



# Avoiding the overload: User requirements for an interior HMI in mixed traffic

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## Motivation

- Automated vehicles (AVs) in mixed traffic will be responsible for **communication** with **vulnerable road users (VRUs)** despite performing the driving task [1]
- For **passengers**, the driving task will change to a more observational task with a shift of control towards the AV [2]
- Due to this **loss of control**, passenger's **trust** in **AV's capabilities** to deal with **VRU-vehicle scenarios** seems to be crucial for **psychological comfort** and **user acceptance** [3]
- Importance** of an **interior HMI (iHMI)**:
  - Increase of **transparency** in communication between AVs and VRUs and therefore **trust** in AV's capabilities
  - Avoidance of **psychological discomfort** in passengers (e.g. due to incomprehensible driving maneuvers or fear of collisions)
- Key challenge** for iHMI design:
  - Complex urban traffic scenarios (with numerous VRUs) could lead to an **iHMI overloaded with information**
  - Usability problems can arise [4]
- Aim** of this study:  
Identifying **user requirements** for prioritizing information in VRU-vehicle scenarios to achieve a clear, **user-friendly iHMI**.



## User Requirements

### Information requirements for iHMI

- 1 Transparency regarding information acquisition of AV**
  - Capabilities of the AV to **detect VRUs** (e.g. sensor range, detection of hidden VRUs)
  - Expectations:** Detailed information on system functionality, but strongly dependent on interest and experiences of passengers (novelty effect).
- 2 Transparency regarding situation comprehension of AV**
  - Capabilities of the AV to **evaluate the traffic scenario** (e.g. prediction of presence & evaluation of driving relevance of VRUs)
  - Expectations:** Well visualized situation comprehension of the vehicle with emphasis on driving relevance of VRUs.
- 3 Transparency regarding vehicle behavior**
  - Anticipation** of driving maneuvers, especially in **complex scenarios** with VRUs who are relevant to driving
  - Could increase psychological comfort of passengers through **reducing perceived risks of collisions** with VRUs

### Modality requirements for iHMI

- Visual** information
- HMI should be able to be **switched on or off** depending on the passenger's interest and experiences

## User Focus Group

### Participants

- N = 5 (3 females, 2 males)
- M = 49 years (SD = 17 years)
- Driver license (at least 5 years), urban driving experiences



### Agenda

- Discussion about **VRU-vehicle scenarios** while **manual driving**
  - 2 videos: VRU-vehicle scenarios of varying complexity
  - Regarding VRUs: Which factors are relevant for drivers and influence the driver's attention, decision-making and behavior?
- Discussion about the relevance of an **iHMI in automated driving**
  - Short video: Functionality of automated vehicles
  - Which information could be useful for passengers of AVs in VRU-vehicle scenarios?



## Conclusion

### Implications for interface designers and researchers

- Information requirements reflect the three levels of **situation awareness** [5]
- Important design features:** Driving relevance of VRUs and the therefore arising complexity of traffic scenarios
- Design features can help to **prioritize information**



### Limitations

- Participants didn't have **realistic experiences** with AVs
  - Tendency to overestimate the importance of explicit information provided by an iHMI
  - Imagination about AVs could have been biased through media reports (fatal pedestrian accident with AV in the USA)



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### Further research

- Evaluation of **HMI prototypes** in driving simulator
- Which factors influence **driving relevance** of VRUs? Importance of factors from [6]?
- Differences between **VRU groups** (e.g. pedestrians, cyclists, children)?
- Importance of an iHMI depending on **experiences** (mental model) of passengers?



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