

## Criticality Analysis – Method

# 8.1 | Criticality Analysis for the Verification and Validation of Automated Driving Systems (I)

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### Criticality Analysis – Introduction & Artifacts

#### Questions

- **When** does criticality arise in the operational domain (OD)?
  - **What** causes this increased criticality?
  - **Which** are the critical scenarios?
- A criticality analysis answers these questions!

#### Definitions

**Criticality** (of traffic situation): combined risk of the involved actors when the situation is continued

The open context of the OD is mapped to a manageable set of safety-relevant artifacts.

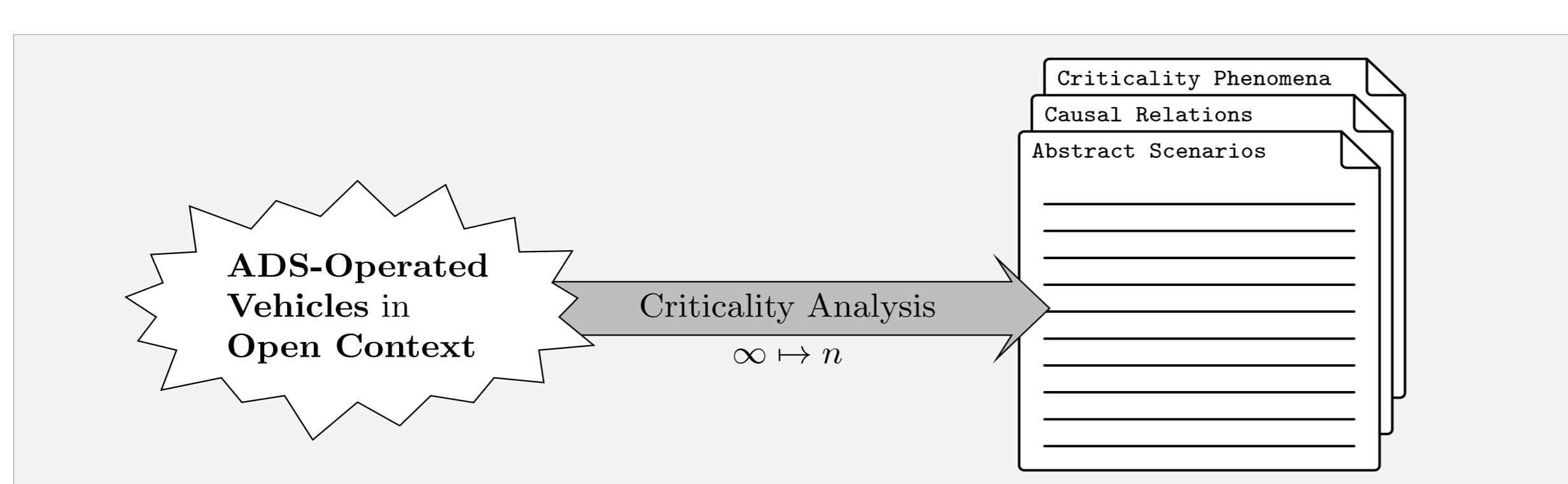
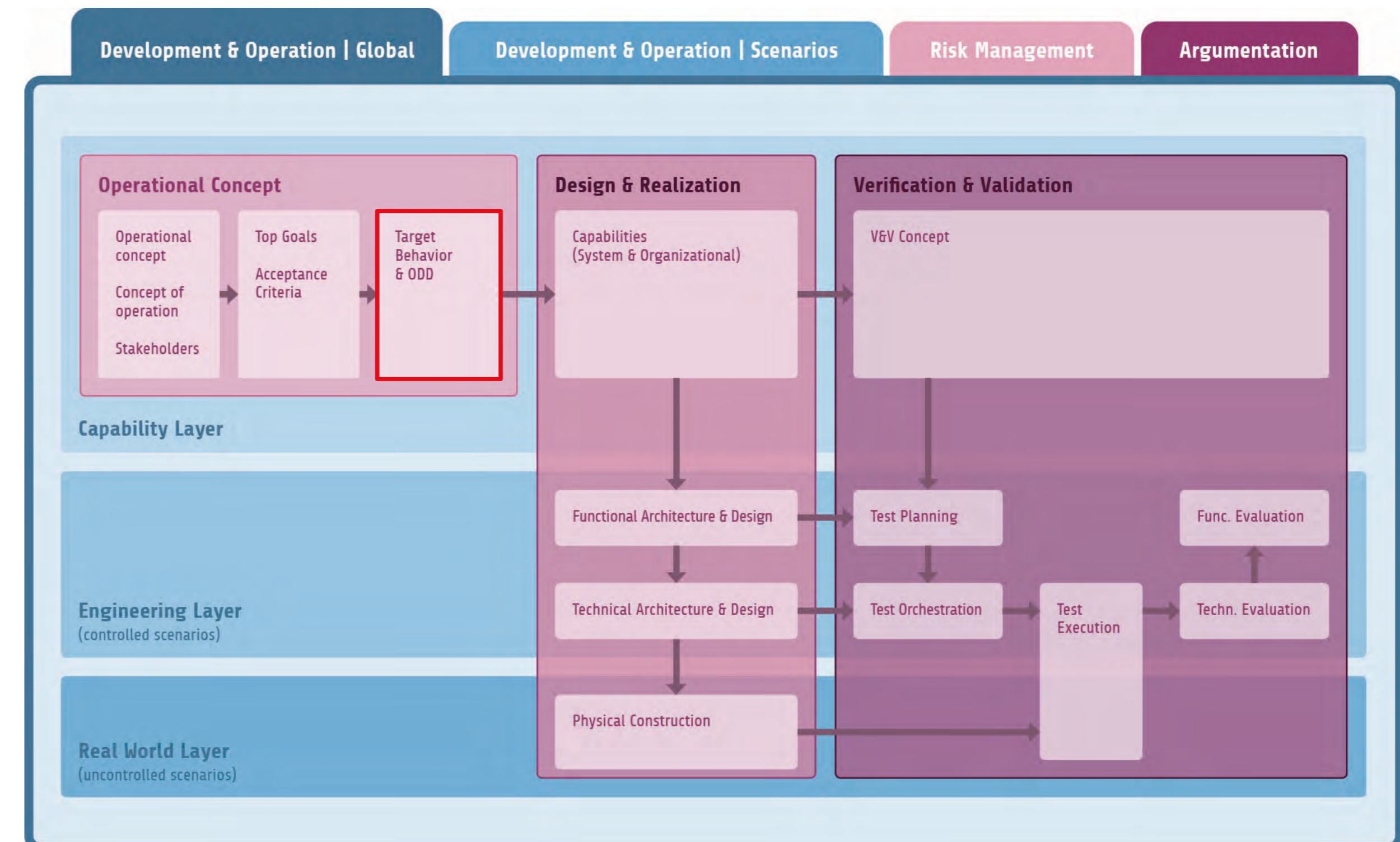


Figure 1: Idea of the criticality analysis (© DLR e.V.)

#### Artifacts

- **Criticality Phenomena (CP)**: influencing factors in scenarios associated with increased criticality [Posters #5.2, #9.1, #9.3, #9.4]
- **Causal Relations (CR)**: creation and plausibilization of graphical models that explain how CP lead to increased criticality [Posters #8.3, #9.5]
- **Abstract Scenarios (AS)**: based on CP and CR, link to scenario-based development, verification, and validation [Posters #9.2, #9.5]



### Criticality Analysis – Tools & Contribution

#### Tools

- Ontologies & OD Description [Posters #5.2, #9.1, #9.2]
- Criticality Metrics [Posters #8.3, #9.6, #9.7, #9.8]
- Data Analysis [Posters #9.1, #9.4, #9.6]
- Simulation Systems and Models [Posters #9.5, #9.6, #9.7]

#### Contribution to VVM

- **CP, CR**: source of information for HARA
- **CR**: basis for ADS behavior requirements
- **AS**: for ADS validation on behavior level
- **Safety Argument**:
  - identification and evaluation of triggering conditions
  - quantification via criticality metrics
  - Possibly saturation claims

#### References:

- [1] Neurohr et al., Criticality Analysis for the Verification and Validation of Automated Vehicles, IEEE Access, 2021
- [2] Koopmann et al., Grasping Causality for the Explanation of Criticality for Automated Driving, arXiv, 2022
- [3] Westhofen et al., Criticality Metrics for Automated Driving, Archives of Computational Methods in Engineering, 2022

Key Artefacts

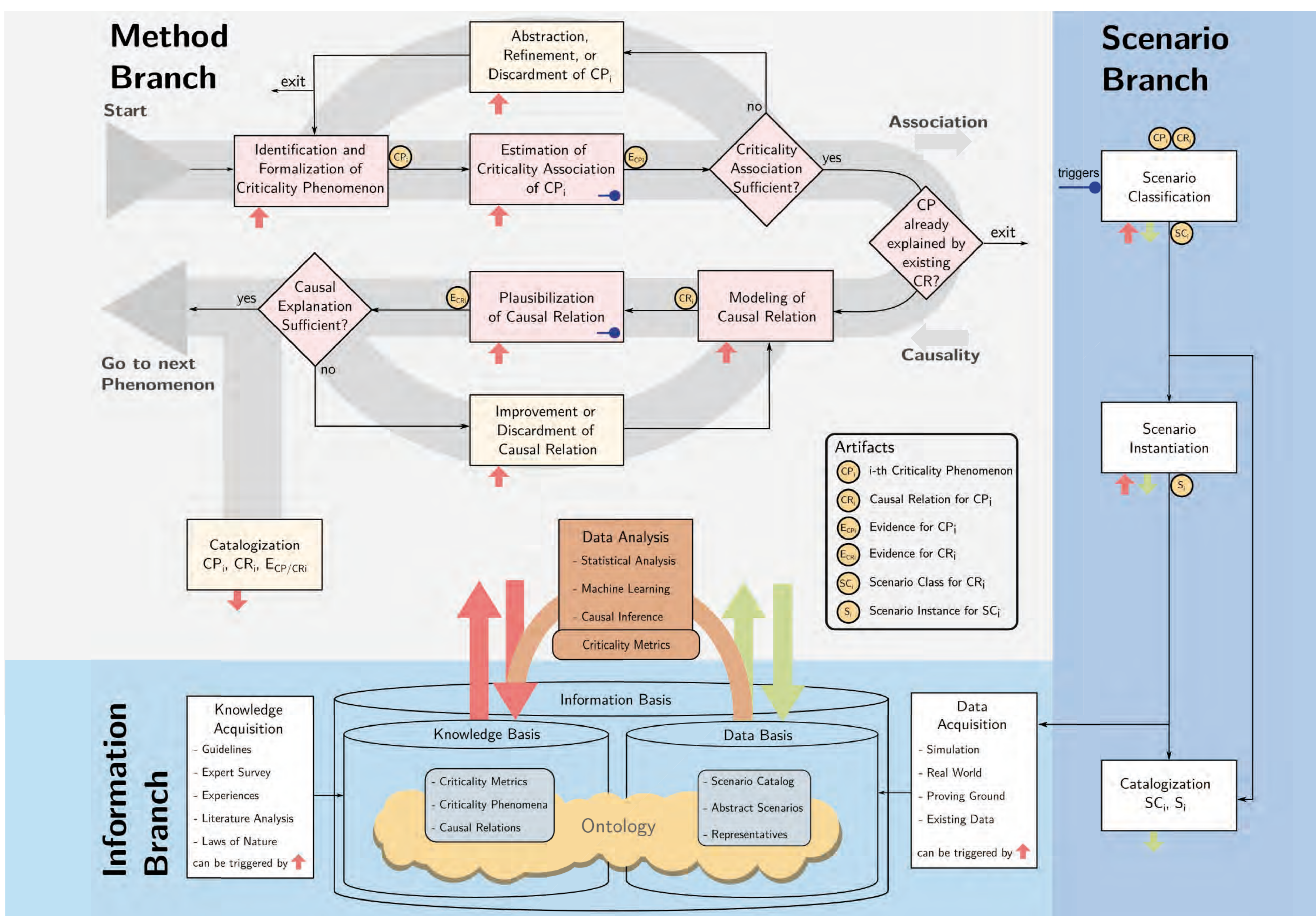


Figure 2: Overview of the procedure of the criticality analysis, structured into method branch, information branch, and scenario branch (© DLR e.V.)

### Partners



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