

Effects of Non-Driving Related Tasks on Take-Over Performance

- During highly automated driving (SAE Level 3) the driver is allowed to temporarily engage in non-driving related tasks (NDRTs).
- However, the driver is required to appropriately respond to a take-over request and resume manual driving when system limits occur.
- What is the impact of different NDRTs on take-over performance?



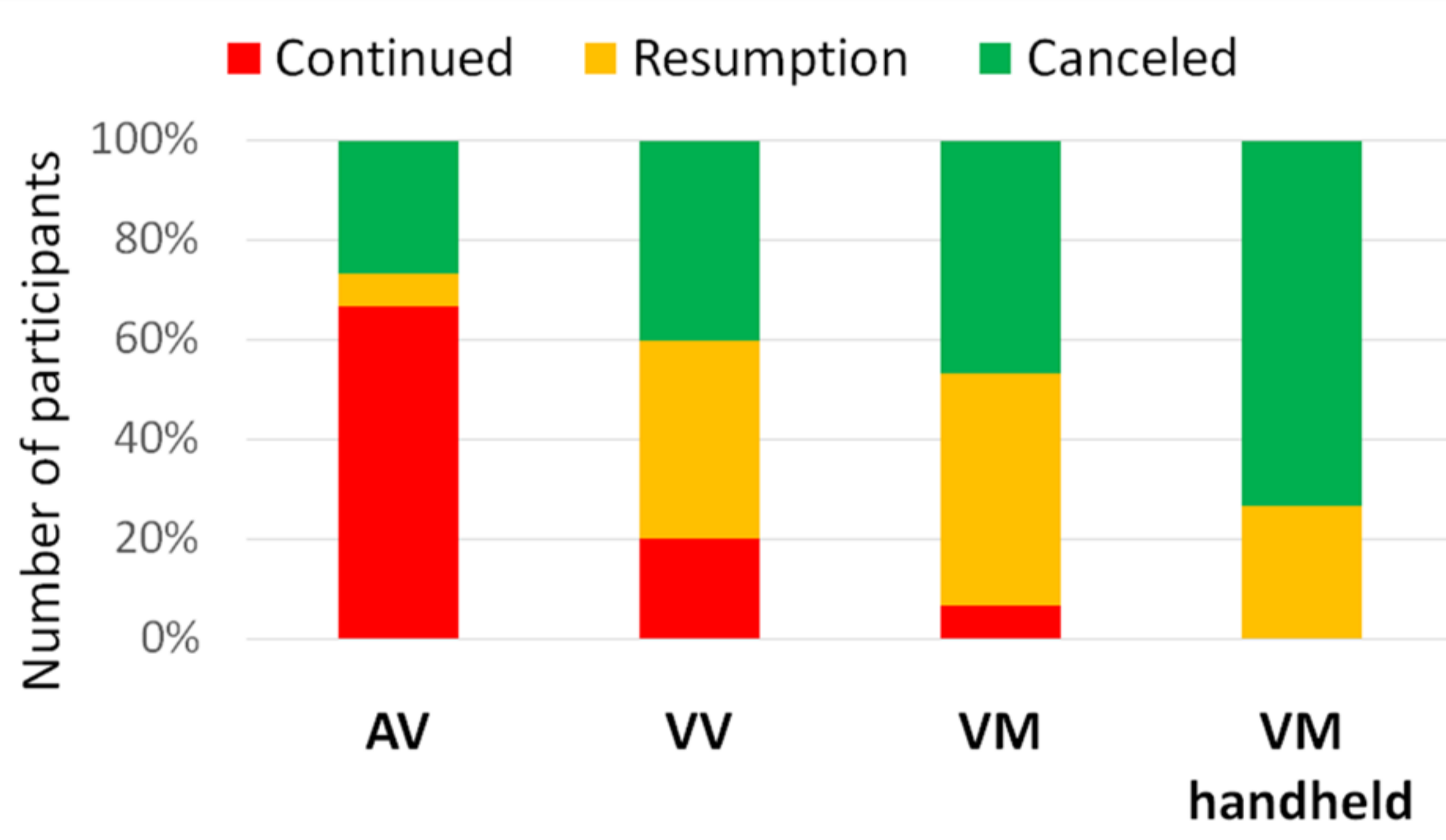
IMPACT OF TASK MODALITIES

Study Design

- Driving simulator study (N = 30)
- Manipulation of NDRT modalities
- Critical take-over situation (obstacle): Time to Collision (TTC) = 6 sec.
- Analysis of drivers' task disengagement and take-over performance

Results

- Significant effect of task modalities.
- The visual-manual (handheld) task degraded performance the most.
- Hands-on time was particularly affected.
- **Self-regulation:** Visual-manual NDRTs were canceled most strictly.

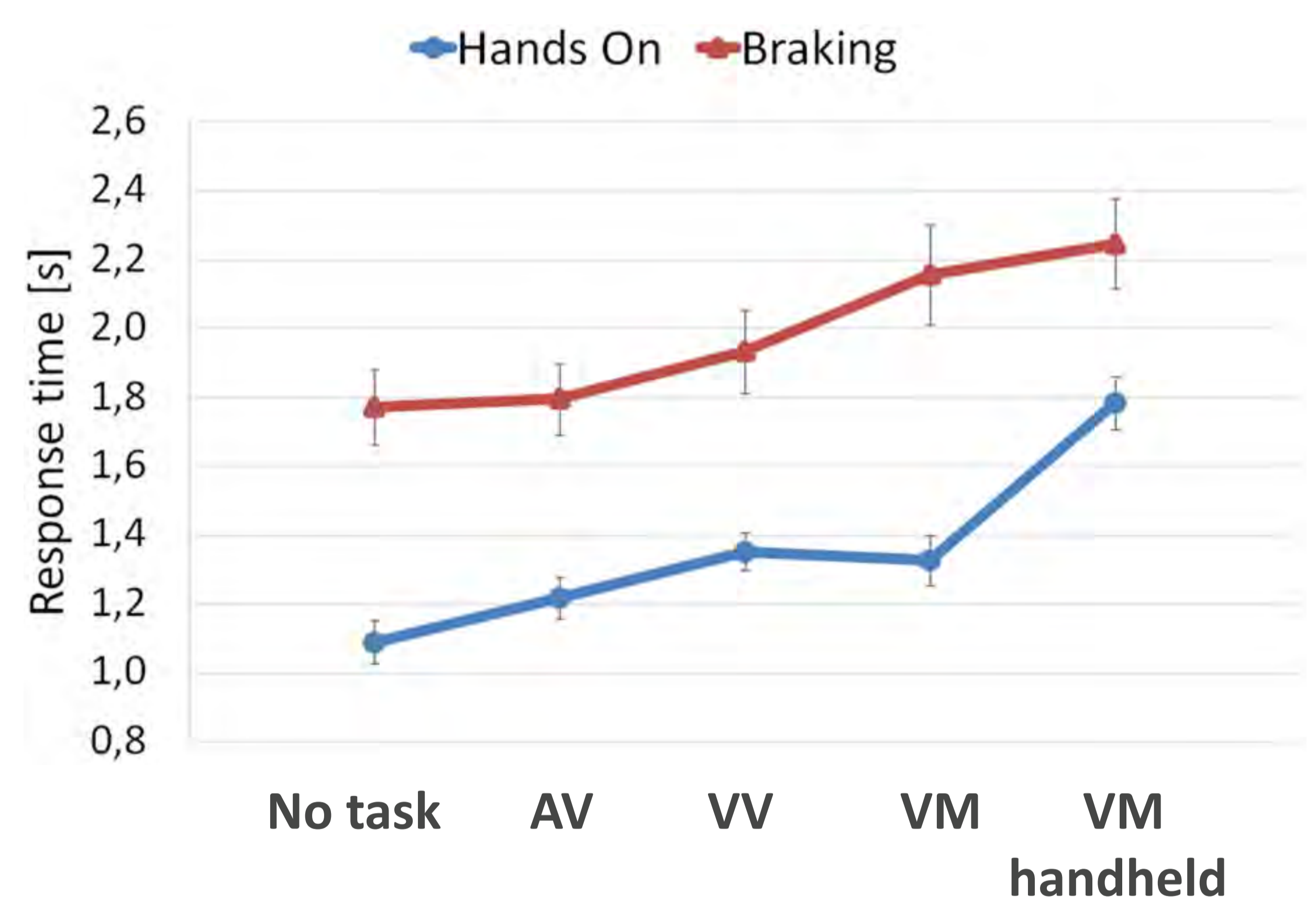
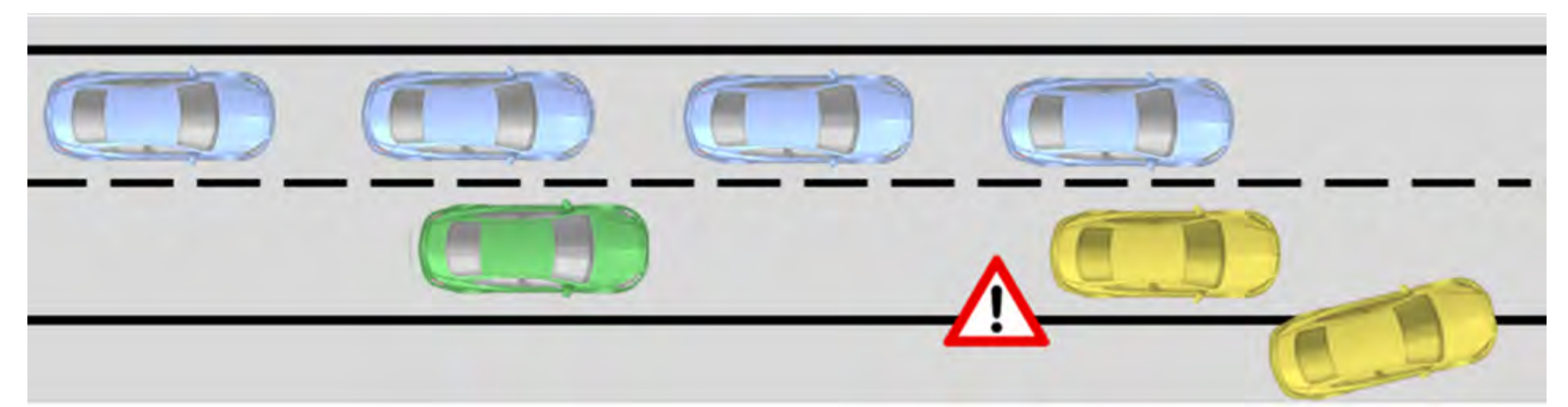


Disengagement from the NDRTs in take-over situation.

Non-driving related tasks used in the simulator study.

NDRT	Stimulus	Response	Description
AV	Auditory	Vocal	Repeating spoken text verbally
VV	Visual	Vocal	Reading out text
VM	Visual	Manual	Texting
VM handheld	Visual	Manual	Texting (Tablet handheld)

Schematic representation of the take-over situation.



Take-over times for the different NDRTs.

IMPACT OF MENTAL WORKLOAD

Study Design

- Driving simulator study (N = 14)
- Broken car scenario with two time budgets: TTC = 6 vs. 8 seconds
- Re-use of tasks AV and VM handheld
- New task: VM handheld, high workload (WL)
- Analysis of take-over performance

Results

- **Hands-on time:** Significant effect of modalities, no effect of mental workload
- **Take-over time:** Tendency that both, modalities and mental workload, have an impact.
- Similar results for both time budgets

NDRT	Stimulus	Response	Description
AV	Auditory	Vocal	Repeating spoken text verbally
VM Low WL	Visual	Manual	Texting (Tablet handheld)
VM High WL	Visual	Manual	Alphabetizing („drive → deirv“, Tablet handheld)

