

How cell phone use affects reaction time of older drivers

P. Papantoniou, C. Antoniou, G. Yannis, E. Papadimitriou, D. Pavlou, J. Golias

National Technical University of Athens, Department of Transportation Planning and Engineering, Athens, Greece



BACKGROUND

Although **older drivers** are involved in a few accidents in terms of absolute numbers, they represent one of the highest risk categories for accidents involving fatalities and serious injuries per number of drivers and per distance travelled probably because of their great fragility and reduced tolerance to injury. Furthermore, **cell phone use** is estimated to be an important cause of vehicle accidents. Even if cell phone use can be considered as part of everyday the increased use of cell phones from drivers of all age groups while driving makes the investigation of their influence on driving behaviour and on road safety very essential. In addition, as there are a lot of different methods and measures that exist for evaluating driving performance, the selection of the specific measures for driver distraction research, as in other areas of research, should be guided by a number of general rules related to the nature of the task examined as well as the specific research questions. Within this framework, **reaction time** measures is an increasingly popular set of variables primary because of the relationship with accident risk.



Although **older drivers** are involved in a few accidents in terms of absolute numbers, they represent one of the highest risk categories for accidents involving fatalities and serious injuries per number of drivers and per distance travelled probably because of their great fragility and reduced tolerance to injury. Furthermore, **cell phone use** is estimated to be an important cause of vehicle accidents. Even if cell phone use can be considered as part of everyday the increased use of cell phones from drivers of all age groups while driving makes the investigation of their influence on driving behaviour and on road safety very essential. In addition, as there are a lot of different methods and measures that exist for evaluating driving performance, the selection of the specific measures for driver distraction research, as in other areas of research, should be guided by a number of general rules related to the nature of the task examined as well as the specific research questions. Within this framework, **reaction time** measures is an increasingly popular set of variables primary because of the relationship with accident risk.

OBJECTIVE

The objective of this research is **the analysis of the reaction time of older drivers while talking on the cell phone**. For this purpose, a large driving simulator experiment is carried out, in which 95 drivers from three different age groups (young, middle aged and older) were asked to drive under different types of distraction (no distraction, conversation with passenger, cell phone use) in rural and urban road environment, in low and high traffic. In addition, two unexpected events are set in each driving scenario, where the reaction time of each driver is recorded.

EXPERIMENT DESIGN

Sample

- The sample of participants is 95 healthy drivers
- 28 young drivers aged 18-34 years old
- 31 middle aged drivers aged 35-54 years old
- 36 older driver aged 55- years old



Distraction conditions:

- undistracted driving
- driving while conversing with a passenger
- driving while conversing on a cell phone.

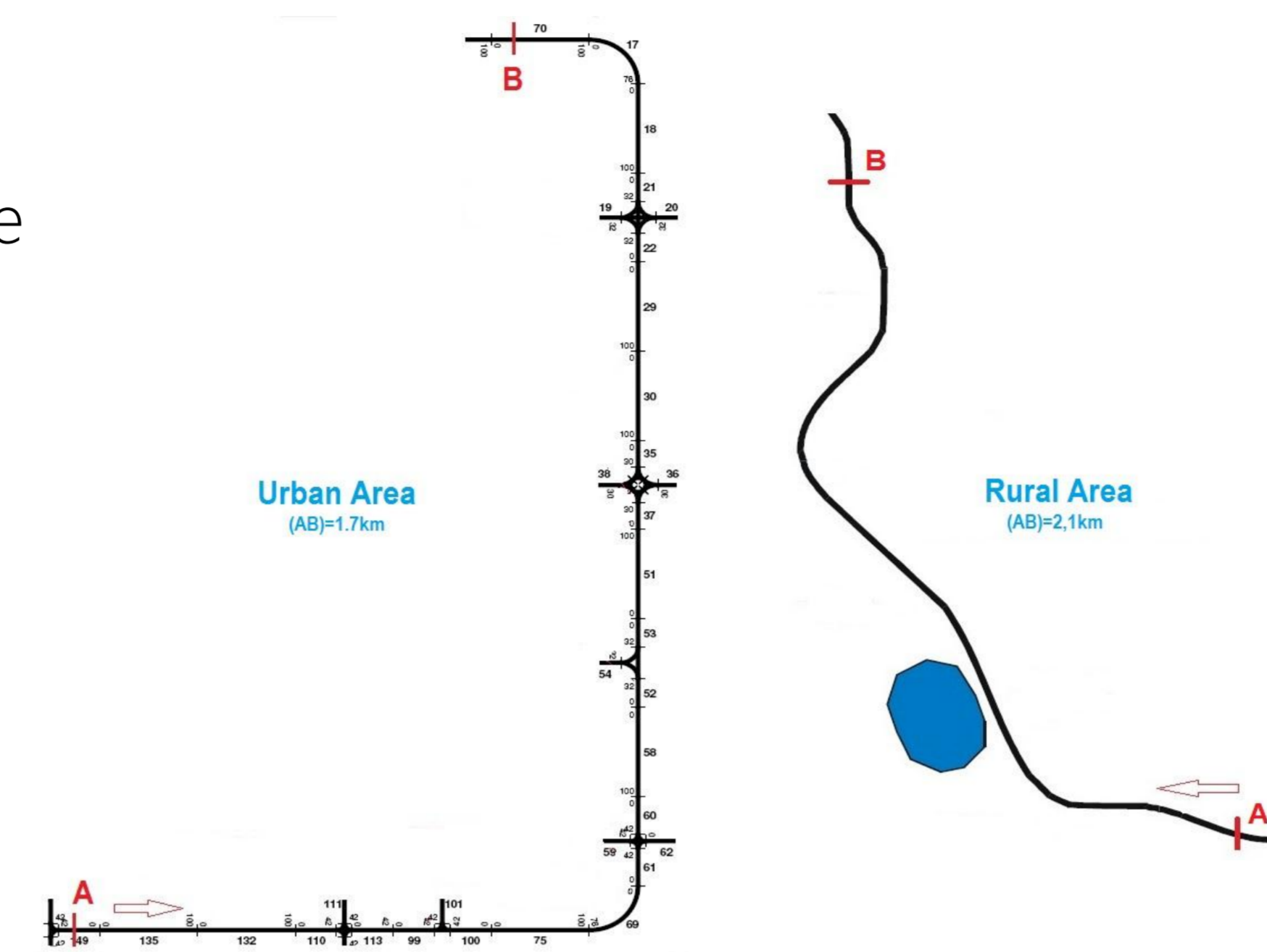
Conversation topics

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

EXPERIMENT PROCEDURE

Driving scenarios

- 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 the bigger part dual carriageway, separated by guardrails, and the lane width is 3.5m



Traffic scenarios:

- 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

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

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.

Unexpected incidents

During each trial of the experiment, 2 unexpected incidents were scheduled to occur along the drive:

- incidents in rural area concerned the sudden appearance of an animal
- incidents in urban areas concerned the sudden appearance of an adult pedestrian or of a child chasing a ball on the roadway

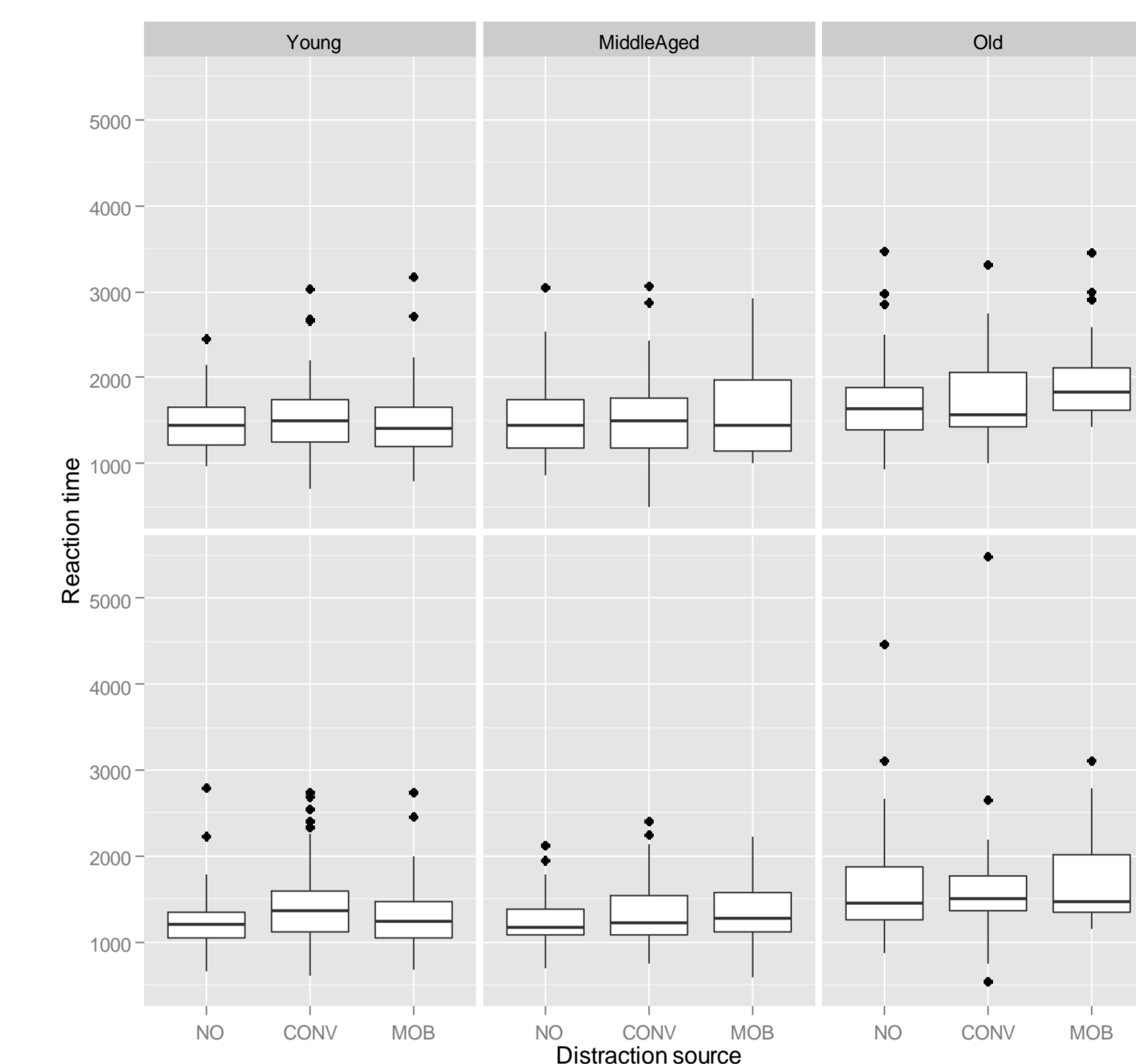


ANALYSIS METHOD

In box plots, the spacing between the different parts of the **box plot** indicates the degree of dispersion and skewness in the data and identifies outliers:

- The line in the middle of the boxes is the median
- 25% of cases have values below the bottom line
- 25% of cases have values above the top line
- 50% of the cases lie within the box

RESULTS



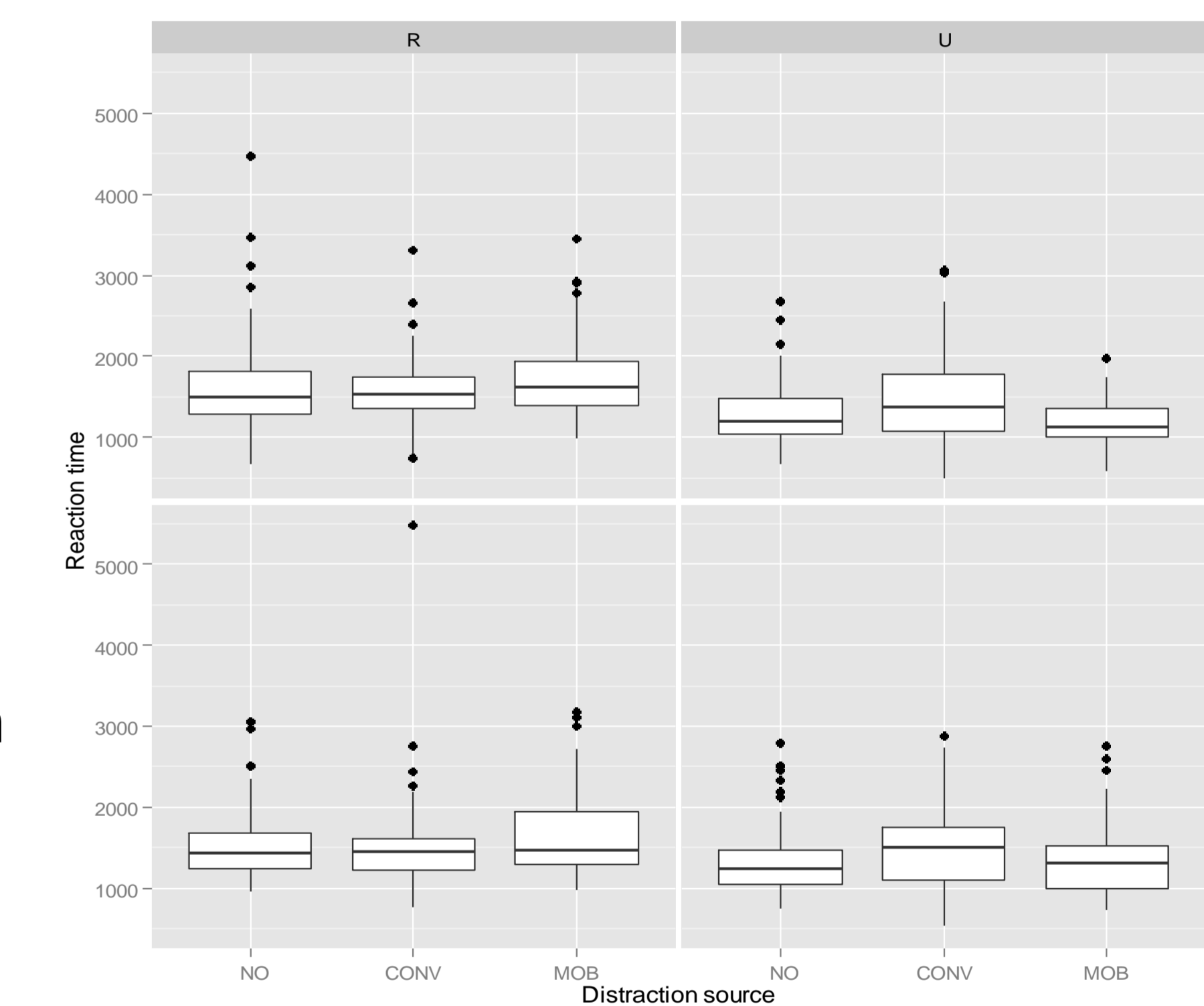
Regarding the effect of **driver characteristics** on reaction time

older drivers have the worst reaction time when talking on the cell phone

young and middle aged drivers of both genders are characterized by higher reaction times when conversing with a passenger than when talking on the cell phone

Regarding the effect of **road and traffic characteristics** on reaction time

- both in rural and urban areas in low traffic conditions distracted
- both in rural and urban areas in low traffic conditions distracted driving results to increased reaction time



CONCLUSIONS

- while talking on the cell phone or conversing with passenger, drivers of all age groups have **higher reaction times** compared with undistracted driving
- **age** has the higher effect on reaction time as older drivers have the worst reaction times comparing to young and middle aged drivers
- in **urban areas** drivers achieve better reaction time than in rural areas probably due to the fact that in urban areas, the complex road environment keeps the drivers alerted
- **female drivers**, especially in rural areas, were found to have the worst reaction times, while talking on the cell phone

ACKNOWLEDGEMENT

This paper is based on a research project implemented within the framework of the Operational Program "Education and Lifelong Learning" of the National Strategic Reference Framework (NSRF) - Research Funding Program: ARISTEIA (Action's Beneficiary: General Secretariat for Research and Technology), and is co-financed by the European Union (European Social Fund -ESF) and Greek national funds.