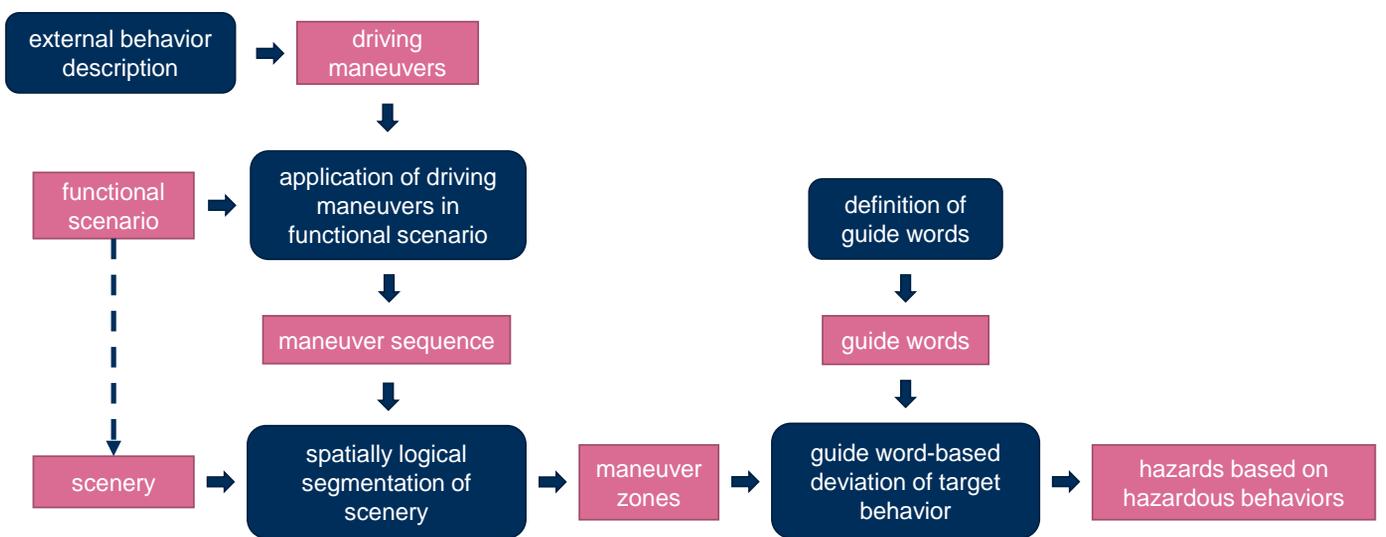


MANEUVER-BASED HAZARD IDENTIFICATION

Contributions to a systematic identification of hazards for automated driving systems

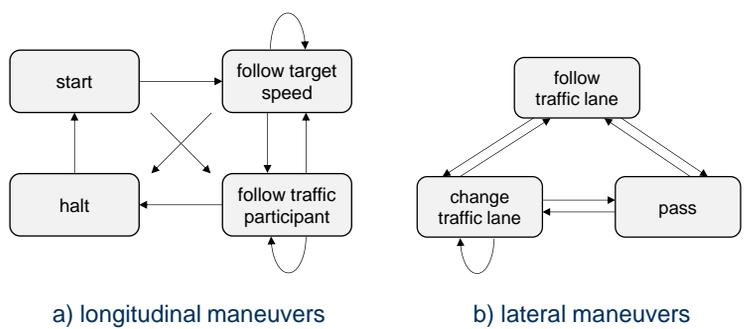
Nayel Fabian Salem, TU Braunschweig; Christian Lalitsch-Schneider, ZF; Martin Butz, Bosch

Methodological overview



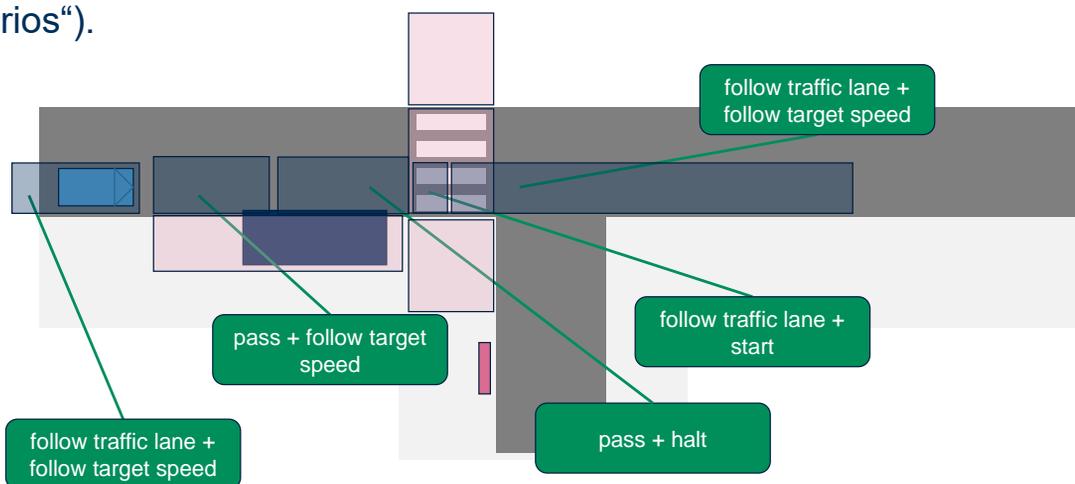
Maneuver-based behavior description

Based on Jatzkowski et al. [1] we initiate our hazard identification by applying a set of predefined lateral and longitudinal maneuvers. Transitions between maneuvers are triggered by changes of the ego's tactical intention.



Application of maneuvers in a functional scenario

Adopting the maneuver taxonomy by applying maneuver and information zones to a functional scenario enables us to derive a semantic structure of the scenery (cf. Butz et al. [2] and our Poster „Structuring the Scenario Space using Abstract Scenarios“).



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MANEUVER-BASED HAZARD IDENTIFICATION

A systematic identification of hazards for automated driving systems

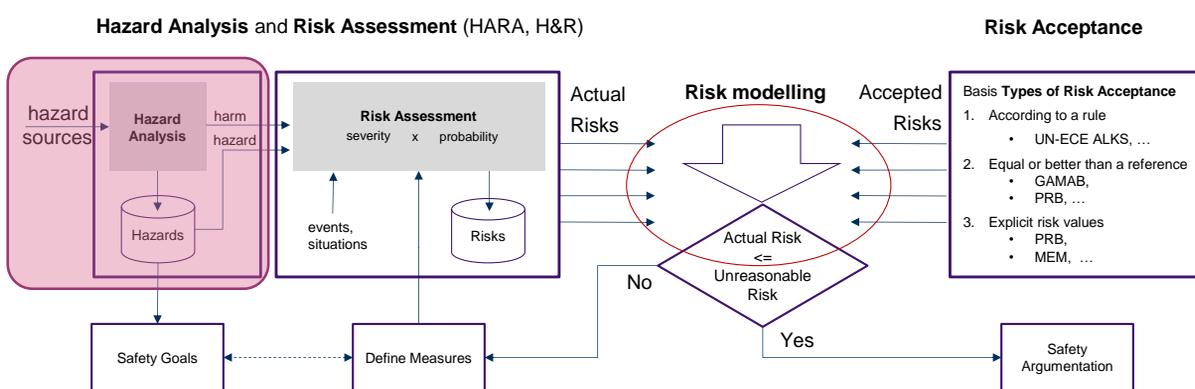
Guide-word-based hazard identification

Evaluating the specified sequence of maneuvers by a HAZOP inspired approach (cf. Kramer et al. [3], Graubohm et al. [4]) hazards can be identified based on the target behavior description. Deviations of the maneuver are systematically analyzed by the utilization of guide words (e.g. *no, early, late, less, more*). The following table summarizes an example for the second zone in the example scenario.

Maneuver	Pass
Correct if (context)	Ego orients itself as far left in the lane as possible and as much as necessary to pass the parked vehicle
Deviation (guide word)	Less
Observable effect(s) in scenario	Lateral distance to the parked vehicle is insufficient
Hazard	Potential collision with the parked vehicle

Next step: Hazard classification and risk assessment

These hazards constitute one input to the risk management core (please find more information on our poster on “Risk Modelling”).



References

- [1] I. Jatzkowski et al., “Zum Fahrmanöverbegriff im Kontext automatisierter Straßenfahrzeuge; English: Towards the terminology of driving maneuvers for automated vehicles,” TU Braunschweig, Braunschweig, Technical report, May 2021.
- [2] M. Butz et al., “SOCA: Domain Analysis for Highly Automated Driving Systems,” presented at the 2020 IEEE 23rd International Conference on Intelligent Transportation Systems (ITSC), Sep. 2020. doi: 10.1109/ITSC45102.2020.9294438.
- [3] B. Kramer, C. Neurohr, M. Büker, E. Böde, M. Fränze, and W. Damm, “Identification and Quantification of Hazardous Scenarios for Automated Driving,” in Model-Based Safety and Assessment, vol. 12297, M. Zeller and K. Höfig, Eds. Cham: Springer International Publishing, 2020, pp. 163–178. doi: 10.1007/978-3-030-58920-2_11.
- [4] R. Graubohm, T. Stolte, G. Bagschik, and M. Maurer, “Towards Efficient Hazard Identification in the Concept Phase of Driverless Vehicle Development,” 2020 IEEE Intelligent Vehicles Symposium (IV), pp. 1297–1304, Oct. 2020, doi: 10.1109/IV47402.2020.9304780.

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