advertisement, several design guidelines have been published in many countries, and in some of them roadside advertising is not permitted. However, the continuous pressure for more and more advertising caused by significant financial interest, have resulted an increased number of advertisement signs along the roads (Herrstedt et al., 2013). At this point it should be noted that the primary reason of the existence of an advertisement sign is to capture driver's eye in order to transmit the message that advertises. As a result, driver's attention is away for the task of driving for a significant period of time. This disturbed attention diminishes driver's ability to respond and avoid a crash caused by an unexpected event (Herrstedt et al., 2013). In addition, several studies have demonstrated that advertisement signs, especially the more aggressive ones, have a clear impact on

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