



HUMAN-MACHINE-
INTERACTION

Influence of Workload and NDRT on Driver's Gaze Behavior and Reaction

Objective: Impact of non-driving related tasks (NDRT) during L3-automated driving on driver's takeover behavior (time and quality)

Experimental Design: Experiments on the impact of NDRT performed in a prototype L3-System with generic HMI:

- 5 empirical studies; 541 test drivers; L3-automated drive: 184 hours; reference data (manual drive): 83 hours
- Specification of test scenarios in a Moving Base Driving Simulator to study the driver takeover behavior with/without ToR; in various situations
- NDRT with different requirements on motivation (3 workload groups*) & cognitive loads



*3 Workload Groups:

HWL = High Workload Group: Tasks are mandatory,

FWL = Free Workload Group: Tasks are voluntary,

Control Group: No NDRT (No Workload)

Test Situations



Situation 1: **Object Cut-In**
No Take-Over-Request issued as system can cope with the situation

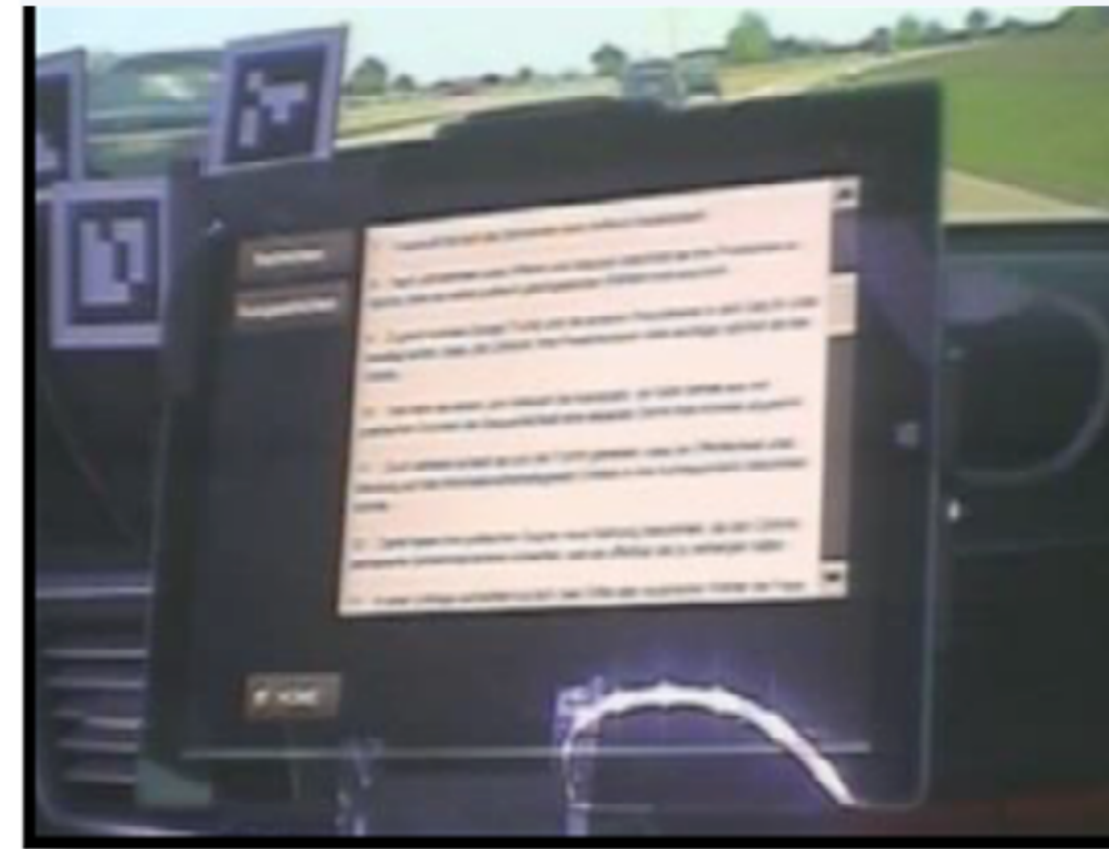


Situation 2: **Missing lane markings**. Take-Over-Request issued and crosswind. Driver Take-Over necessary



Situation 3: **Blocked lane**
No Take-Over-Request issued as system can cope with the situation

Cognitive Loads



NDRT1: a) Text reading
b) response to text queries

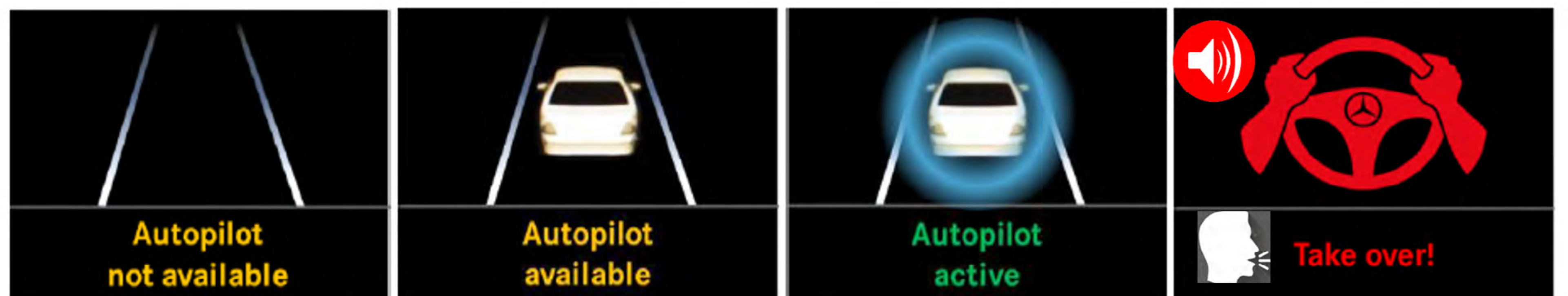


NDRT2: a) Video watching
b) response to queries on video



NDRT3: Item search on neighbor seat (requires body rotation)

- Issue of Take-Over Request (ToR) with Multimodal Signal (visual & auditive)



- Measurement method for gaze behavior is using Head-Mounted-Eye-Tracker System (Dikablis Professional)



RESULTS FROM TESTS IN A PROTOTYPE L3-SYSTEM WITH GENERIC HMI:

- Development of metrics for the evaluation of driver performance during transition L3 → L2 driving.
- Selfregulation in the use of NDRTs shows comparable takeover reaction time for L0 and L3.
- Reaction time is practically almost independent from the type of NDRT.
- Workload and gaze behavior are correlated during L3-automated drive.
- NDRT improves the vigilance.