

# Modified Multiple Resource Model for multi-modal HMIs in automated driving

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Within the BMWi-funded project KARLI, an HMI system for automated driving will be developed to ensure level-compliant occupant behavior considering SAE Levels 0 - 4. It is to be expected, that drivers of automated vehicles will be exposed to situations where multitasking is required.

Particularly in takeover situations, drivers will have to process a large amount of information while simultaneously gaining situation awareness and eventually taking over driving tasks. Such situations carry a high risk of cognitive overload. Hence, the HMI system should deliver necessary information efficiently without distracting drivers from their tasks at hand.

The authors of this paper propose applying a simplified version of Wickens' multiple resource model to support level-compliant behavior by ensuring that the driver is optimally able to perceive and process the information provided by the HMI. The adapted model consists of two dimensions to visualize a driver's utilization of mental resources: Currently used modalities and ongoing perceptive/processing processes. The system will be monitoring driver condition, including currently executed tasks.

By categorizing this information into the adapted resource model, the HMI will be able to rate and classify the driver's current mental workload and choose a modality, whose perception requires the currently least occupied resources.

A driving simulator study will explore the adapted model's suitability in the domain of automated driving. On top of this, the methodological approach to empirically test the multiple resource model will be evaluated on its eligibility. The report will present the results of the study as well as methodical implications.