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Exploratory analysis of the effect of distraction on driving behaviour through a driving simulator experiment

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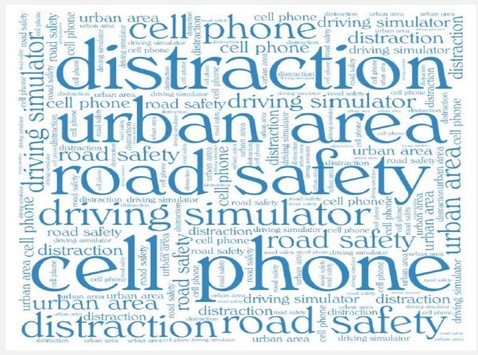
Abstract

Driver distraction constitutes a basic factor for increased risk for road accidents in Greece and internationally. The objective of this research is the investigation of the effect of different types of distracted driving on driving performance.

For this purpose, a **driving simulator experiment** was carried out at the simulator of the National Technical University of Athens, in which 87 participants were asked to drive under different types of distraction and under different traffic conditions on urban area.



Data collected from the driving simulator experiment include both **longitudinal** control measures (mean speed, headways), **lateral** control measures (lateral position, standard deviation of lateral position) and the **reaction time** of the driver at unexpected incidents.

Experiment design

Sample

The sample of participants is 87 healthy drivers
- 32 young drivers aged 18-34 years old
- 33 middle aged drivers aged 35-54 years old
- 22 older driver aged 55-80 years old

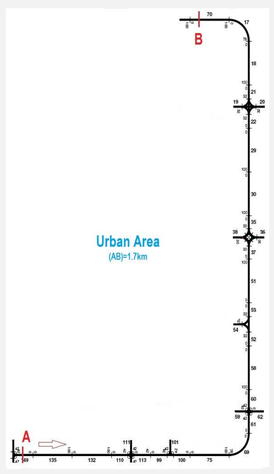
Familiarization

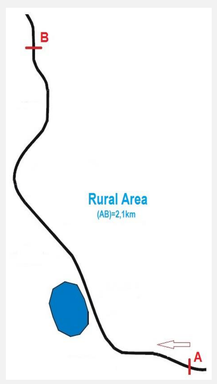
During the familiarization with the simulator, the participants practiced in:
- handling the simulator (starting, gears, wheel handling etc.)
- keeping the lateral position of the vehicle
- keeping stable speed, appropriate for the road environment
- braking and immobilization of the vehicle.

When all criteria the above were satisfied (there was no exact time restriction), the participant moved on to the next phase of the experiment.

Driving scenarios

<u>Road environments:</u>
- A rural route that is 2.1 km long, single carriageway and the lane width is 3m, with zero gradient and mild horizontal curves
- An urban route that is 1,7km long, at its bigger part dual carriageway, separated by guardrails, and the lane width is 3.5m





<u>Traffic scenarios:</u>
- Moderate traffic conditions, corresponding to an average traffic volume Q=300 vehicles/hour
- High traffic conditions, corresponding to an average traffic volume of Q=600 vehicles/hour

<u>Distraction conditions:</u>
- undistracted driving
- driving while conversing with a passenger
- driving while conversing on a mobile phone.

Conversation topics

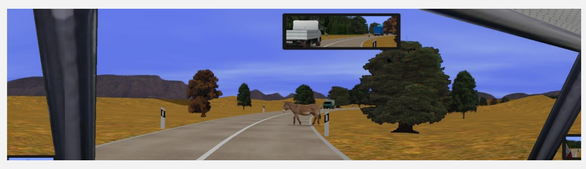
Family, Origin, Accommodation, Travelling, Geography, Interests, Hobbies, Everyday life, News, Business

Randomisation

A randomization in the order of the area type in which the participant is going to drive, as well as in the order of the traffic and distraction scenarios is taking place

Incidents

During each trial of the experiment, two unexpected incidents occurred at fixed points

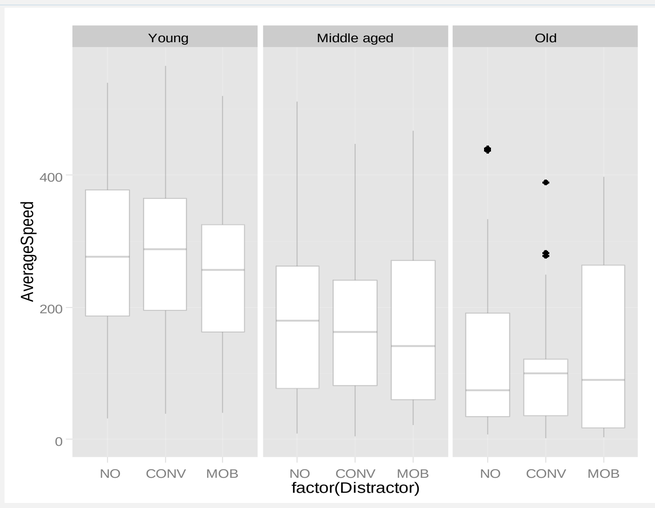


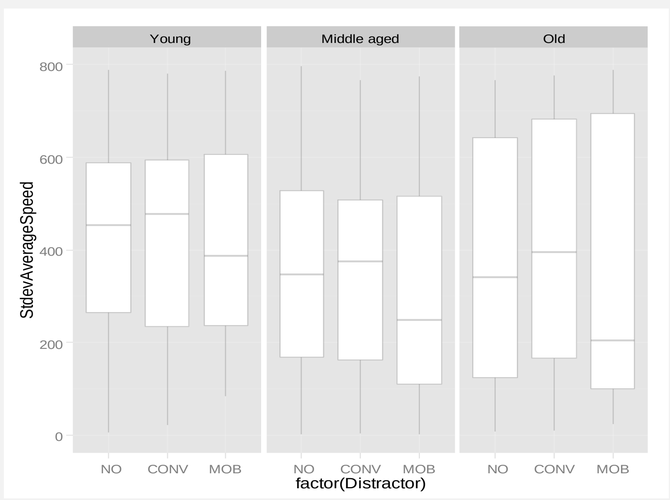
Results

In order to analyse specific driving performance measures a descriptive analysis took place through box plots:
- The line in the middle of the boxes is the median
- The bottom of the box indicates the 25th percentile
- The top of the box represents the 75th percentile

Average speed

- young drivers drive in higher speeds in comparison with middle aged and older drivers
- drivers of all age groups reduce their speed, especially while talking on the mobile phone
- while conversing with the passenger, young and middle aged drivers do not change the mean speed



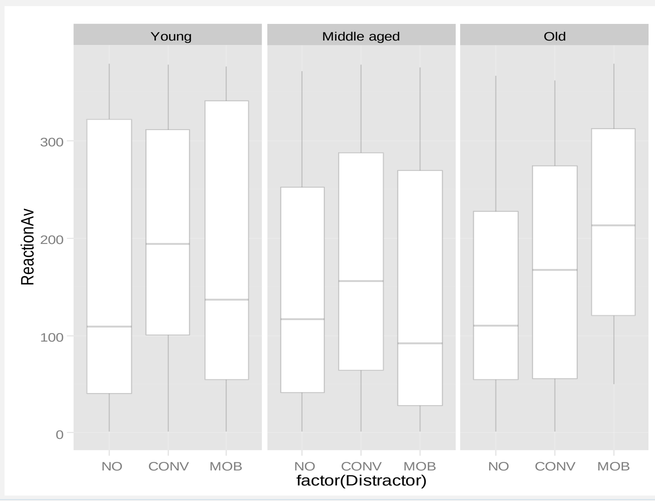


Speed variability

- drivers of all age groups have higher speed variability when conversing with the passenger
- drivers while talking on the cell phone exhibit significant lower speed variability indicating compensatory behaviour

Average speed

- all drivers have higher reaction times on both types of distracted driving
- young and middle aged drivers indicate higher reaction times when conversing with the passenger
- older drivers have the worst reaction time when talking on the mobile phone



Conclusions

- while conversing with the passenger young and middle aged drivers do not change the mean speed while older drivers tend to increase the speed probably due to a feeling of secure that exists due to the passenger
- older drivers are not familiarized with the use of mobile phones and cannot operate calls as young or middle aged drivers so mobile phone has a potential negative impact on road safety and may lead to increased accident risk for older drivers
- regarding the reaction time, results indicate that the distraction mechanism between conversation with the passenger and mobile phone is different and has totally different consequences in the various age groups

Acknowledgment

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