

The Influence on Road Safety Due to Driver Distraction from Outdoor Advertising: Case Study

Anamarija L. Mrgole *

*University of Maribor, Faculty of Civil Engineering, Transportation Engineering and Architecture,
Smetanova ulica 17, 2000 Maribor, Slovenia
Email: anamarija.mrgole@um.si*

Abstract

This paper provides a review of current research on driver distraction, focusing on outdoor advertising. Also examined is whether, and to what degree, these degradations in driving performance translate into a decreased road safety. Disorders of the driver during driving can be divided into four basic groups: visual disturbances; The driver does not look at driving directions, hearing impairment; The driver is disturbed by a sound that does not pay attention to the current traffic situation, hand interference; The driver does not use both hands for steering with a steering wheel and a cognitive disorder; Not the driver's focus and indecision. Roadside advertising is intended to attract the driver's attention, which at a given moment reduces the driver's attention to the actual traffic situation and driving. A driver's disturbance may also be caused by roadside advertising in the event of a strong luminance of the advertised screens, talking about the blindness of the driver or in case of motion. The literature review, however, provides a possible proposal for the regulation of roadside advertising in such a way that it is not a disturbance of the driver or a possible non-visualization of vertical signalization. In the final section of the paper, recommendations for future research is provided.

Keywords: Driver distraction Advertising; Outdoor Advertising; Road Safety.

1. Introduction

Driving is an intricate assignment, requiring the simultaneous execution of different subjective, physical and psychomotor abilities[1]. However, these complex task do not stop drivers engaging in various non driving related activities. Any activity even only simple distraction like outdoor advertising has the potential to degrade drivers.

* Corresponding author.

performance and have large consequence on road safety [2]. Driver distraction or inattention to the road it is claimed to be a factor in over half on incidents [3]. To increment road safety, we have speed traps, radars, traffic calming measures, breathalyzers, higher priced grounded penalties, and so forth. All things considered, most accidents are not caused by drunk drivers or speeding, but rather by diverted drivers. There is no real way to quantify the exact effect of these activities, however there is little uncertainty that they have by and large spared thousands of lives. However, there is one special case, one glaring oddity that negates every other measure and endeavors that have been made to spare lives on our streets. That oddity is roadside advertising. Although the research of driver distraction in the past was vastly covered, there is still no universal agreement upon definition of driver distraction. In literature we can find a range from driver distraction occurs when a driver is delayed in the recognition of information needed to safely accomplish the driving task because some other event, activity, object or person within or outside the vehicle compelled or tended to induce the driver's shifting attention away from the driving task [4]. The outdoor advertising industry has one particular objective: to stand out enough to be noticed. For a hundred years we've had boards scattered over our urban areas screaming out their messages about new products, shows, applications and services. Be that as it may, boards just work on the off chance that you see them. Along these lines, progressively, they are getting greater and brighter with an end goal to occupy a bigger group of onlookers. The freshest development is advanced announcements which show another commercial like clockwork — blazing a huge number of times every day. Wickens [5] has described the interference of the task, when two stimuli share the same input of modality and response type. It is expected from outdoor advertising to attract visual attention of the driver with cognitive central processing, therefore it would be expected to cause task interference with driving task, which requires from the driver visual task and central processing.

1.1. Previous literature

It consequently appears likely that outdoor advertising can distract drivers in a way that their reaction to road signals and possibly other road users is delayed. The experiment that presents a range of performance measures using a high-fidelity driving simulator, as this technique provides a balance between the control of a indoor research and the realism of an on road study. It really is consequently anticipated that distraction because of outdoor advertising would impair drivers' ability to properly follow road indications and change lanes quickly. The driver's distraction has already been extensively researched, especially as a disturbance within the vehicle. Authors like Chan and Singhal [6], Young and his colleagues [7], Bendak and Al-Saleh [8], Crundall, Van Loon [9], Underwood, [10] and many other authors have already written about the driver's disruption in vehicle technology. An extensive research project of Lee and his colleagues [11] demonstrates that drivers attention on outdoor advertising, it is not easy for on road studies to analyses how outdoor advertising change the driver perception as the environmental surroundings cannot be completely controlled to billboards alone. However, this situation is not an issues in a simulated environment. The percentage of time drivers will be in the middle of the road not approaching left or right side line on the street is expected to be high, in the experiment presented we did not involve approaching from the sides. It was assumed that outdoor advertising presence would draw attention away from the street ahead, towards roadsides where billboards were situated. A study was made by Smiley, Smahel & Eizenman [3] where visual distraction was shown to significantly delay the detection of emergent stimuli by up to 1 second which, in real-world situations, translates into a delayed response of drivers.

The perception of driver distraction outside the vehicle is some kind new idea. It has been log suggested that in vehicle distraction can divert drivers from operation task of driving. The current experiment includes static outdoor advertisement. The visual attention literary works suggests that the subject on the advertisement can involuntarily attract attention [12]. Therefore, it was expected the presence of outdoor advertising should attract eye movements and affect responses to road signs. It was also examined whether the effect of outdoor advertising can change within the presence of traffic, so one of the drives included lead vehicles. Lead vehicles may raise the effect of this outdoor advertising and we can expect increased workload of maintaining a headway distance which is acceptable. Nonetheless it is also possible that lead cars may attenuate the effectuation of outdoor advertising, as drivers will concentrate on the automobile ahead in order to keep the specified headway. Lead vehicles have already been discovered to increase the proportion of the time fixating on the (vehicles and) road ahead [10], and also this effect is expected in the experiment that is present.

1.2. Study overview and summary of hypotheses

The importance of roadside advertising was also recognized by the advertising industry as an important factor in attracting the attention of passers-by drivers [10]. In his study, Crundal compared two different types of advertising in different conditions, where the measure of eye movement and time of appreciation were measured. These criteria were in such a way that in one case, drivers were alerted to the outward advertising in the second case, but the outer advertising carts were not expected. Studies and their results recognize the importance of potential driver disturbance with external roadside advertising and impact on the driver's ability to drive. Increasing the information provided to drivers also means reducing the ability to detect important traffic signs and alerts. The purpose of the study is to recognize external advertising as a reduction in driver's awareness and reaction time in different road environments.

2. Materials and methods

2.1. Subjects

Forty-seven subjects (27 women) with a mean age of 35.4 years took part in this study. On average, they had 17.2 years of driving experience (since passing their driving test). Their average annual kilometers driven was 7512.

Table 1: Participant age group and gender diversity

	<i>Age group</i>		
<i>Gender</i>	25-35	35-65	Total
Male	8	12	20
Female	10	17	27
Total			47

2.2. Stimuli and apparatus

The Study was conducted in a simulated room with mixed design was employed in outdoor advertising. The

between-group variable was instruction set. The first group were given instructions to concentrate on the hazardous nature of each clip. The second group had less emphasis placed on the hazard perception task, and in addition they were told to watch out for advertisements that they might pass, as these would play a part in a subsequent memory test.

2.3. Procedure

Experimental subjects were seated 3 m from the screen in a semi-dark room and allowed to read the instructions. After calibration, they were randomly presented with of 10 clips. For the comparative study, the 3D simulator program and the Eye Tracker of the Tobi subcompany were used. The simulation of the ride took place on urban rural roads as well as on the motorway. The test group carried the vehicles on exactly the same road sections in five consecutive repetitions. Road sections is a test vehicle group with roadside advertising and also without road advertising. The order of the terms was balanced among the participants. The posters were placed at random locations, with the condition of the installation in such a way that they were not directly covered by vertical traffic signals. Four simulators were placed in the simulation, two on the left and on the right side, and one that the driver was able to see on the plane in changing the driving belt. Figure 1 shows a simulation of driving without a billboard, Figure 2 has randomly placed bulletin boards along the road. The dependent variables for evaluating the driver's performance and factors influencing the driver's attention were selected. The driving data was automatically written with the driving simulator program. For longitudinal control, the selected variable was the time to contact (touch), which is more meaningful than the speed of the drive. The speed of driving depends primarily on the type of road categorization. The subject of the research was as minimum as the TTC (time to contact) time, or the time to touch. Before the start of the test, a test driver was introduced to the driving simulator where they could be briefly acquainted with commands on the steering wheel of the simulator and the Eye Tracker. Only after the calibration of the steering wheel and the adjusted comfort of the Eye tracker glasses was the participant tested the simulator. Sequential after the test run, the participant-departments of all five simulations participate. Each participant had to adhere to road traffic regulations perceived in the driving simulator. The simulation of the journey contained 4.5 km of urban area, 3 km of rural area and 6 km of motorway section. Due to the driver's limitations on road traffic regulations in the 3D simulator, the average speed 59km / h in the rural area, 38km / h in the urban area and 107km / h on the motorway section. The test group test is completed with the question of detecting the last traffic sign and the detected advertising area.



Figure 1: Driver simulation no outdoor advertising.



Figure 2: Driver simulation with outdoor advertising.

All obtained results were dealt with according to two factors: advertising (two levels) and categorization of the road (three levels).

The driver's ability varied the glare to the categorization of the road and advertising. The average time, outside the lane, showed that the categorization of the road is essential.

$$F(2, 89)=15,8; p < 0.001 - \text{no outdoor advertising} \tag{1}$$

$$F(1, 41)=3,98; p=0,04 - \text{with outdoor advertising} \tag{2}$$

All results obtained were considered. As shown in Figure 3, the presence of advertising boards resulted in the time when the driver was driving outside the lane.

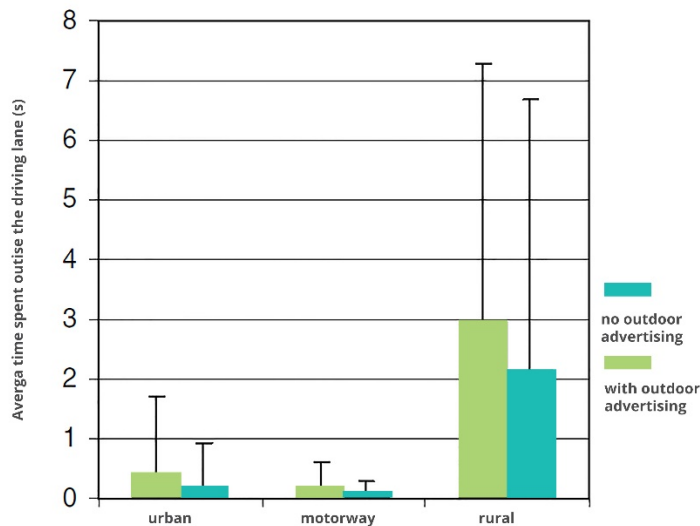


Figure 3: Driver simulation no outdoor advertising

The analysis of the results showed substantially deviation between:

$$F(1, 47)=17,8,7; p < 0.001 - \text{motorway} \tag{3}$$

$$F(1, 41)=15,7,7; p < 0.001 - \text{rural area} \tag{4}$$

Table 2: Number of collisions according to the type of road and advertising

	With outdoor advertising	No outdoor advertising
Urban	8	1
Rural	4	0
Motorway	1	1

The comparison of accidents during the simulation is shown in Table 2, where it is evident that there were several accidents in the event of external roadside advertising being disturbed by the driver.

The driver's attention was measured with the Eye Tracker in such a way that the screen was divided into three equal parts, the desired view was used to analyze the middle part of the screen driver's attention - straight ahead.

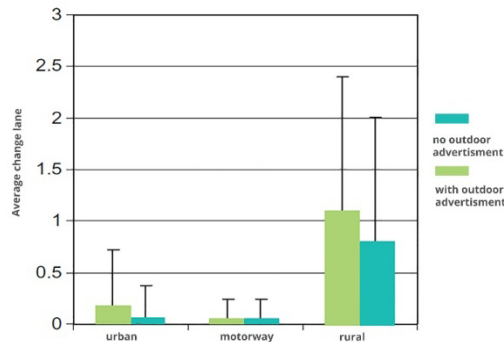


Figure 4: Driver simulation no outdoor advertising

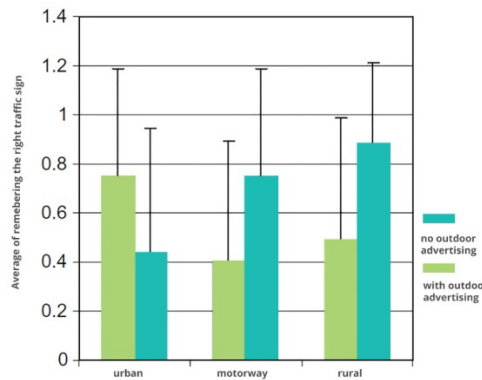


Figure 4: Driver simulation no outdoor advertising

The analysis of the time delay of the driver's views showed that drivers are perceiving repeatedly outdoor

advertising on the right, which is mainly conditioned by the driving direction.

3. Conclusion

The results show that the presence of advanced advertising affects the driver's behavior in road traffic. The research studies show that the increase in pro-metric accidents with regard to the increase in the number of billboards.

The study shows the impact on outdoor roadside advertising with disturbances to the driver and his visual disturbance. The presence of billboards has resulted in longer-time drivers than the road conditions. The presence of billboards is increasing according to a change in the driver's attention or changes in the driver's views. It has been proven that shorter changes to the driver's vision are also related to something that is close to or close to the driver. Similar to something (he's home).

The study has shown that outward-road advertising is certainly a disturbance to the driver. In any case, a wide range of billboards of different sizes and layouts are even more attractive for the views of the drivers. In accordance with the written record, it is possible to say that traffic safety has been reduced due to the layout of billboards. It is noteworthy that colors are often used on the bulletin boards, such as yellow and red, in which case the vertical traffic signalization that the driver can ignore due to the disruption of the advertising board will hide before that advertisement panel.

In Slovenia, it is necessary to establish a methodology for placing large road signs on the Billboard, not only from the construction aspect - the distance from the edge of the road, but also to a uniform size and an angle setting. In the future, it would also make sense to consider limiting the color combination of advertising boards that would not cause fusion with vertical traffic signalization.

References

- [1] K. L. Young and P. M. Salmon, "Examining the relationship between driver distraction and driving errors: A discussion of theory, studies and methods," *Safety Science*, vol. 50, no. 2, pp. 165–174, 2012.
- [2] T. Horberry, J. Anderson, M. A. Regan, T. J. Triggs, and J. Brown, "Driver distraction: The effects of concurrent in-vehicle tasks, road environment complexity and age on driving performance," *Accid. Anal. Prev.*, vol. 38, no. 1, pp. 185–191, 2006.
- [3] A. Smiley, T. Smahel, and M. Eizenman, "Impact of Video Advertising on Driver Fixation Patterns," *Transp. Res. Rec. J. Transp. Res. Board*, vol. 1899, pp. 76–83, Jan. 2004.
- [4] F. Streff and H. Spradlin, "Technical Report Documentatio~n Pa e Driver Distraction, Aggression, and Fatigue: A Synthesis of the Literature and Guidelines for Michigan Planning," 2000.
- [5] C. D. Wickens, "Multiple Resources and Mental Workload," *Hum. Factors J. Hum. Factors Ergon.*

- Soc., vol. 50, no. 3, pp. 449–455, Jun. 2008.
- [6] M. Chan and A. Singhal, “The emotional side of cognitive distraction: Implications for road safety,” *Accid. Anal. Prev.*, vol. xxx, 2012.
- [7] M. S. Young, J. M. Mahfoud, N. A. Stanton, P. M. Salmon, D. P. Jenkins, and G. H. Walker, “Conflicts of interest: The implications of roadside advertising for driver attention,” *Transp. Res. Part F Psychol. Behav.*, vol. 12, pp. 381–388.
- [8] S. Bendak and K. Al-Saleh, “The role of roadside advertising signs in distracting drivers,” *Int. J. Ind. Ergon.*, vol. 40, no. 3, pp. 233–236, 2010.
- [9] T. Taylor et al., “The view from the road: The contribution of on-road glance-monitoring technologies to understanding driver behavior,” *Accid. Anal. Prev.*, vol. 58, pp. 175–186, 2013.
- [10] D. Crundall, E. Van Loon, and G. Underwood, “Attraction and distraction of attention with roadside advertisements,” *Accid. Anal. Prev.*, vol. 38, no. 4, pp. 671–677, 2006.
- [11] S. E. Lee, M. J. McElheny, and R. Gibbons, “Driving Performance and Digital Billboards Prepared for: Foundation for Outdoor Advertising Research and Education,” 2007.
- [12] S. E. Christ, R. A. Abrams, E. J. T., B. D., and Y. S., “The attentional influence of new objects and new motion,” *J. Vis.*, vol. 8, no. 3, p. 27, Mar. 2008.