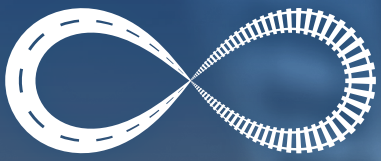

CETRA 2018

5th International Conference on Road and Rail Infrastructure
17–19 May 2018, Zadar, Croatia

Road and Rail Infrastructure V

Stjepan Lakušić – EDITOR

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ANALYSIS OF SELECTED TYPES OF ADVERTISEMENT INFLUENCING THE DRIVER´S VISUAL ATTENTION IN REAL ROAD TRAFFIC

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Abstract

One of the probable causes of road accidents may be a high density of information which may cause the driver to miss a fact significant for dealing with an individual road traffic situation. In particular failure or distraction of the driver's attention often leads to a late recognition of the risk or insufficient information processing. The primary task of advertisement is to attract attention of consumers. Advertisements near the road undoubtedly belong to substantial distractors. The aim of this article is to present the results of the analysis of the impact of advertisement on the driver's attention in real road traffic. For the analysis of the selected types of advertisement equipment (small advertising equipment, billboards, bigboards and megaboards) the eyetracking methods have been used. Most of currently realized studies have analysed the influence of advertising device under simulated conditions. Therefore, this measurement has been realized in real traffic. Measurement has been carried out with 30 drivers, on 3 different routes in the city. Achieved results illustrate the negative impact of advertisement on the driver's visual attention that has been observed and confirmed.

Keywords: accident, driver, distraction, advertisement, eyetracking

1 Introduction

Trend of accident analysis researches tends to reduce the number of road traffic accident or reduce the consequences, especially fatalities. Human failure is a commonly reported cause of motor vehicle collisions. One of the possible cause of accident can be the high density of information. The driver could neglect the essential fact necessary for dealing with a specific traffic situation. High density of information also affect the ability to detect hazard i.e. the driver's reaction time to external stimuli.
In recent years, a work focused on the driver behavior i.e. driver visual perception has used eye-tracking methods. Eye-tracking methods have been used to measure a view direction or an eye movements relatively to the head. Visual attention change may indicate the driver's intention or his mental or physical state and have allowed monitoring and evaluating of visual sequences of drivers and easily understand to reasons of their behaviour.
The methods based on eyetracking techniques have been currently widely used to analyse not only visual perception of drivers (e.g [10][11][12]), but also for the analyzis of traffic signs perception [1] or selected distraction elements (for example bilboards [8][15]). Eyetracking techniques have been also used for the analysis of pedestrian perception [5] or for the analysis of transport infrastructure ([17]).

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In recent years, advertising facilities in the road surroundings have led to a number discussion. As advertising device could be considered every single device for written, visual or otherwise advertisement or promotion. Regulation of advertising has been defined by different legal regulation in the Czech Republic in terms of different statutory interest [16]. In 2017, a change in the legal regulation was made in the Czech Republic. Placement of advertising facilities has been directly prohibited in the protection zone of motorways and first-class roads. Existing advertising facilities must be removed from the vicinity of these roads. Therefore, it is reasonable to expect that the advertising equipment will be moved to the vicinity of the local roads, especially in the urban areas. In-depth analysis of the safety risks associated with the installation of advertisement at the border of the road transport zone is an important potential for implementing new corrective actions to reduce the incidence of driver interference.
The goal of this work is to introduce the influence of advertisement on the driver attention. The goal of the advertisement is to attract person to promote product or service. Besides the distraction of driver's attention from driving-related information, advertising facilities may also overlap traffic signs or merge with them. Driver distraction caused by advertisement has been contained in many studies, most of them have been focused on the selected types of distraction or advertisement.
Influence of LED bilboards on the driver attention have been contained in [8]. The impact of these types of advertisement on the accident rate have been analyzed by [1]. How has been the visual perception of driver affected by dynamic advertisements examined [15]. The impact of the elevated advertising compared to the advertisement along the streets has been analyzed by [3]. The effect of advertising equipment on driving performance was examined by [4] and [13]. Also the effect of the emotional charge of advertisements on driving performance was examined [9]. A simulation study showed that driver reaction times were shorter in times when advertisements produced strong, especially positive, emotions. The goal of this study has been to analyze the various negative influences that advertising in the urban area affects the driver, especially distraction and glare.

2 Methods

The aim of this paper was to analyze how selected types of advertisement influencing the driver´s visual attention in real road traffic. For this purpose, eye-tracking method has been used.

2.1 Eye-tracking

Eye-tracking method is used to measure motion of an eye relatively to a head. The purpose of the eye movements is to fixate objects in the field of a view, in the area of sharp vision (foveal region). The movement of the eye can be divided into several basic types, the most important are fixations and saccades. Fixations has been defined as pauses over informative regions of interest. The sacaddes are rapid movements between fixations. The time of fixation of the driver's eye on the advertisement was analyzed, i.e. the time when the advertisement is in the area of the sharp vision. As shown in [14], fixation analyzation is a eligible method of minimizing the complexity of eye-tracking data while retaining most essential characteristics for the purposes of understanding cognitive and visual processing behavior.
In this study, the video-based eyetracker has been used. This type of device combines a video images and a pupil reflection exploiting an infrared light. An infrared light is shone into the eye and then it is reflected from the lens and sensed by a video camera [6].

2.2 Experiments

Drivers (men) aged from 24 to 55 (n = 30, mean age = 32; standard deviation 8) participated in this study. All participants in this study were free of medical and cognitive impairment. The experiments were realized on three different routes in the city. Measurements were carried out in the real road traffic under similar climatic condition. In the course of experiment every driver was exposed to different types of situation – pedestrians on zebra crossing, intersection crossing, crossing with tram-way etc.
For the purpose of this study, any outdoor advertisement placed in the road vicinity has been analysed. With regard to the frequency representation of each advertisement type on the routes, the advertising facilities were divided into three groups. Most often types of advertisement are billboards, the standard billboard size is 5.1 x 2.4 m. This type of advertisement has been analysed separately. 120 billboards has been analysed in sum. Frequent type of advertisement are also bigboards (9.6 x 3.6 m) or megaboards (12 x 6 m, 16 x 9 m, 24 x 8 m). There were 63 bigboards and megaboards on these three tracks. There are also advertising facilities on columns, advertising signs and other smaller advertising facilities in the city. Due to the diversity of advertisement types, these advertising facilities were analysed in one group. In total 160 smaller advertisement has been analysed. In detail basic characteristics of these routes are stated in Table 1.

Table 1 Basic route characteristics

	1	2	3	total
route total length	9 km	12 km	16 km	37 km
number of small advertisements	85	37	38	160
number of bilboards	74	12	34	120
number of megaboards/bigboards	36	6	21	63

3 Results

Gaze duration on all types of advertisement were analysed. Distribution of fixation time is not normal (Gaussian), but they rise slightly rapidly on the left and have a long positive tail on the right. The results obtained on the individual test routes were compared using nonparametric Kruskal-Wallis test. This test indicated not statistically significant differences between gaze duration on the same types of advertisement on the different test route. Fixation times for individual types of advertisement could be analyzed together independently of the test route. The results of this analysis also indicate that gaze duration at the advertisement depends not only on the person and content of the advertisement, but also on the type (size) of the device. Kruskal-Wallis test indicate statistically significant difference ($p = 0.00$) in type of advertisement. Graphical representation of the obtained results is documented by the Figure 1. Based on multiple comparisons, it could be said that the difference between billboards and bigboards with megaboards is not statistically significant. However, the difference between these groups and smaller advertising devices is statistically significant.
As stated in [7], visual perception and vision differ. Participant does not have to perceive all subjects even though the subject is caught by his eye. Inclusion of interview during the measurement to verify whether the participant perceives the advertisement has been difficult for realisation with regards to the driving situation complexity and number of the advertisement. Mainly interviewing during driving could distort the results. Participants also must not have been acquainted with the aim of the experiment.
Therefore, for the results objectivization and analysis of differences between vision and visual perception, another set of measurement has been made. Six drivers participated in this case study. Forty minutes long route has been established in the city. During driving, drivers were

asked on a couple of different questions. Part of these questions were concerned also on an advertisement. On this test track, based on previous studies, six of the most often monitored billboards has been selected. After driving around these advertisement, drivers were asked if they are able to reproduce the content of advertisement. In 75 % of cases, if the driver looked at the advertisement, he was able to reproduce the content correctly. For the purpose of this study, only men aged from 24 to 55 (n = 30, mean age = 32) were analyzed. In the future studies, also the influence of sex, age, driving experience and the other driver characteristics should be analyzed.

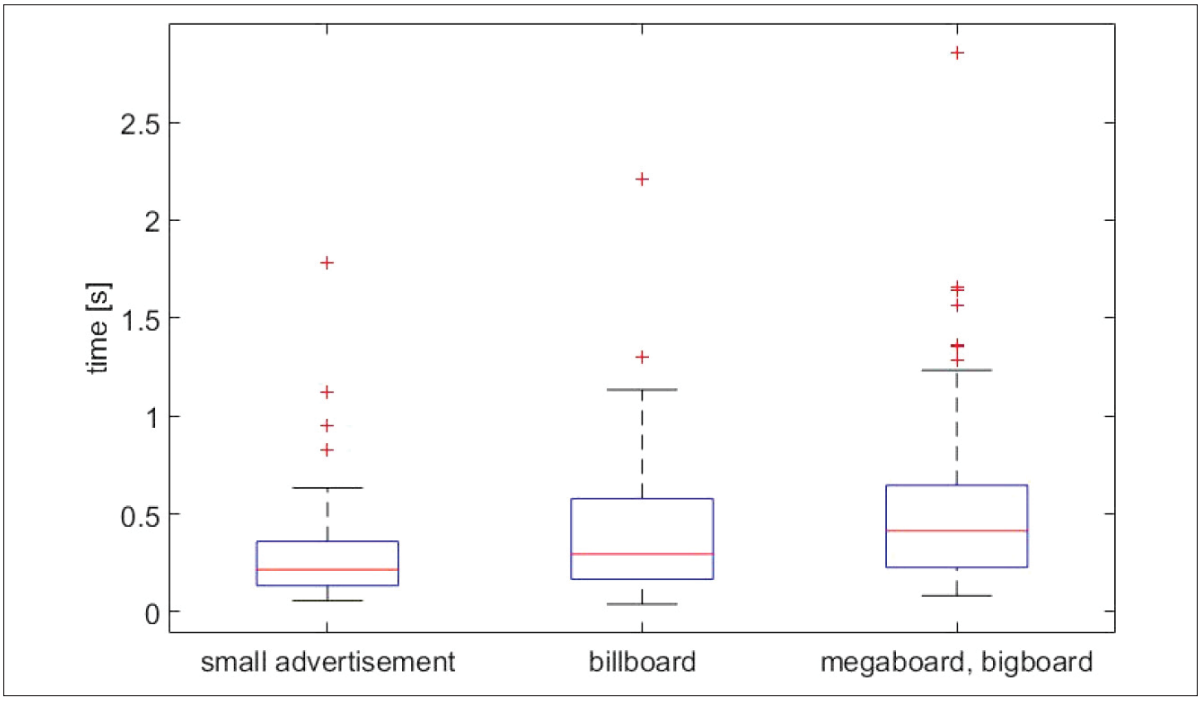

Figure 1 Box plot – comparison of advertisement types

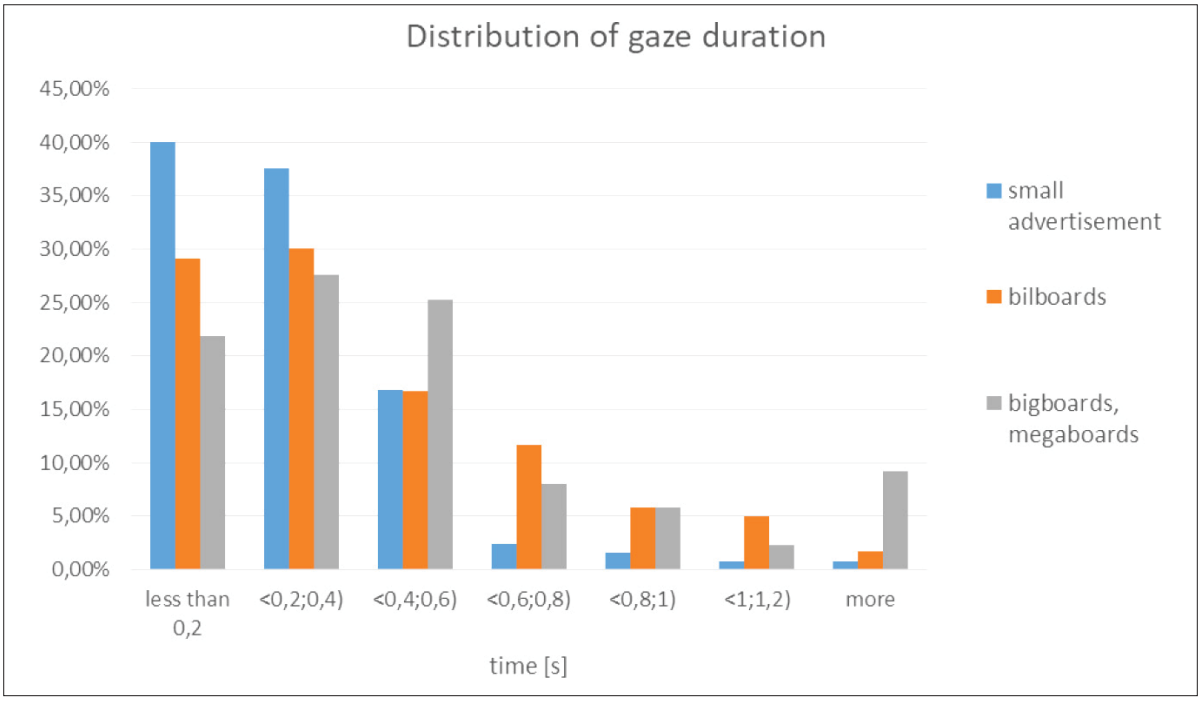

Figure 2 Distribution of gaze duration on the selected types of advertisement

4 Conclusion

The traffic environment contains many important information, which necessarily has to be perceived by driver. Most of the information need to be sensed visually. The goal of advertising device has been to attract the attention of target group, i.e. distract the attention of road users. The legislation focused on the advertisement regulation has been discussed especially in recent years. Currently, the placement of advertisement has been prohibited in the protection zones of motorways and first-class roads. A transfer of the advertisement to the vicinity of local roads especially to the urban areas could be expected. Despite the lower speed of the vehicle in the urban areas, the driver attention has been exposed to the higher number of stimuli – pedestrians, intersection, etc.
The impact of advertising devices has been analyzed by a number of studies, however mostly in simulated condition. The aim of this study was to analyze the influence of different type of advertisement (in terms of size) in real road traffic in the urban areas. Though, the content of the advertisement and the personal prefferences are important factor, the dependence of distraction on the type of advertisement has been proved.
Results of different driver on different routes shown not statistically significant differences in terms of advertisement type on these routes, so summary analysis of selected advertisment type has been possible to make. Summary analysis of different advertisement types shows statistically significant differences. While between time of the fixations on billboards, bigboards and megabords differences was not statistically significant, gaze duration on small advertising devices compared to the other types was significantly smaller.
In 75 % of cases, if the driver looked at the advertisement, he was able to reproduce the content correctly. For the further results objectivity, using of performance test or at least interview should be beneficial. The inclusion of the survey during driving is problematic, especially because participants should be uninformed with the goal of the experiment.
As was shown in this study, all types of advertisement (regardless of size) has affected driver's attention. The average duration of the glances for the subjects was 0.4 s. if attention is held by an advertisement during the hazard onset, then drivers reaction time could be affected, so any required manoeuvre may be delayed, increasing the likelihood of an accident.

Affiliation

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