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ASSESSING DRIVING BEHAVIOUR IN THE ELDERLY: METHODOLOGICAL ISSUES



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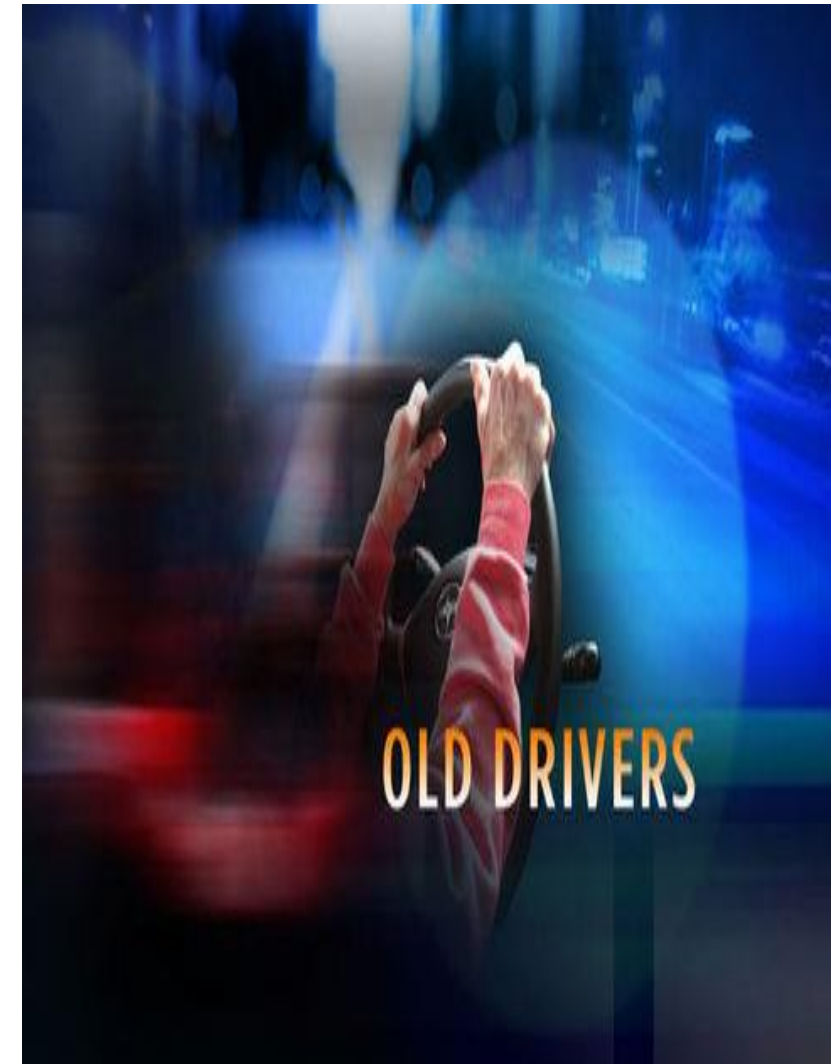
Objective and structure

Objective

To provide a comprehensive review of the methodological issues concerning the assessment of driving behaviour in the elderly

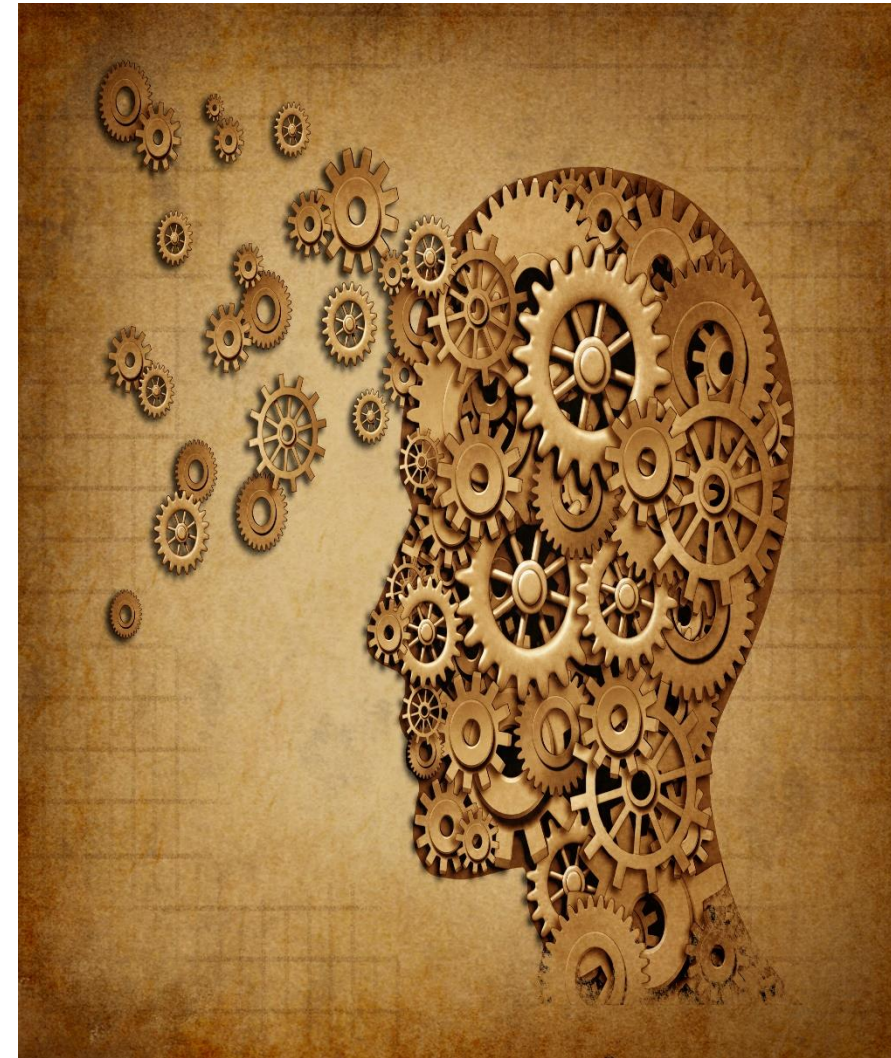
Structure

- Introduction
- Older driver behaviour and safety characteristics
- Driving Behaviour Experiments
- Analysis Challenges
- Conclusions



Introduction

- Although older drivers are involved in a few accidents in terms of absolute numbers, they represent one of the **highest risk** categories.
- Demographic growth, increased licensing rates and increase car use lead to an **increase** in the number of older drivers.
- In 2013, over **6.400 elderly** people died in road traffic accidents in 24 European countries.
- The number of elderly people is expected to almost **double** by 2050 in OECD countries.



Older driver behaviour characteristics

Older drivers have a relatively high fatality rate due to:

- functional limitations
- physical vulnerability
- low annual mileage

Particular Older Driver Behaviour characteristics

- driving habits
- social behaviour
- risk compensation
- changing behaviour over time



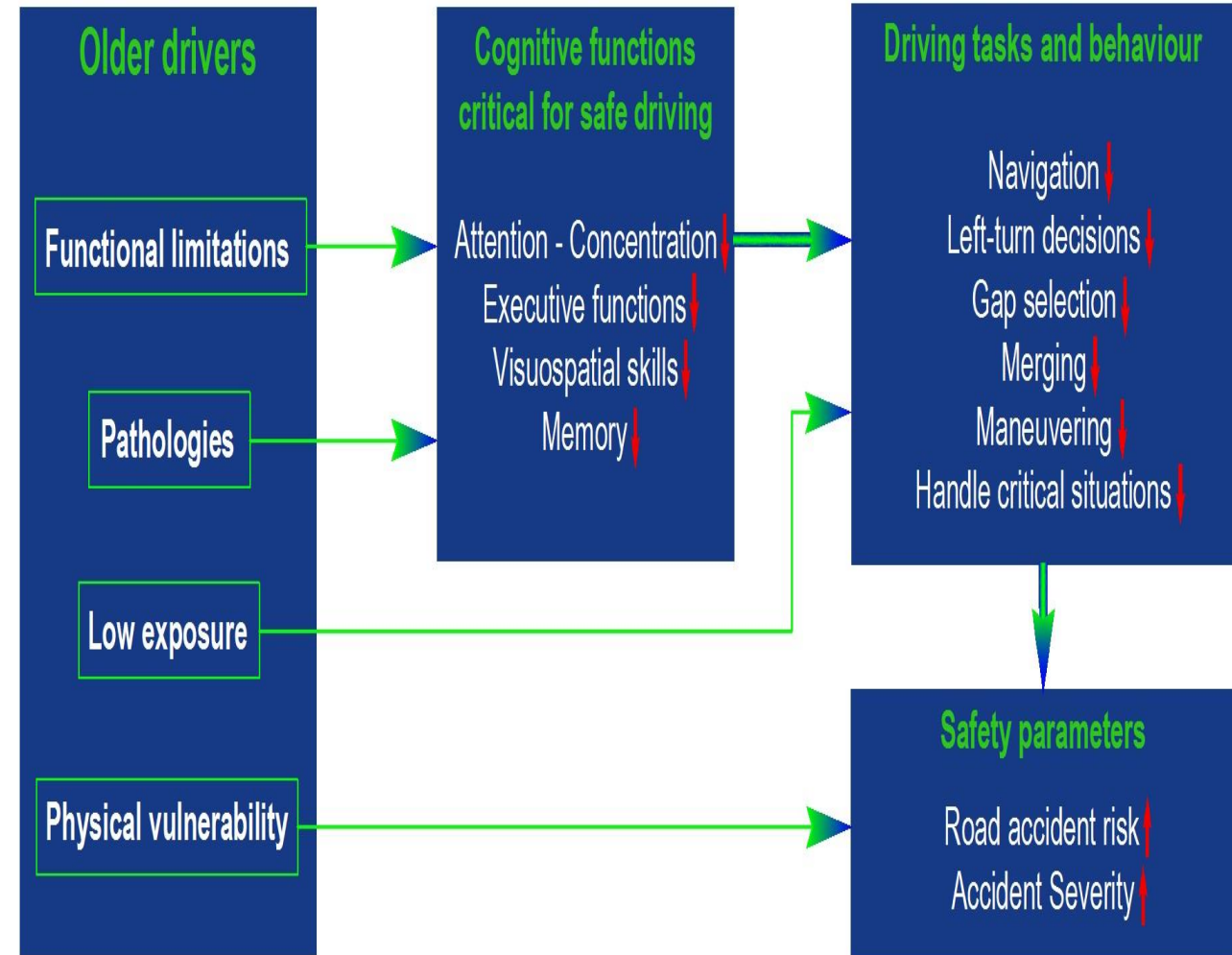
Cognitive functions related to safe driving

- Driving – sufficient cognitive, visual and motor skills
- **Cognitive functions** related to driving may be categorized into the following six neuropsychological domains (Reger et al. 2004):
 - mental status-general cognition
 - attention–concentration
 - executive functions
 - language–verbal functioning
 - visuospatial skills
 - memory



Cognitive functions critical for safe driving

- **Attention**
 - quick perception of the environment
- **Executive functions**
 - process multiple simultaneous environmental cues
 - rapid, accurate and safe decisions
- **Visuospatial skills**
 - position the car accurately on the road
 - manoeuvre the vehicle correctly
 - judging distances and predicting the development of traffic situations
- **Memory**
 - journey planning
 - adapting behaviour



Driving Behaviour Experiments

- Driving Simulator Experiments
- Naturalistic Driving Experiments
- On road experiments
- In Depth Accident Investigations
- Surveys on Opinion and Stated Behaviour



Driving simulator experiments

Examination of a range of driving performance measures in a controlled, relatively realistic and safe driving environment

Advantages

- Collection of data which would be very difficult to collect under real traffic conditions
- Exploration of any possible driving scenario
- Driving conditions are identical for all drivers

Disadvantages

- Non totally realistic simulated road environment
- Possibility of adopting a different driving behaviour
- Feeling of safety
- Simulator sickness



Naturalistic driving experiments

A research method for the observation of everyday driving behaviour of road users

Advantages

- Large degree of control over the variables that affect driving behaviour
- Researchers study issues that cannot be investigated in a lab
- Help support the external validity of research

Disadvantages

- Difficult to determine the exact cause of a behaviour
- The experimenter cannot control outside factors
- Traffic incidents are very rare



On-road experiments

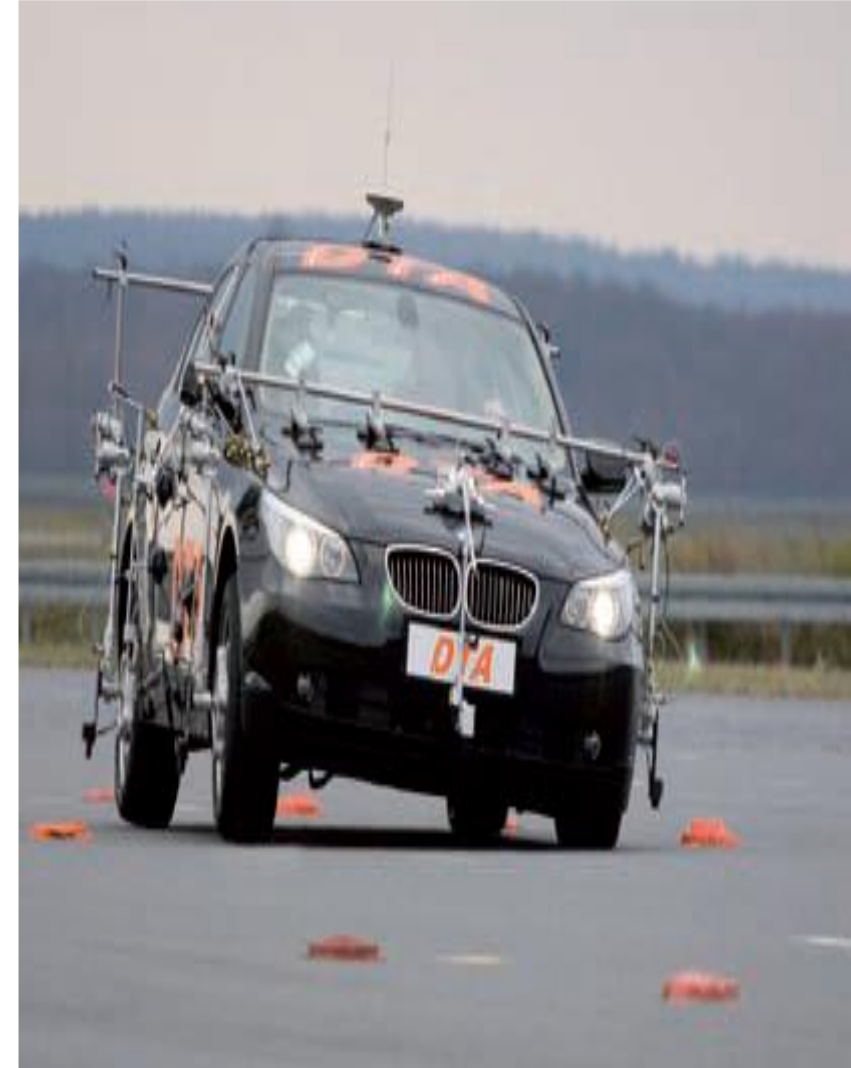
Studies using instrumented test vehicles to gain greater insights into the factors that contribute to road user accident risk and the associated crash factors at specific conditions.

Advantages

- Large degree of control over the variables that affect driving behaviour
- Study of actual observed behaviour

Disadvantages

- Data not collected over a longer time period and in response to selected interventions



In depth accident investigation

In-depth accident data describe the causes of accidents and injuries and aim to reveal detailed and factual information from an independent perspective on what happens in an accident

Advantages

- Describe the accident process and determine appropriate countermeasures
- Provide a major contribution to the development of new safety policies

Disadvantages

- Insufficient reconstruction evidence



Surveys on opinion and stated behaviour

In stated behaviour surveys, a reference questionnaire is built, based on a list of selected topics and a representative sample of population is interviewed

Advantages

- Survey design may control for external factors
- Allow to investigate new situations, outside the current set of experiences

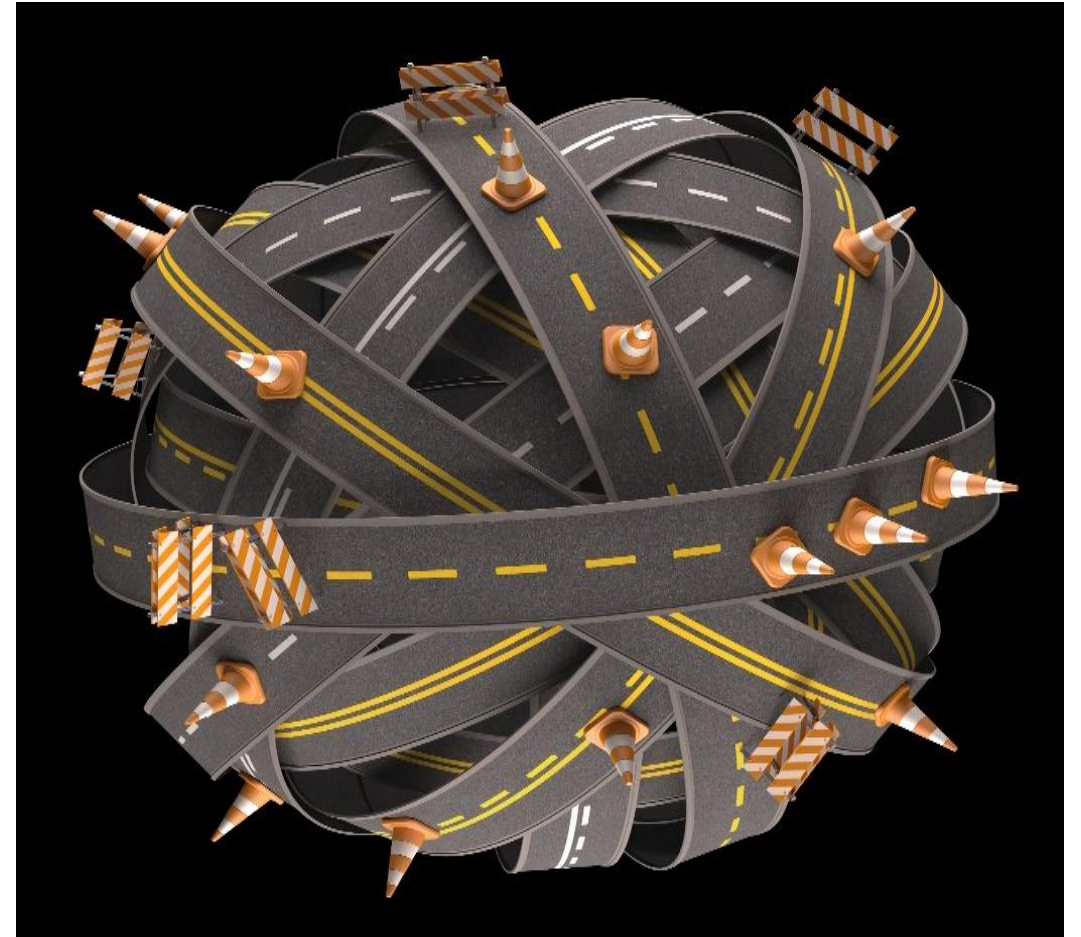
Disadvantages

- Often hypothetical nature of questions
- Actual behaviour is not observed
- Over- or under-representation of actual behaviour



Driving performance measures

- Lateral Control Measures
- Longitudinal Control Measures
- Reaction Time Measures
- Eye movement measures
- Workload measures
- Safety measures



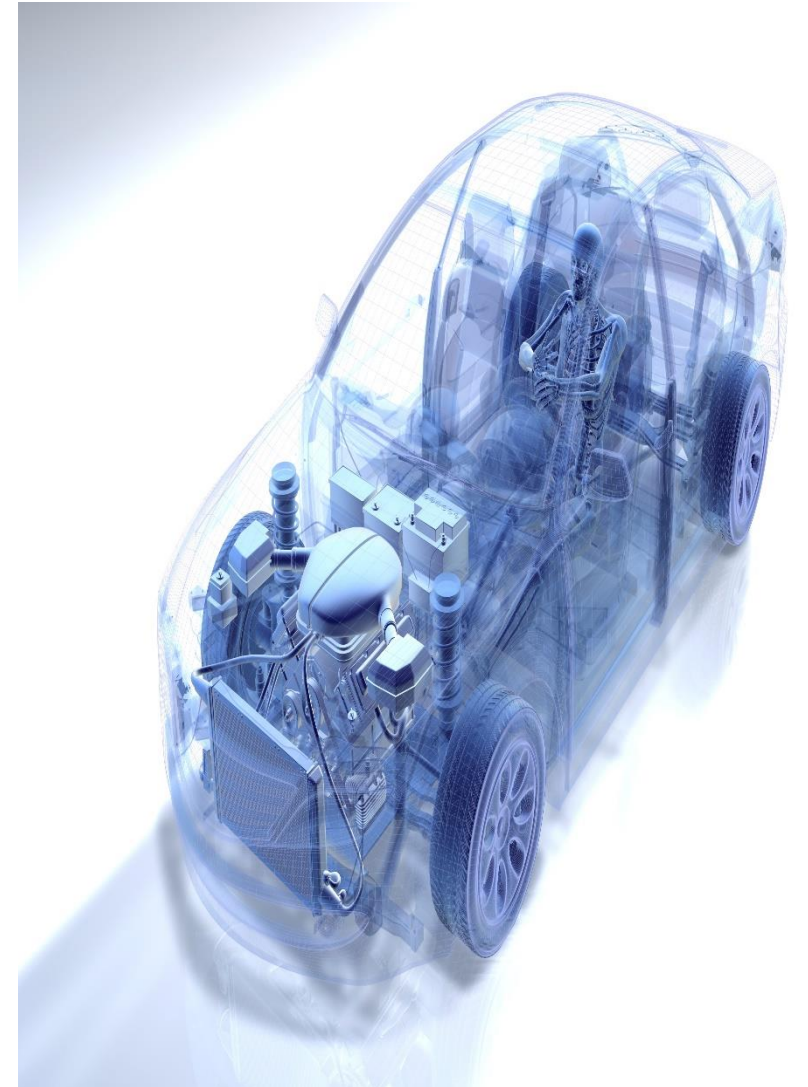
Methodological challenges

Reliability

- Increased variability - Older people may perform very well on one occasion and much worse on another
- Aged related health conditions change from day to day

Validity

- Differential exposure
- Difficulties in distinguishing the effects of normal age-related changes from those from age-related disorders
- Older adults may take one or more prescription drugs which may impair driving



Conclusions

- Every **experiment type** has benefits and deficiencies. Combination and meta-analysis of experiments results may bring more reliable conclusions.
- **Sample size** should correspond to the number of variables to analyse.
- Internal structure of experiments has a direct impact to the results **reliability**.
- **Valid data** analysis requires multi-annual effort to address the high complexity.



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