

INFORMATION SOCIETY TECHNOLOGIES (IST)

PROGRAMME



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Empirical comparison of methods for off-line workload measurement

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EXECUTIVE SUMMARY

This deliverable reports the results of an empirical comparison of the offline driver workload and distraction assessment methods developed in AIDE Task 2.2.2 to 2.2.6. In the present task, a driving simulator study was carried out to test viability and interaction of the selected methods during a real experimental situation. The following methods have been selected for the study:

- Visual Demand Measurement tool (VDM), which is a tool developed for the analysis and pre-calculation of eye tracker data, representing measurement of eye-glance behaviour,
- Peripheral Detection Task tool of a cognitive-tactile type (TPDT), representing secondary task methodology,
- two metrics of driving control (Modified Lateral Position Variation, Steering Wheel Reversal Rate), representing performance indicators, and
- a questionnaire method, the Driving Activity Load Index (DALI), representing subjective workload assessment methods.

The main objective of the present study was to investigate, how well the dependent variables of the recommended methods distinguish among the levels of the experimental factors (road type/environment, secondary task type, secondary task difficulty). As experimental factors, three road scenarios (city vs. rural road vs. highway), two types of secondary task (visual vs. cognitive), and two levels of task difficulty per task type (easy vs. difficult) were used.

In terms of the methods under investigation, the results can be summarized as follows:

- Gaze parameters
The validity of gaze parameters is almost self-evident. The VDM-tool could not yet be used, but the parameters recommended for analysis with the VDM tool show reasonable results.
- Tactile Peripheral Detection Task
The application of the cognitive-tactile TPDT was unproblematic. Sensitivity for the two cognitive tasks (+2 vs. -7, i.e., counting up in steps of 2 vs. counting backwards in steps of 7) was surprisingly low. For some participants simultaneous task performance (i.e. driving plus TPDT plus a difficult secondary task) is quite stressful.
- Driving performance
Sensitivity of Modified Lateral Position Variation was a little lower than one could expect in the present study. Steering Wheel Reversal Rate shows good sensitivity. Generally, the validity of driving performance measures is obvious (similar to that of the gaze data) and the recommended focus on lateral performance seems reasonable.
- Subjective measures
Both application and sensitivity of the DALI version applied here were satisfactory. Application of the abridged version (without „weighting“ part) can be recommended.

As a conclusion of this study, all methods listed above can generally be recommended for future usage and for inclusion in the general methodology to be developed in WP2.1. A joint

usage by combining them within an experiment, however, will require careful planning for each individual experimental set-up to check for potential interference, etc.