

Criticality Analysis - Application

9.6 | Applied Criticality Analysis with CARLA

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Simulation of Traffic Scenarios

Questions

- **How** can criticality be measured?
- **How** can one assess the association of criticality phenomena with the measured criticality?
- **How** can one find the most critical realizations of given logical scenarios?

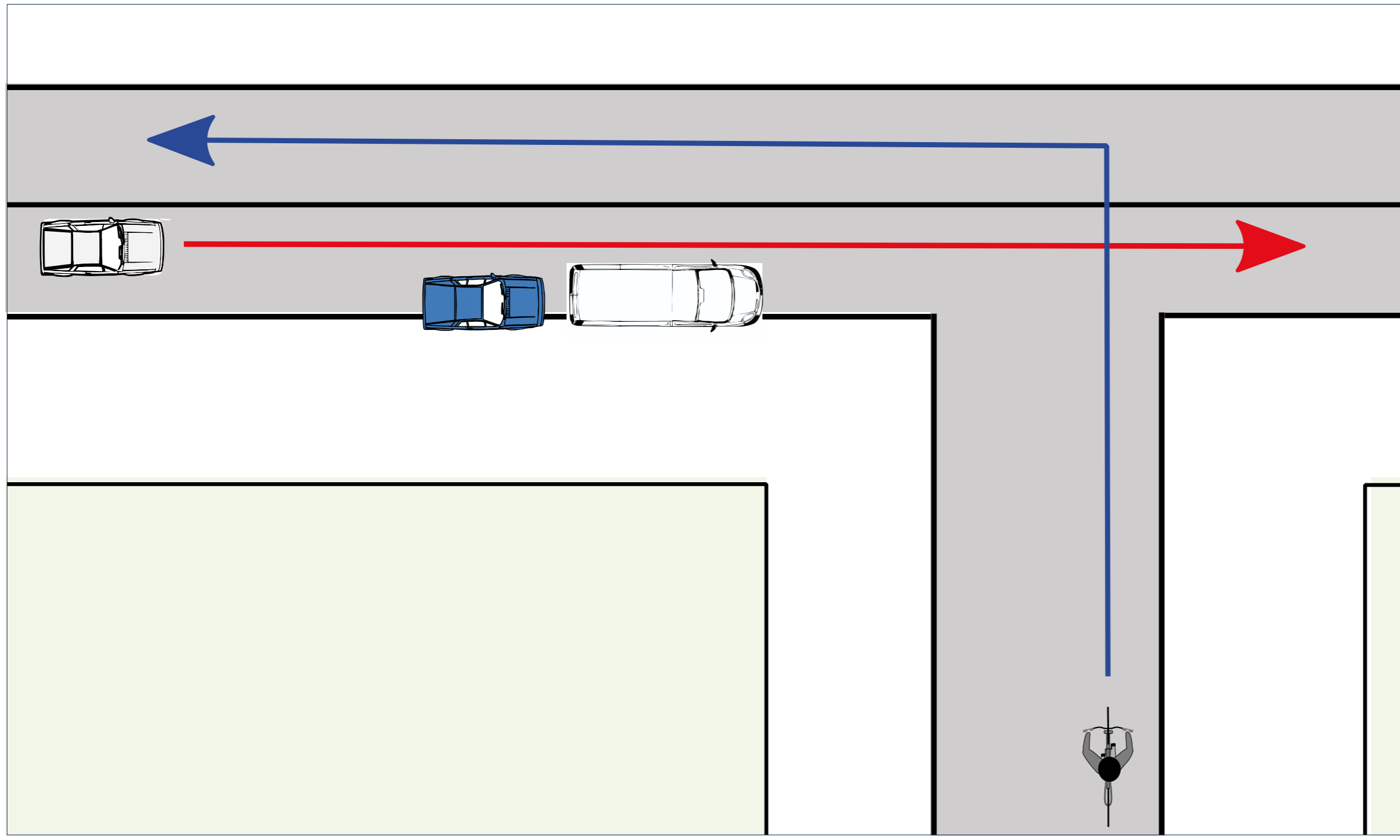


Figure 1: The scenario for the criticality phenomenon „occlusion” that was considered in this exemplary analysis [1]. (© DLR e.V.)

Criticality Metrics

Measuring Criticality

- **Criticality** as combined risk over time is a highly complex concept
- Measuring criticality can only be done for aspects of it, e.g. severity or accident probability.
- For each **criticality phenomenon** a suitable criticality metric has to be assigned
- **Associative analysis** between criticality phenomena and measured criticality (Figure 3)

Examples

- **Time To Collision (TTC):** Measures the time until a predicted collision would occur.
- **Required Acceleration (areq):** Measures the average deceleration that would be required to prevent a predicted collision.

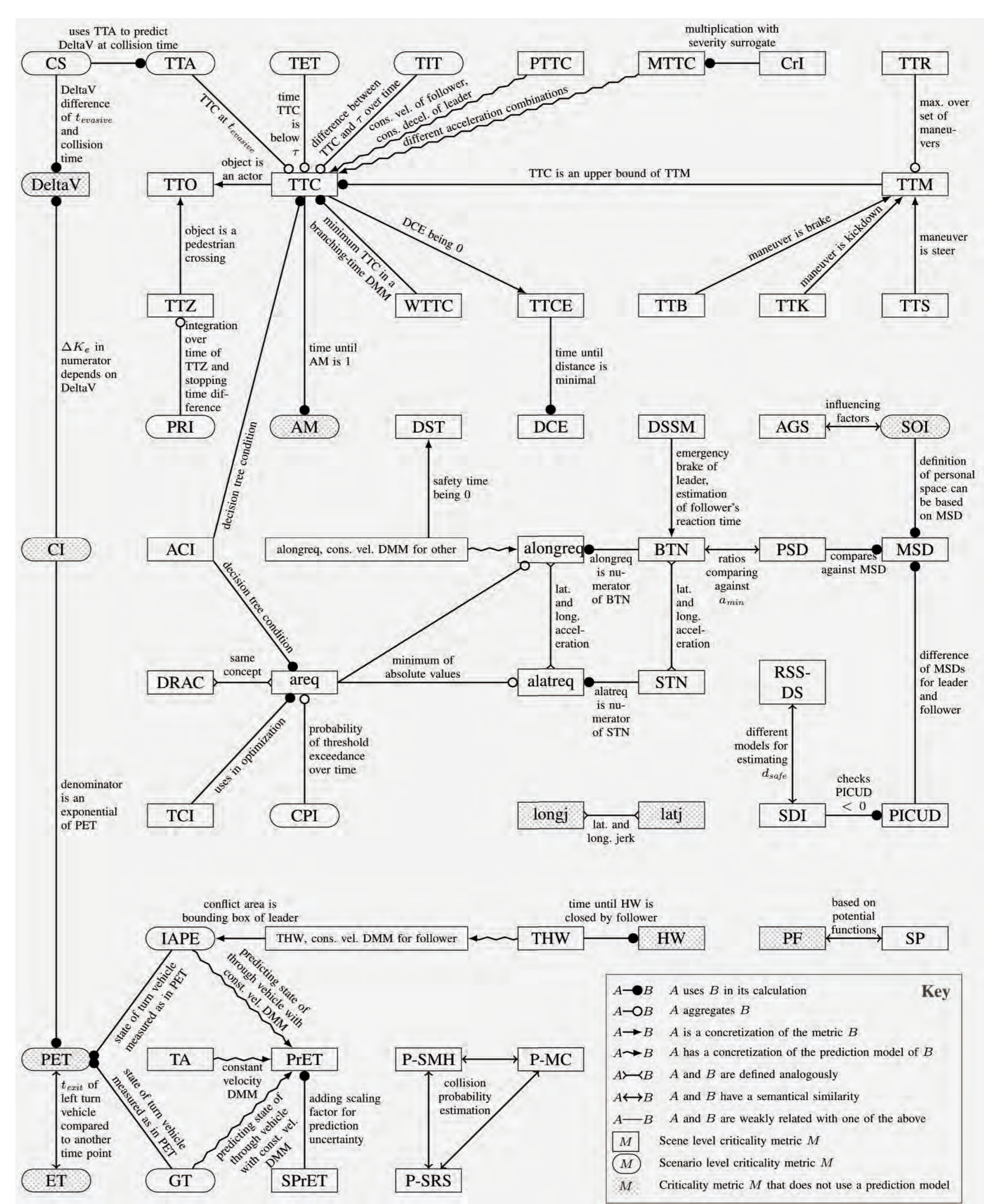
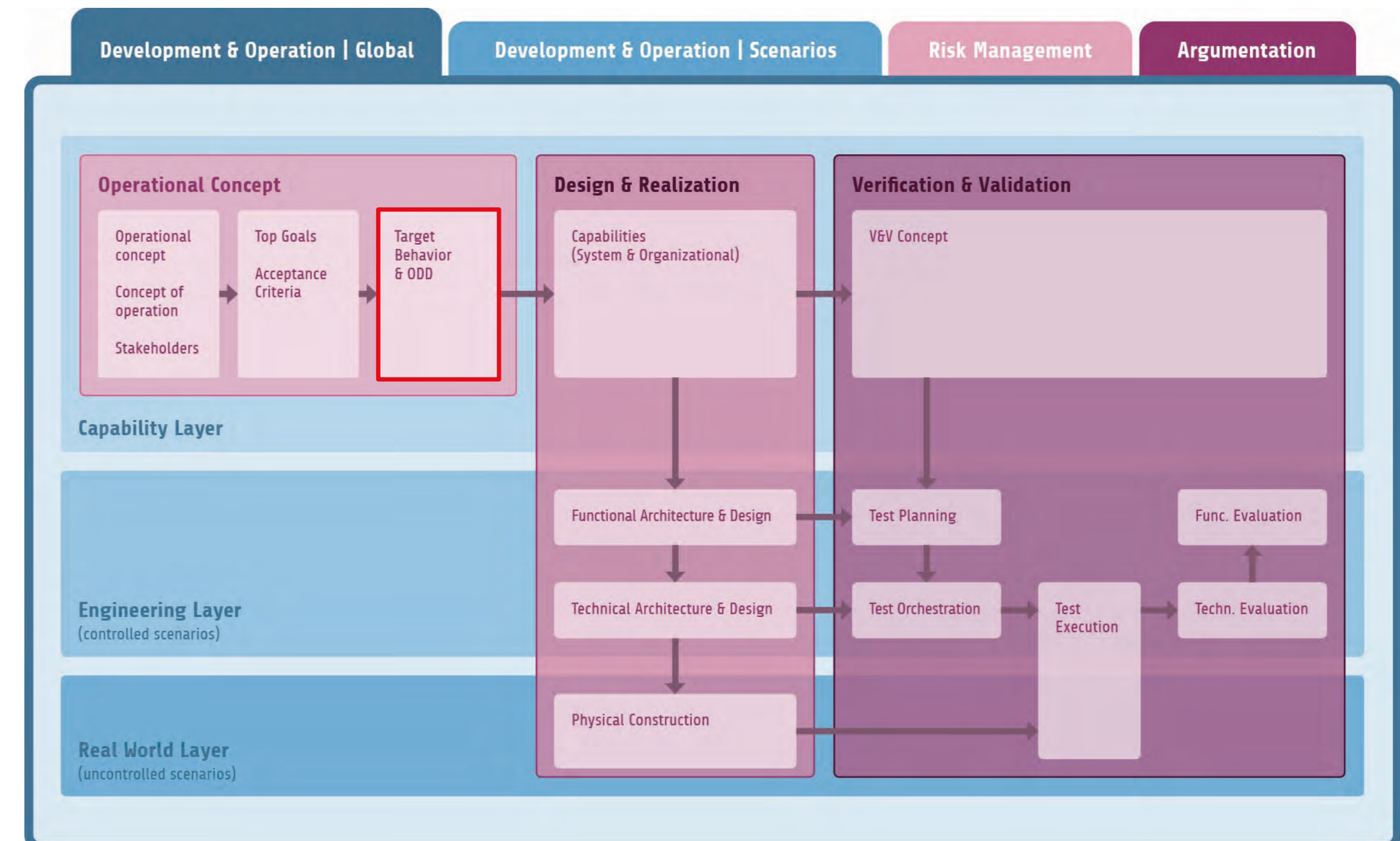


Figure 2: Similarities between a wide variety of criticality metrics. (© DLR e.V.)

Evolutionary Algorithms

- Most criticality metrics don't fulfill the regularity requirements of common optimization algorithms
- **Evolutionary algorithms** are able to optimize a fitness function under rather weak assumptions
- Usage of criticality metrics as fitness functions provides highly-critical scenarios [1]

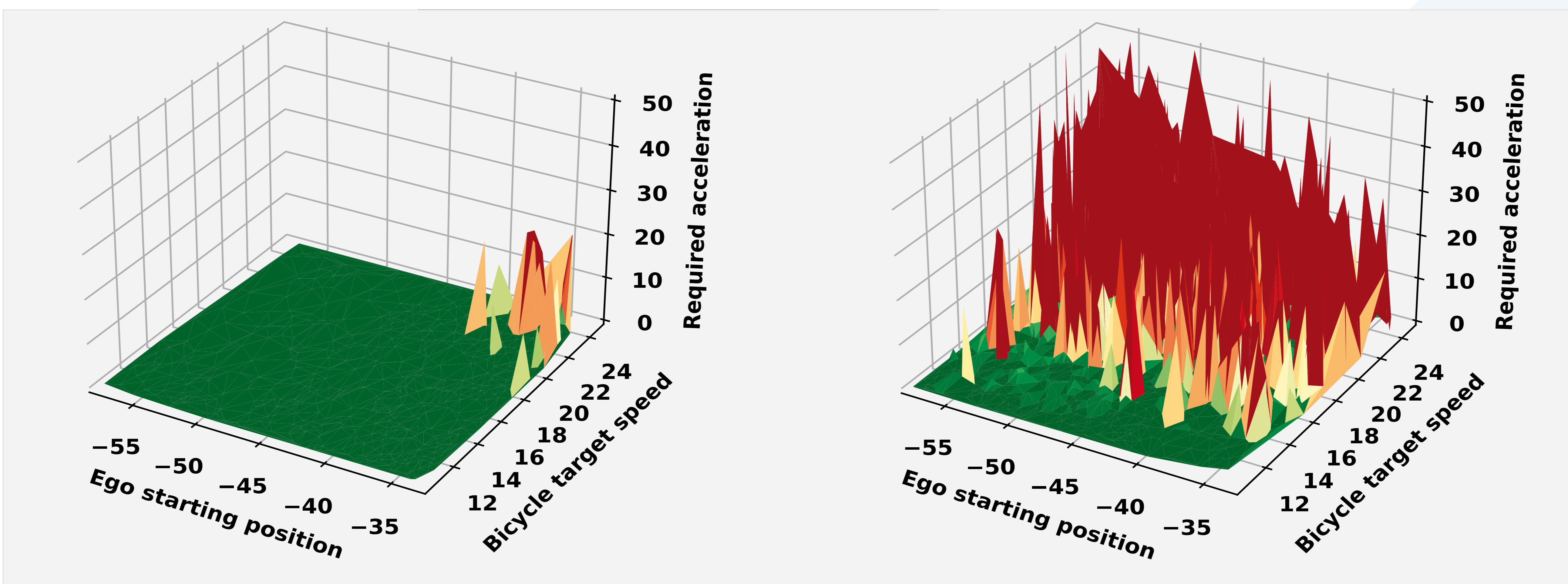


Figure 3: Exemplary visualization of the criticality across the parameter space reduced to two parameters and estimated criticality measured using the Required Acceleration (areq) metric. Left: No static occlusion is present in the scenario. Right: A static occlusion is present in the scenario. (© DLR e.V.)



Find out more:
www.criticality-metrics.readthedocs.io

References:

[1] A. Fehnker, „Application of Evolutionary Algorithms to Analyze Criticality in Urban Traffic Scenarios”, master's thesis, University of Oldenburg, 2022

Partners



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