

# Driver's ability to assess their driving quality while using an in-vehicle information system

**Virpi Anttila**  
**VTT, Building and Transport**

**[virpi.anttila@vtt.fi](mailto:virpi.anttila@vtt.fi)**



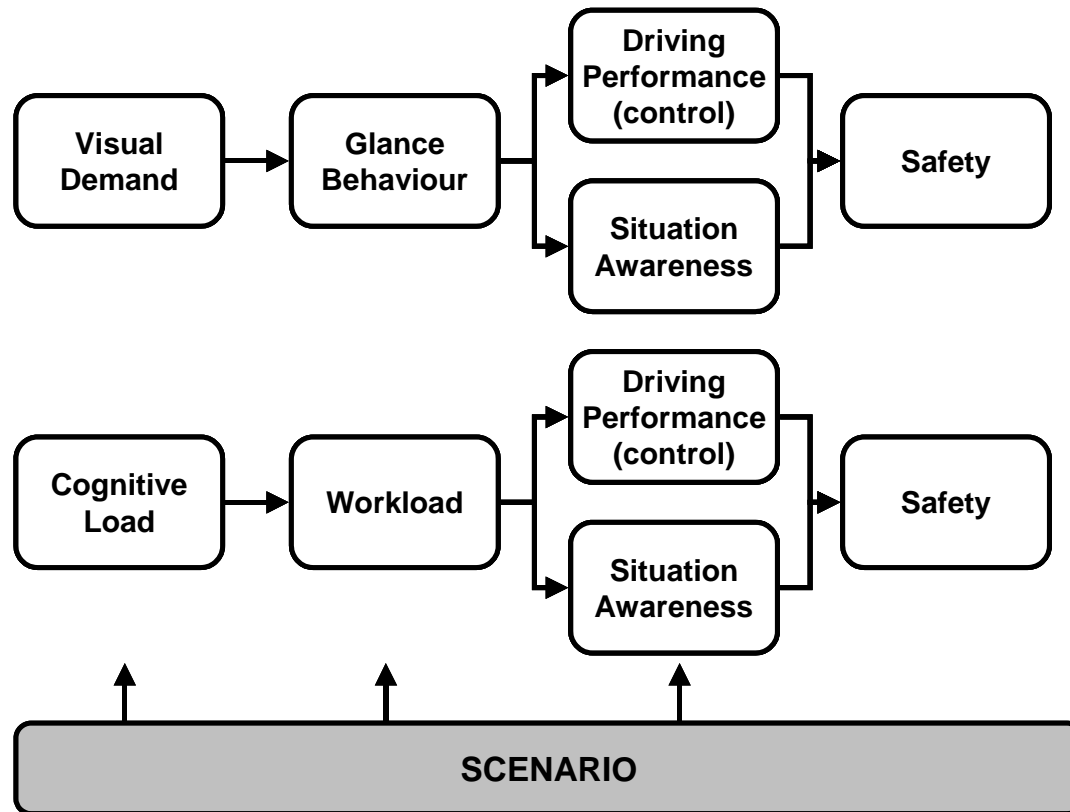
MINISTRY OF TRANSPORT  
AND COMMUNICATIONS FINLAND



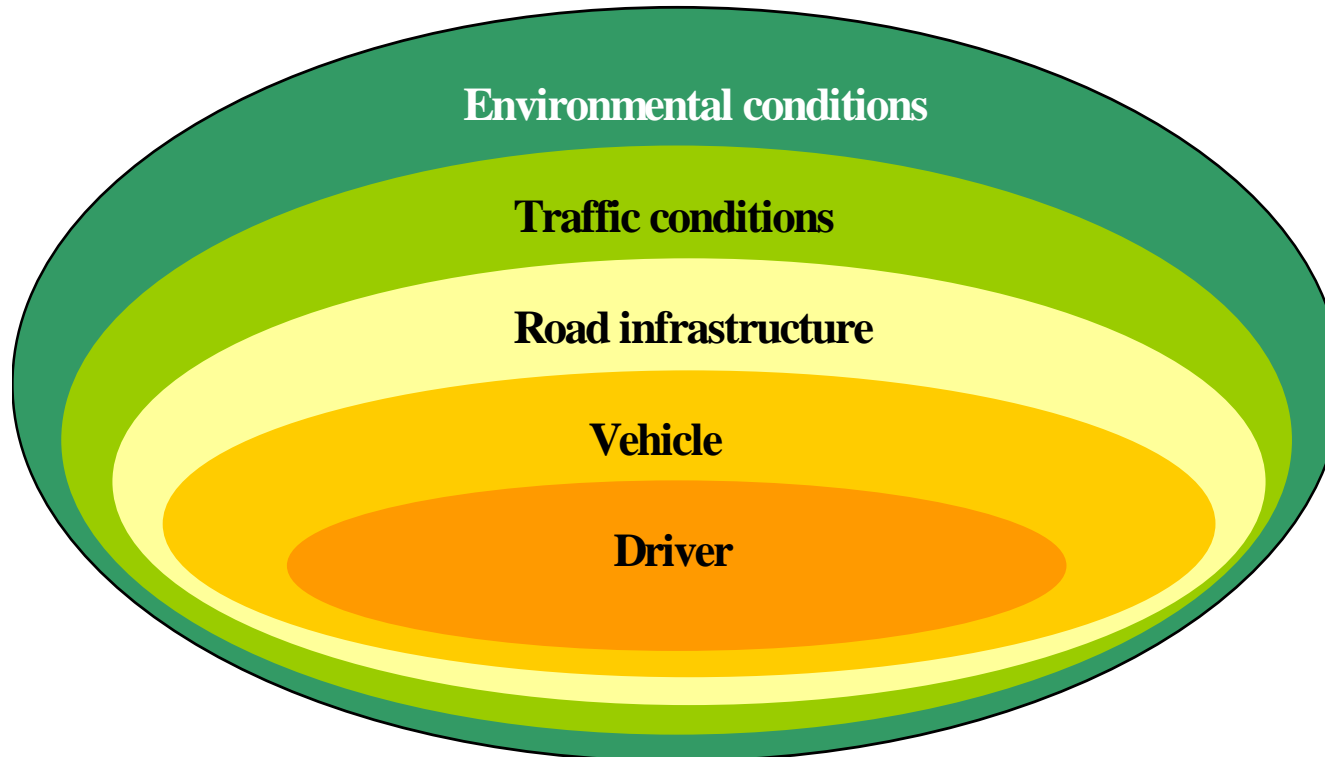
## Special acknowledgements to...

- Juha Luoma, Heidi Sanderg and Mikko Kallio at VTT
- The HASTE consortium
- Finnish Ministry of Transport and Communication

# In-vehicle device and traffic safety



# Scenarios - driving conditions

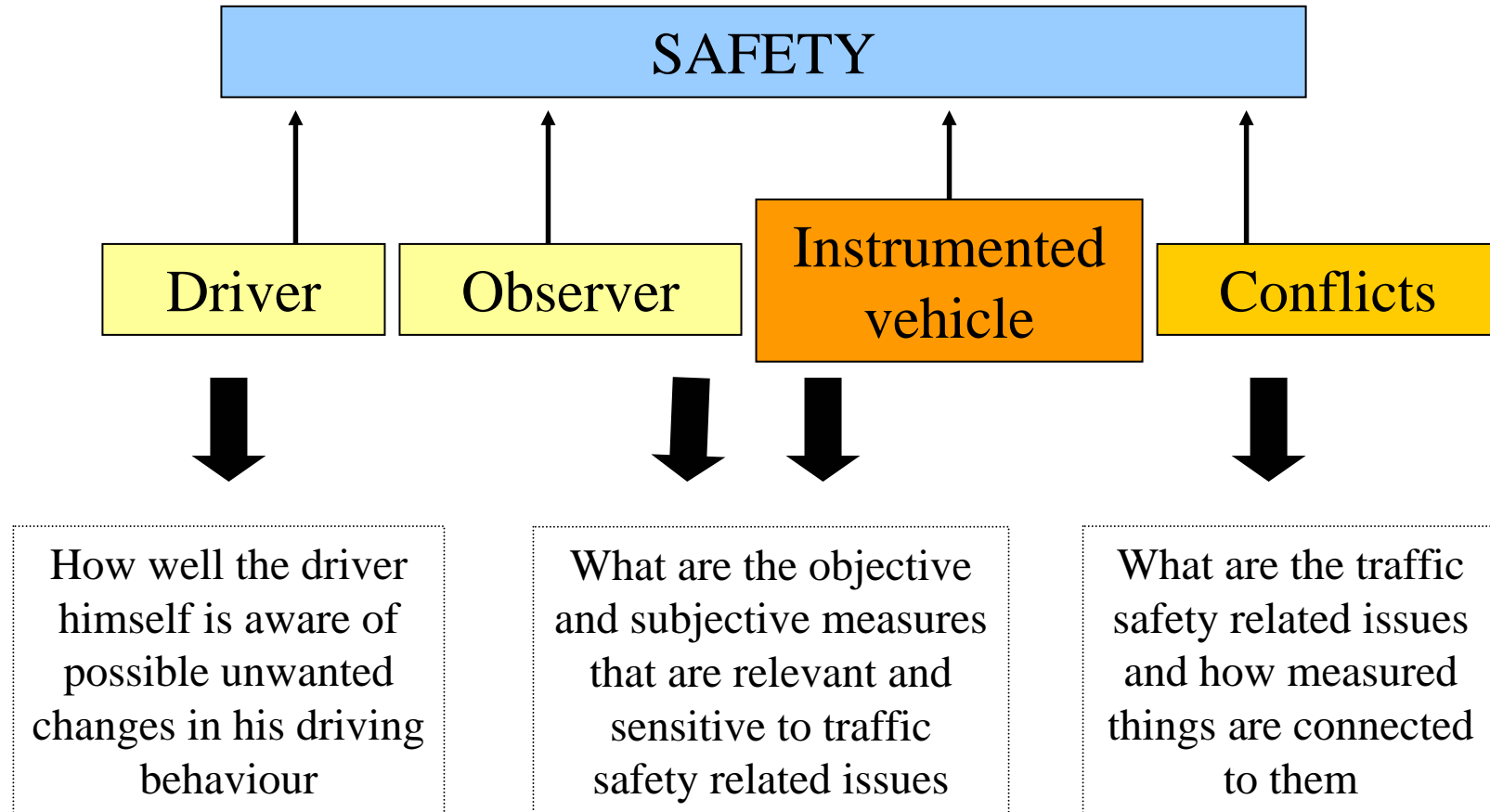


Description of scenarios where in-vehicle devices are most likely to cause some problems in driving behaviour

## Test regime

- Instrumented vehicle - driver and observer in real traffic
- 24 average (25-59) and 24 elderly drivers (65+)
- Three driving conditions
  - baseline
  - VISUAL surrogate IVIS - visual workload (three difficulty level)
  - AUDIO surrogate IVIS - cognitive workload (three difficulty level)
- Two environments
  - rural
  - urban

# Measuring traffic safety?



## Used measures - focus in this presentation

- Drivers' self-reported driving quality - after each set of tasks (30 to 50 seconds) and at the same locations during the baseline run (scale 1-10)
- Observations - driver's performance and the traffic situation with respect to
  - presence and interaction with vehicles (in front, intersection)
  - lane keeping behaviour
  - speed choice and adaptation
  - interaction with vulnerable road users
  - conflicts, dangerous situations

# Drivers rating their driving performance themselves?

- Seemed to be very sensitive to the secondary task and task difficulty...
- ...but what are the drivers rating - the workload or the actual driving performance
- Are drivers always aware of mistakes they make in their driving performance?
  - type of mistake
  - type of driver

# What are the drivers rating...

## ... in accurate driving performance

- Analyse of “accurate driving” - no mistakes observed
- Accurate driving was observed
  - more often in rural environment (67%) than in urban environment (41%)
  - more often with no secondary task (baseline 64%) than with cognitive task (37%) or visual task (23%)
  - more often with average drivers (51%) than elderly drivers (31% ).
- In urban environment, more often when turning right (52%) than left (31%)

## What are the drivers rating... ... beside their driving performance

- Possible other aspects (beside the driving performance) that could affect on driver performance rating
  - drivers' age
  - driving task (left vs. right turning, vehicle following etc.)
  - secondary task (baseline, visual and cognitive load)
  - secondary task difficulty
  - secondary task performance
  - complexity of traffic environment (presence of other road users, interaction)

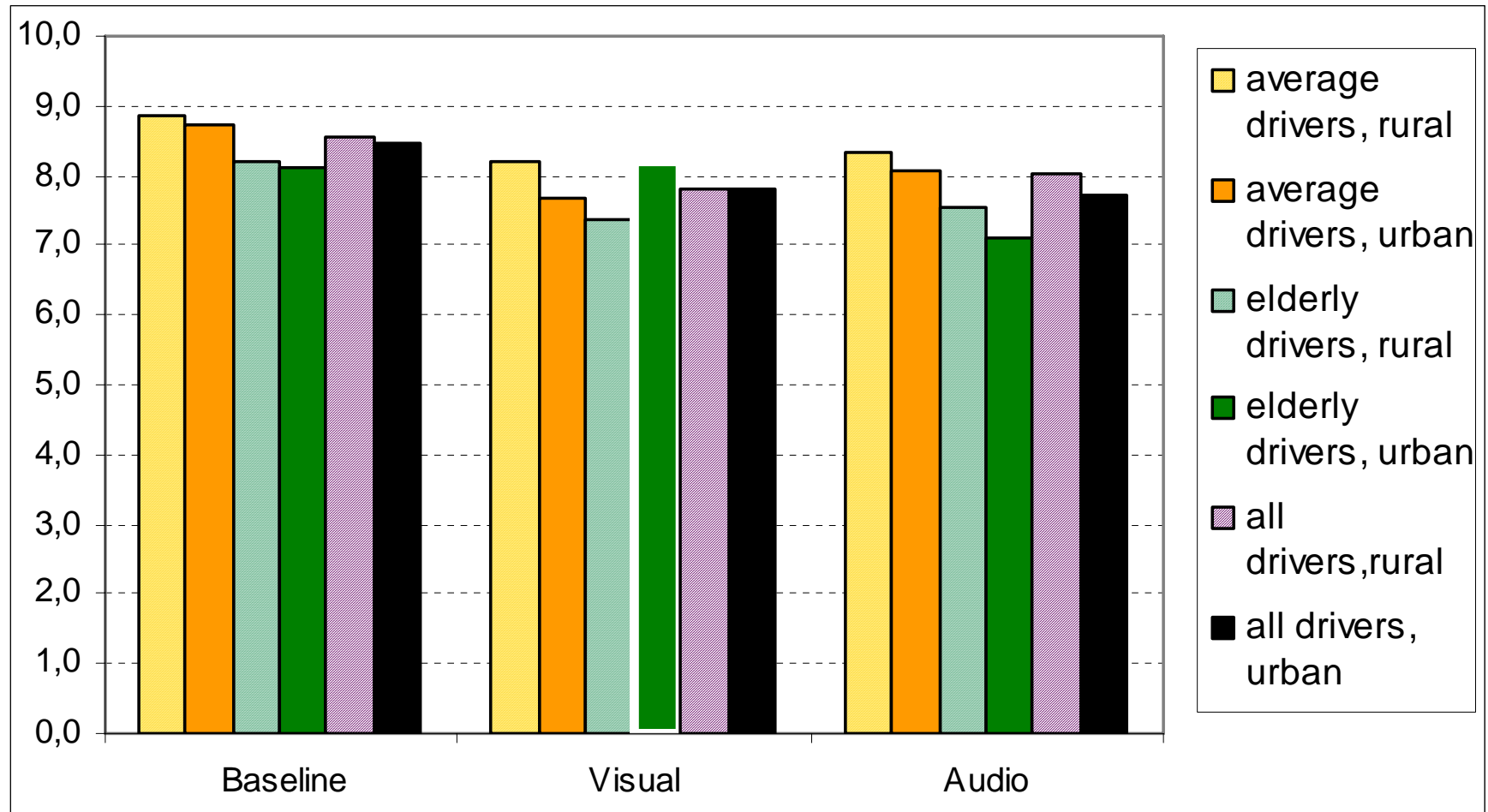
# What are the drivers rating...

## ... in accurate driving performance

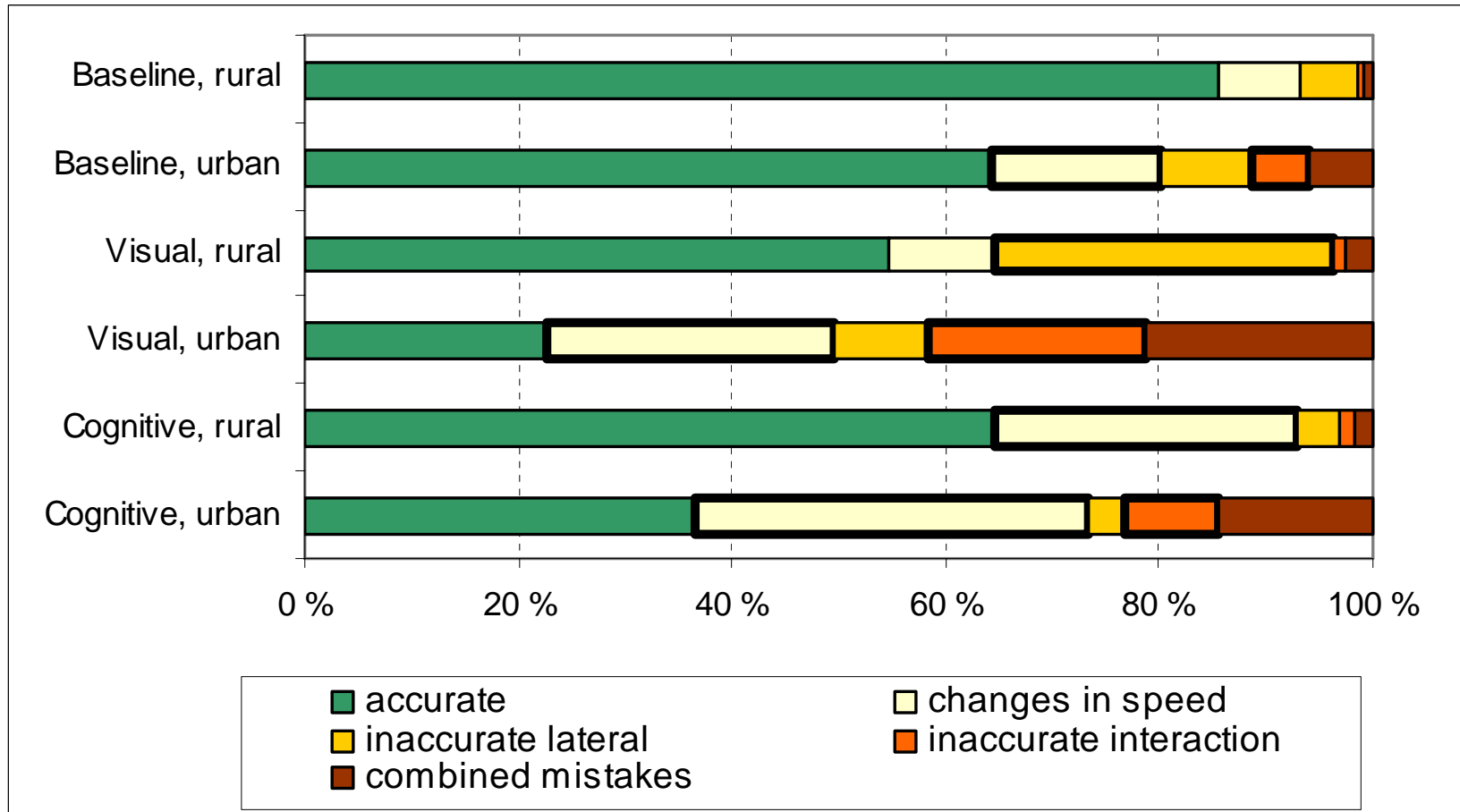
- Secondary task had a statistically significant effect on driving ratings
  - in baseline the average rating was higher than when performing the visual task or the cognitive task
- Drivers' age had a statistically significant effect on driving ratings
  - average drivers rated their driving performance with higher score than elderly drivers
- Driving task in rural environment - driving with no other vehicles in front, the rating was lower compared to ratings in situations when an affecting vehicle was in front

# What are the drivers rating...

## ... in accurate driving performance



# Assessing driving behaviour - changes and inaccurate driving, observations

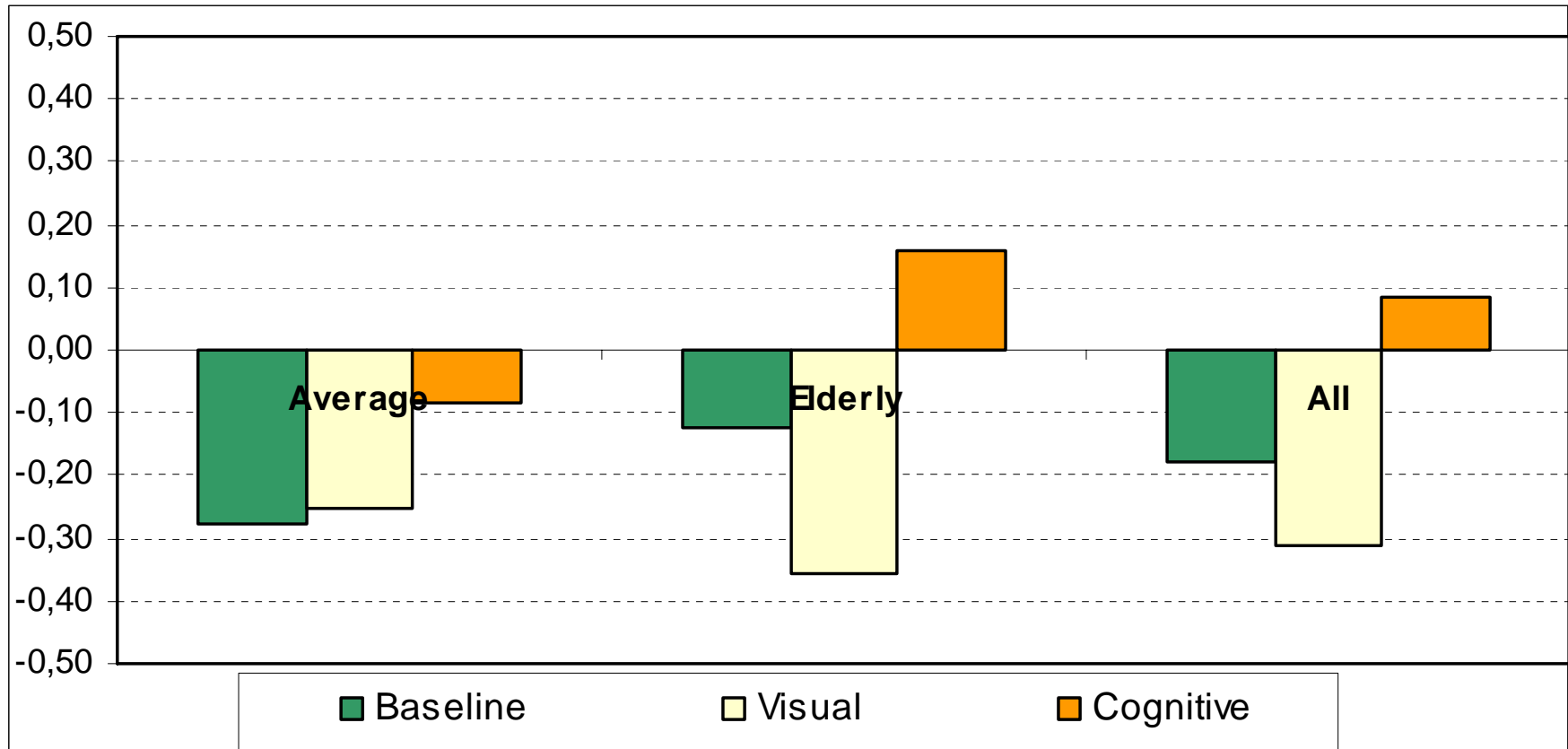


## Assessing driving behaviour - drivers' estimation of driving performance and observations

- **Rural** - focus more on real mistakes (not minor changes)
  - driving too fast (speeding, change in speed limit)
  - rapid correction on lane position
  - dangerous situations
- Separate analyses
  - trial condition (baseline, visual, cognitive)
  - driver's age groups (average, elderly)
  - driver's own driving performance rating (accurate driving) in each trial condition was used as comparison value

# Driving too fast, rural

- difference in driving performance rating (scale 1-10)



## Rapid correction moves (lateral position) - observations, rural

- All together seven cases where rapid correction move with steering wheel was made (out of 864 cases), approximately 1% of all cases
- All with visual secondary task
- Six with elderly drivers, one with average driver

⇒ decreased the driving performance rating by 0,38

⇒ elderly -0,28 vs. average -1,0

⇒ 2/6 of elderly drivers did not decrease their driving rating

## Dangerous situations - observations, rural

- All included dangerous lane behaviour i.e. wondering to lane of oncoming vehicles
- All together eight dangerous situations (out of 864 cases), approximately 1% of all cases
- All with visual secondary task
- All with elderly drivers

⇒ decreased the driving performance rating by 0,1  
⇒ 5/8 of elderly drivers did not decrease their driving rating

## Summary - rural

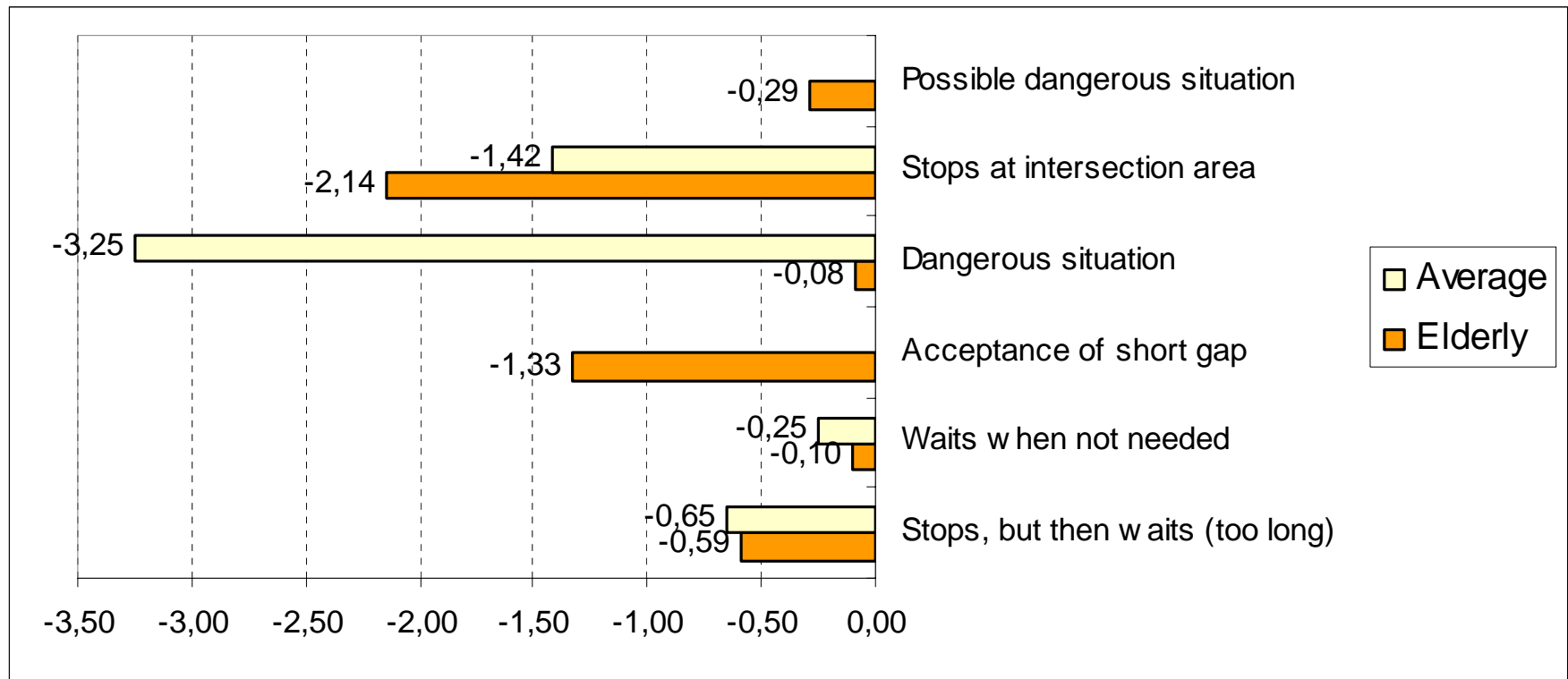
- Driving too fast - reduction between -0.2 and -0.3
  - However, with cognitive task the reduction was smaller
  - Elderly drivers having problems identifying driving too fast when having cognitive secondary task
- Rapid correction moves - reduction between -0.3 and -1.0
  - All with visual task
  - Elderly drivers having problems identifying rapid correction moves as impairing their driving performance
- Dangerous situation - average reduction -0.1
  - All elderly drivers - serious problems identifying dangerous situations ( 5/8 did not reduce their driving performance at all)

## Assessing driving behaviour - drivers' estimation of driving performance and observations

- **Urban** - focus more on mistakes in interaction with other road users (intersections studied)
  - mistakes in interaction with other vehicles
  - mistakes in interaction with pedestrians
- Separate analyses
  - driver's age groups (average, elderly)
  - however, no driver & trial condition -specific accurate driving performance rating to compare to...

# Mistake in interaction with vehicles -

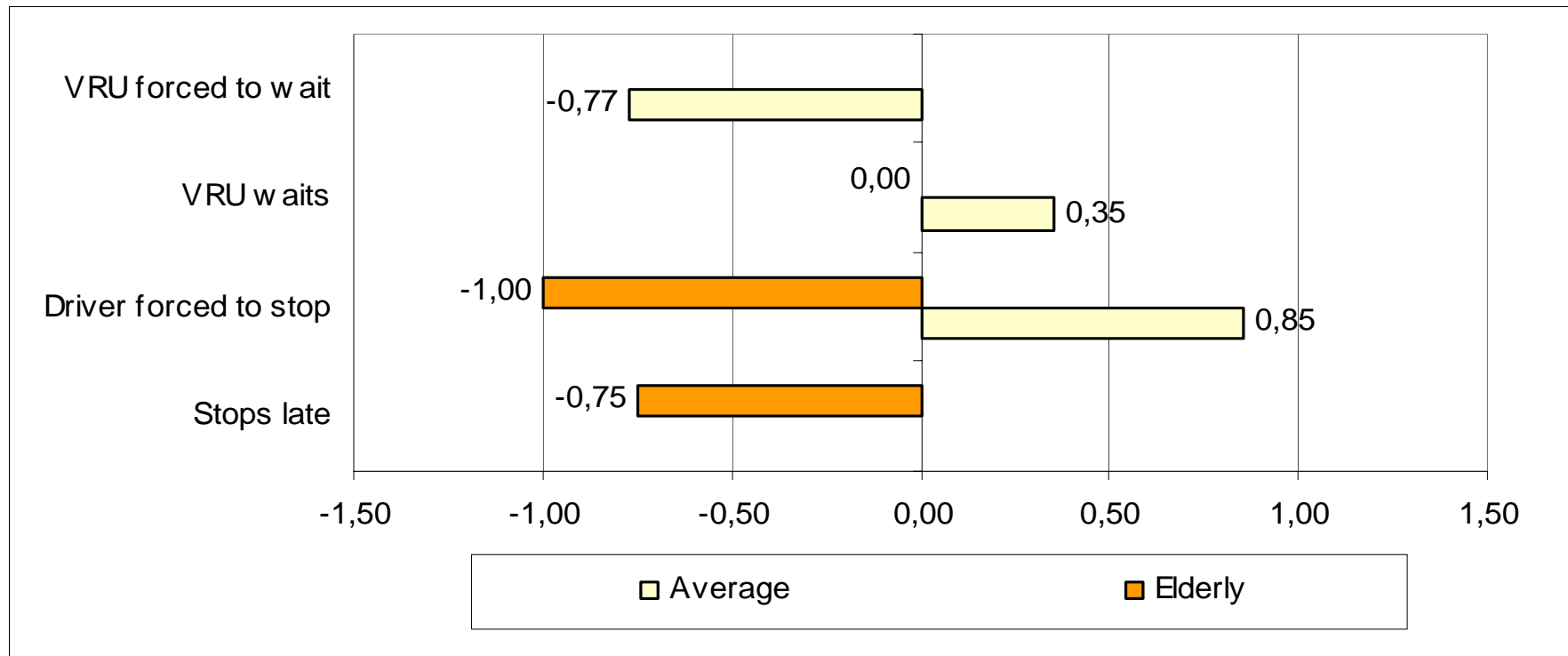
- difference in driving performance rating (scale 1-10)



All together 34 serious mistakes (10% of all cases)/ average 7, elderly 27/  
visual 13, cognitive 12 and baseline 9 cases

# Mistake in interaction with pedestrians -

- difference in driving performance rating (scale 1-10)



All together 23 mistakes (40% of all cases)/ average 10, elderly 13/  
visual 7, cognitive 10 and baseline 6 cases

## Summary - urban

- Mistake in interaction with other vehicles
    - Mistakes such as “acceptance of short gap” and “stopping at the intersection area” are quite well noticed - reduction between -1.3 and -2.1
    - It seems that dangerous situations were noticed by average drivers (-3.2), but not by elderly drivers (-0.08)
  - Mistake in interaction with pedestrians
    - Elderly drivers being more strict when rating their mistakes in interaction with pedestrians
    - Elderly drivers stopping (even late), average drivers forcing their way
- ⇒ Average drivers - having problem in driving performance or in attitude?

## Some questions risen...

- Although a big field trial (1728 observations), number of some mistakes were quite low (frequency of having a crossing path with pedestrian, taken risk in real traffic)
  - no statistical analyses, more like individual observations
  - interaction is hard to measure with objective measures - the reliability of subjective measures, the observations (more analyses will be done)
  - drivers rating their driving performance objectively vs. drivers' opinion about severity of some mistakes (speeding, giving way to pedestrians)

## Conclusion 1/2

- Although drivers' own driving performance rating seems to be sensitive to increasing workload in (secondary) task, there seems to be some problems to use it as (only) indicator assessing driving performance and safety...
  - elderly drivers actually doing more driving mistakes, but not being always aware of their mistakes
  - cognitive secondary task seems to have some effects (speeding, interaction with other road users), but drivers are not always aware of these effects
  - some conflict situations (with pedestrians) were actually rated to better driving performance - having coped with difficult situation?

## Conclusion 2/2

- Assessing in-vehicle device effects on driving performance (and safety) is serious job...
- Visual task and problems with glances to road are quite well-known, but what about cognitive task and/or interaction with other road users..?
- Can we “test” devices with average drivers and just assume the elderly driver will behave similarly?
- Especially in urban environment, the safety of vulnerable road users might be a concern

Thank you!  
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