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.

**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

Non-driving related tasks used in the simulator study.

<table>
<thead>
<tr>
<th>NDRT</th>
<th>Stimulus Response Description</th>
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<tbody>
<tr>
<td>AV</td>
<td>Auditory Vocal Repeating spoken text verbally</td>
</tr>
<tr>
<td>VV</td>
<td>Visual Vocal Reading out text</td>
</tr>
<tr>
<td>VM</td>
<td>Visual Manual (Tablet handheld)</td>
</tr>
<tr>
<td>VM handheld</td>
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</tr>
</tbody>
</table>

Schematic representation of the take-over situation.

Disengagement from the NDRTs in take-over situation.

Take-over times for the different NDRTs.