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How does distracted driving affect lateral position of older drivers?

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Outline

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Background

- Taking into account that inappropriate lateral positioning is one of the primary factors leading to **accidents**, lateral control measures are some of the most commonly used driving behaviour metrics

- Lateral control measures assess how well drivers **maintain vehicle position** within a lane

- The most **popular measures** include
  - Lateral position
  - Standard deviation of lateral position
  - Steering wheel metrics

Objectives

The analysis of the lateral position of drivers from different age groups, while talking on the cell phone and conversing with another passenger

A **driving simulator experiment** was carried out within the framework of the Distract and the DriverBrain research projects (national research funding)

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distrACT

driverBRAIN

Department of Transportation Planning and Engineering, NTUA

Department of Neurology, Psychiatry and Social Medicine, UoA
Department of Psychology, UoA

Driving simulator experiment

Driving simulator

Foerst Driving Simulator (1/4 cab)

Road environment

- Rural: 2.1 km long, single carriageway
- Urban: 1.7 km long, dual carriageway

Traffic scenarios

- Q_L: Low traffic - 300 vehicles/hour
- Q_H: High traffic - 600 vehicles/hour

Unexpected incidents at each trial

- Child crossing the road
- Sudden appearance of an animal

Experiment design

Randomization

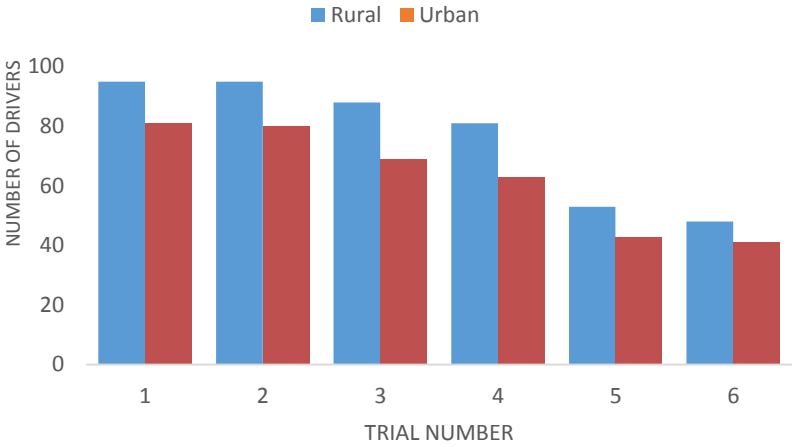
Randomization was implemented in the order of area type, traffic scenarios as well as distraction scenarios

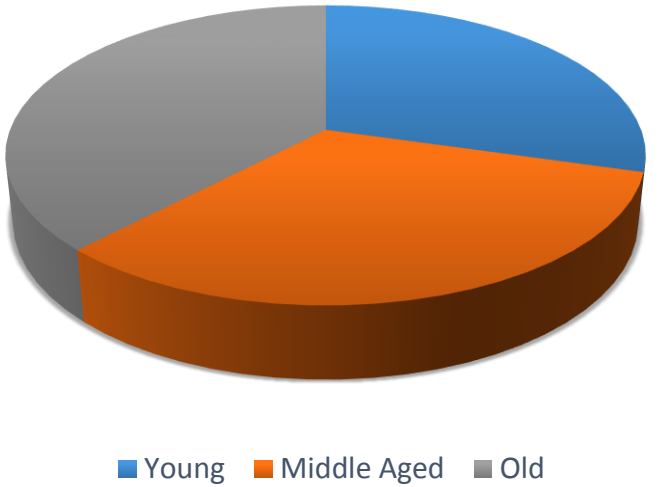
Familiarization

The participant practiced in handling the simulator, keeping the lateral position of the vehicle, keeping stable speed, etc.

Sample

- 28 young drivers (18-34)
- 31 middle aged drivers (35-54)
- 36 older drivers (55+)





Distraction procedure

Distraction sources

- cell-phone conversation
- conversation with passenger

Conversation topics

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

Analysis methods

Driving performance measure

Lateral position - refers to the distance between the simulator vehicle and the right border of the road

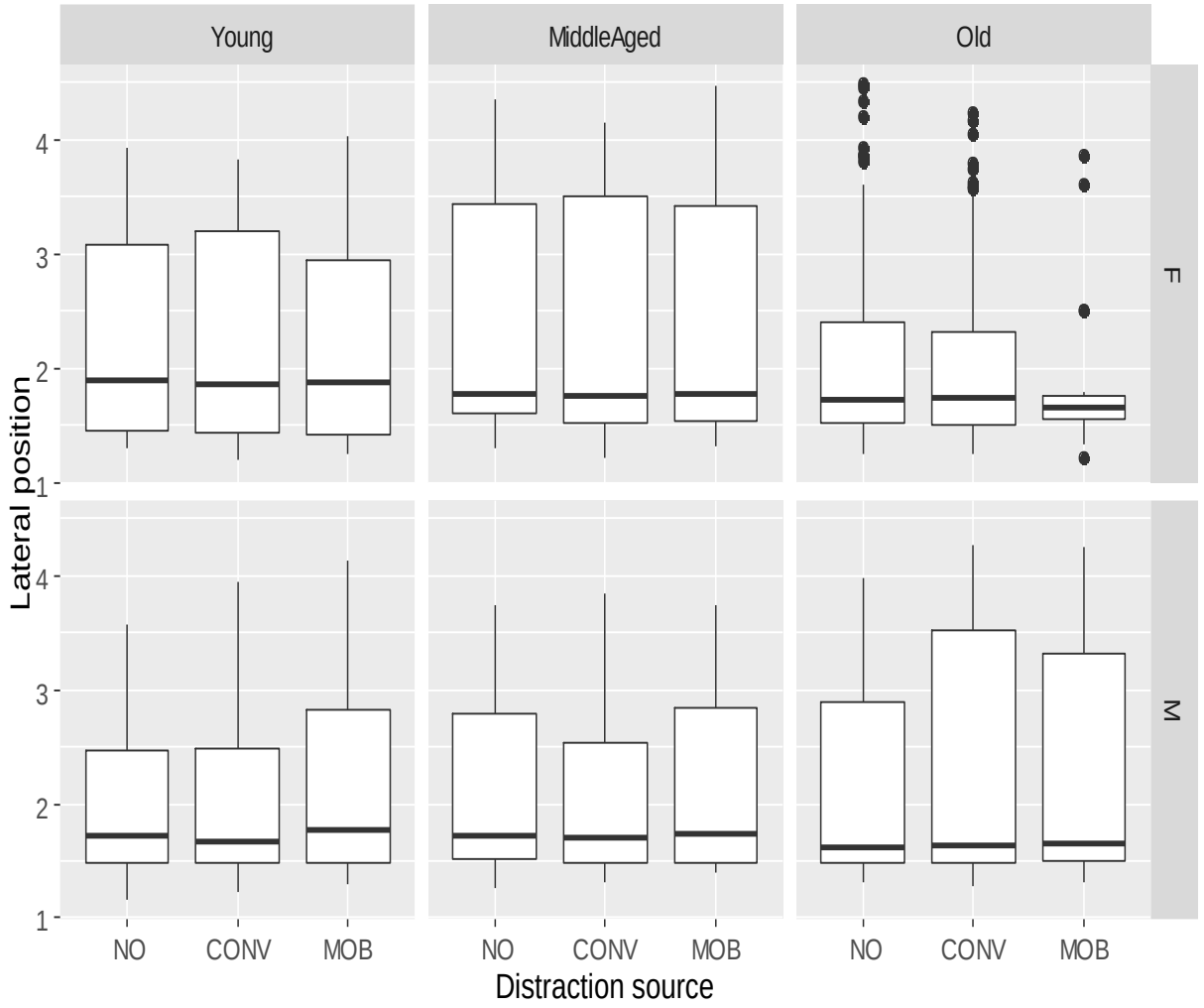
Statistical analysis methods

- Descriptive analysis (box plots)
- Generalized linear models (GLM)
- Generalized linear mixed models (GLMM)

Descriptive analysis

Lateral position of drivers is presented per **distraction factor**, per **age group** and per **gender**

- While talking on the cell phone drivers of all age groups have **higher** lateral position compared with undistracted driving.
- These differences are not very clear indicating that **further analysis** should me implemented in order to investigate the specific effect of each parameter on lateral position of the vehicle



Generalised Lineal Model

Variables	Estimate	Std. Error	t value	Pr(>|t|)
Intercept	1,49	0,04	37,75	< 0,000
Distraction – Cell phone	0,07	0,04	1,86	0,064
Age group – Middle Aged	0,19	0,04	5,17	< 0,000
Age group - Older	0,19	0,04	4,80	< 0,000
Area type - Urban	1,54	0,03	50,67	< 0,000
Traffic – Low	-0,11	0,03	-3,57	< 0,000
Gender – Male	-0,10	0,03	-3,26	0,001
Summary statistics				
AIC	989,29			
Log-restricted-likelihood	-486,61			
Degrees of freedom	810			

- Lateral position of the vehicle is estimated based on **driver characteristics** such as age group and gender, **road environment characteristics** such as area type and traffic conditions, as well as the use of **cell phone**

Generalised Lineal Mixed Model

Variables	Estimate	Std. Error	t value	Pr(>|t|)
Intercept	1,47	0,06	24,20	< 0,000
Distraction – Cell phone	0,07	0,03	2,30	0,021
Age group – Middle Aged	0,20	0,07	3,11	< 0,000
Age group - Older	0,32	0,06	3,19	< 0,000
Area type - Urban	1,53	0,03	56,71	< 0,000
Traffic – Low	-0,10	0,03	-3,97	< 0,000
Gender – Male	-0,10	0,05	-1,78	0,077
Random effect				
By Person ID (stdev)	0,21			
Summary statistics				
AIC	920,51			
Log-restricted-likelihood	-451,26			

- Data involve **repeated measures observations** from each individual drive, as each driver completes six drives in rural and six drives in urban environment
- The likelihood ratio test regarding lateral position $LR_{lat.pos}$= -70,71 (1 degree of freedom) shows that the **random effect** contributes significantly to the fit of the mode

Conclusions

- **Cell phone** use slightly increased lateral position indicating that drivers find difficult to keep the vehicle in a constant distance from the right board of the lane
- **Conversing with a passenger** was not found to affect significantly the lateral position of the vehicle
- **Male** drivers were found to achieve lower lateral position than the female ones
- **Middle aged** and **older** drivers find difficulties in maintaining the driving simulator vehicle compared to young drivers
- **Area type** has the highest effect on lateral position as the urban environment is more complex with much more interactions between vehicles

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