European Naturalistic
Driving Study

Study Design of NDS with examples from UDRIVE

Martin Baumann

German Aerospace Center

UDRIVE overview

- UDRIVE aims to gather knowledge and extend our understanding of the relevant aspects of road safety and efficiency
  - by collecting continuous data on
    - vehicle manoeuvres,
    - on the behaviour of passenger car drivers, truck drivers, and motorcycle riders,
    - and on external conditions
  - over an extended period of time
  - in several European countries
  - under naturalistic driving conditions with unobtrusive recording equipment

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Naturalistic Driving Key elements

- According to PROLOGUE (Sagberg, et al., 2011)
  - Unobtrusive recording of driver and vehicle parameters
  - Normal driving, i.e. driving purpose and driving destinations as defined by the driver, and driving taking place on roads open to ordinary traffic, and with the vehicle that the driver normally uses (owned, leased, or company vehicle)
  - No observer present in the vehicle

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Naturalistic Driving Relation to FOTs

- Main differences:
  - Focus on explanatory factors of crash causation or driver behaviour in general vs. evaluation of systems and function
    - But data in both types of studies to be used for alternative purposes: e.g., efficiency, mobility, environment impacts of driving behviour
  - Basically no experimental control and experimental design in NDS

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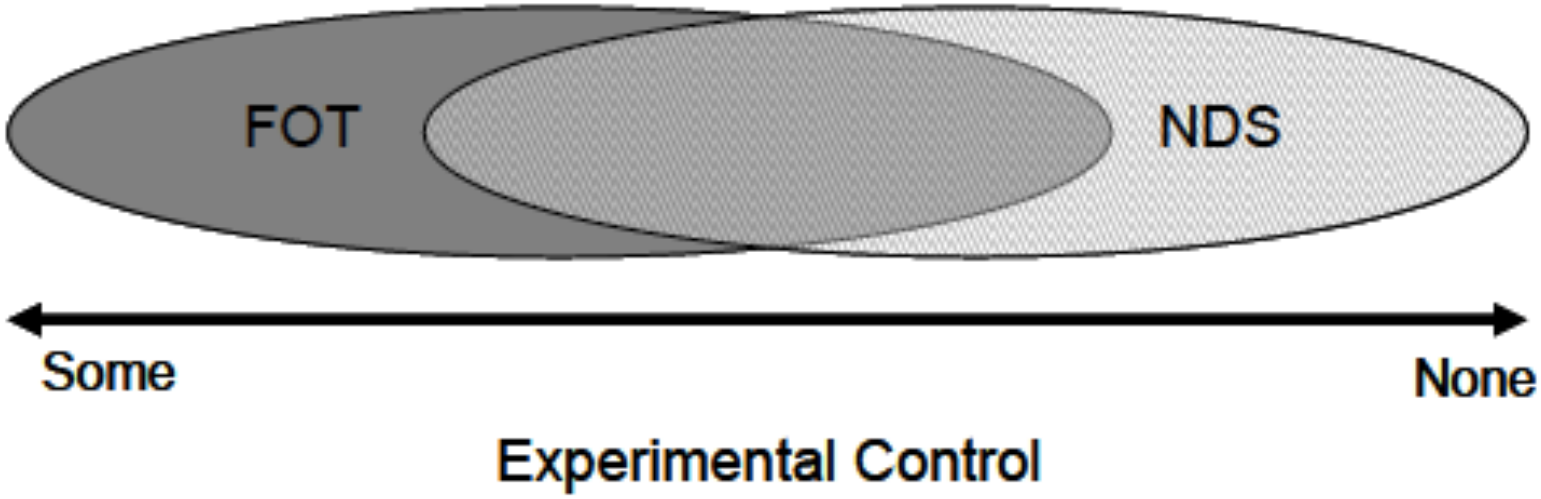
Naturalistic Driving
Relation to FOTs



(Festa v4, p. 5)

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Advantages of Naturalistic Driving Studies

- Only method to observe natural behaviour (incl. risky actions)
  - Reliable information about observable driver behaviour
  - As it occurs within a given context over time
  - Observation of how safety critical events evolve out of normal driving situations
- No manipulation or exclusion of potential contributing factors
  - Can reveal causation chains as well as interactions of factors
- Very high validity

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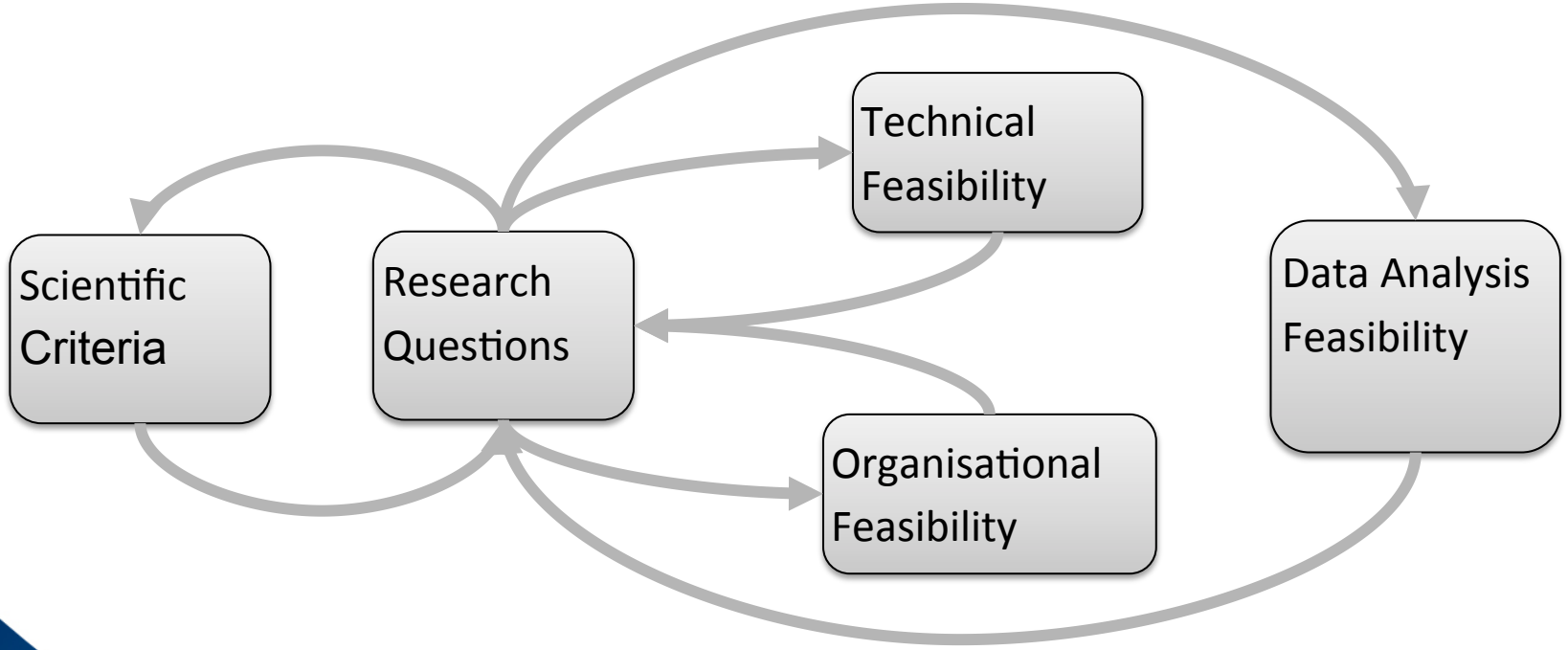
Starting point: Research questions

- Iterative processes



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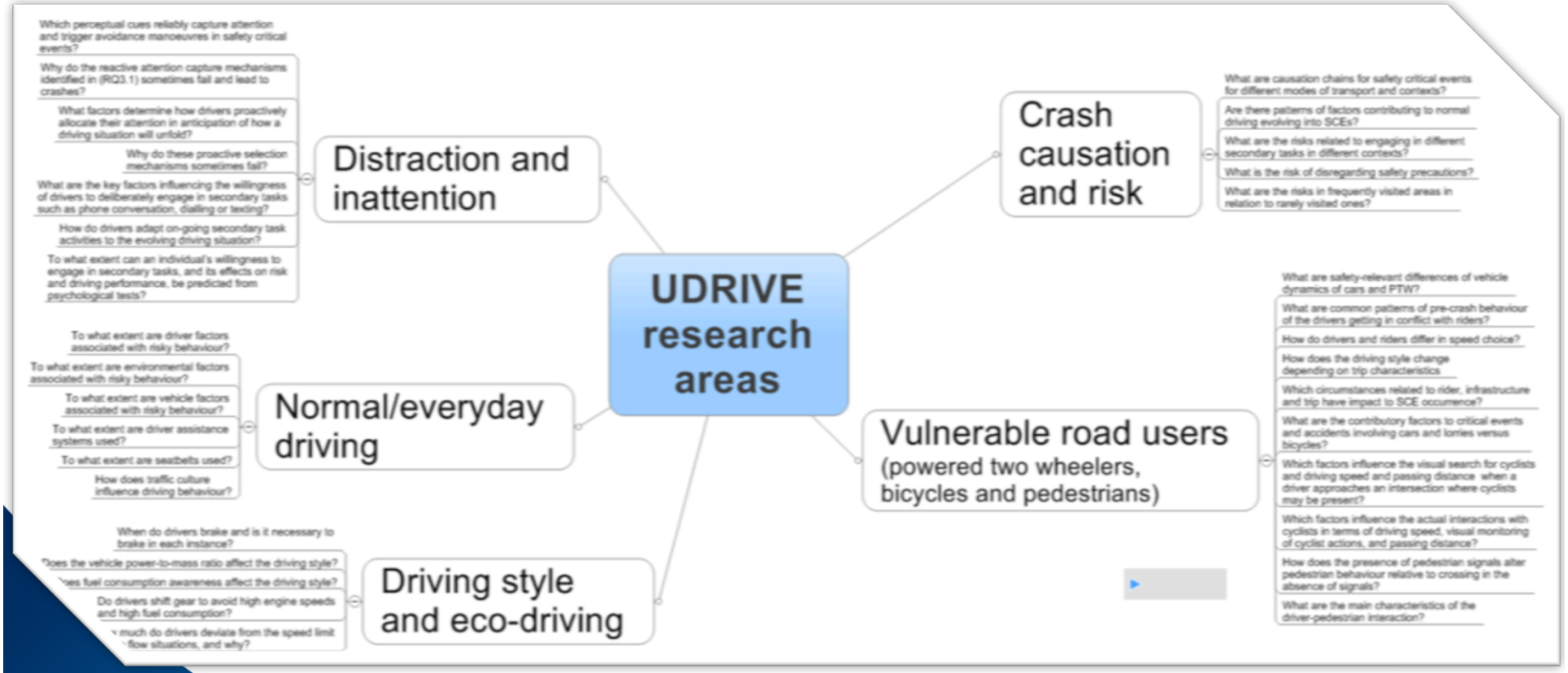
Starting point: Research questions



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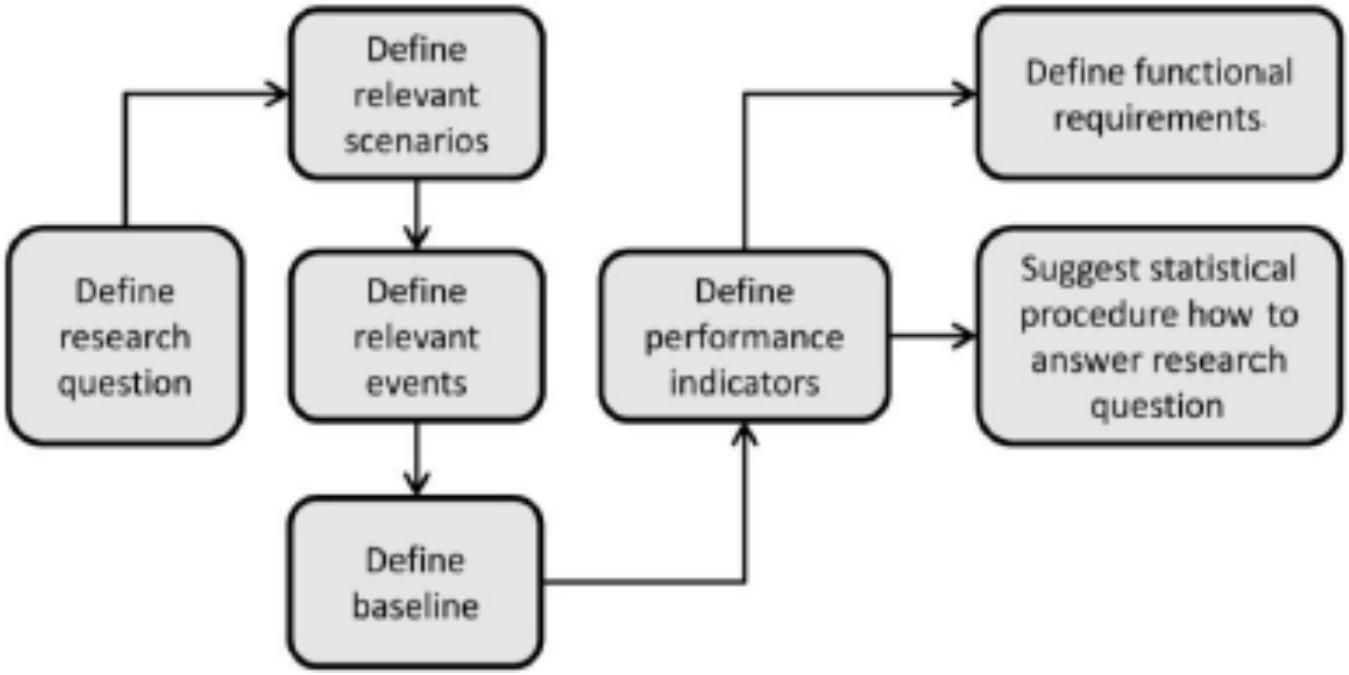
From research questions to study design



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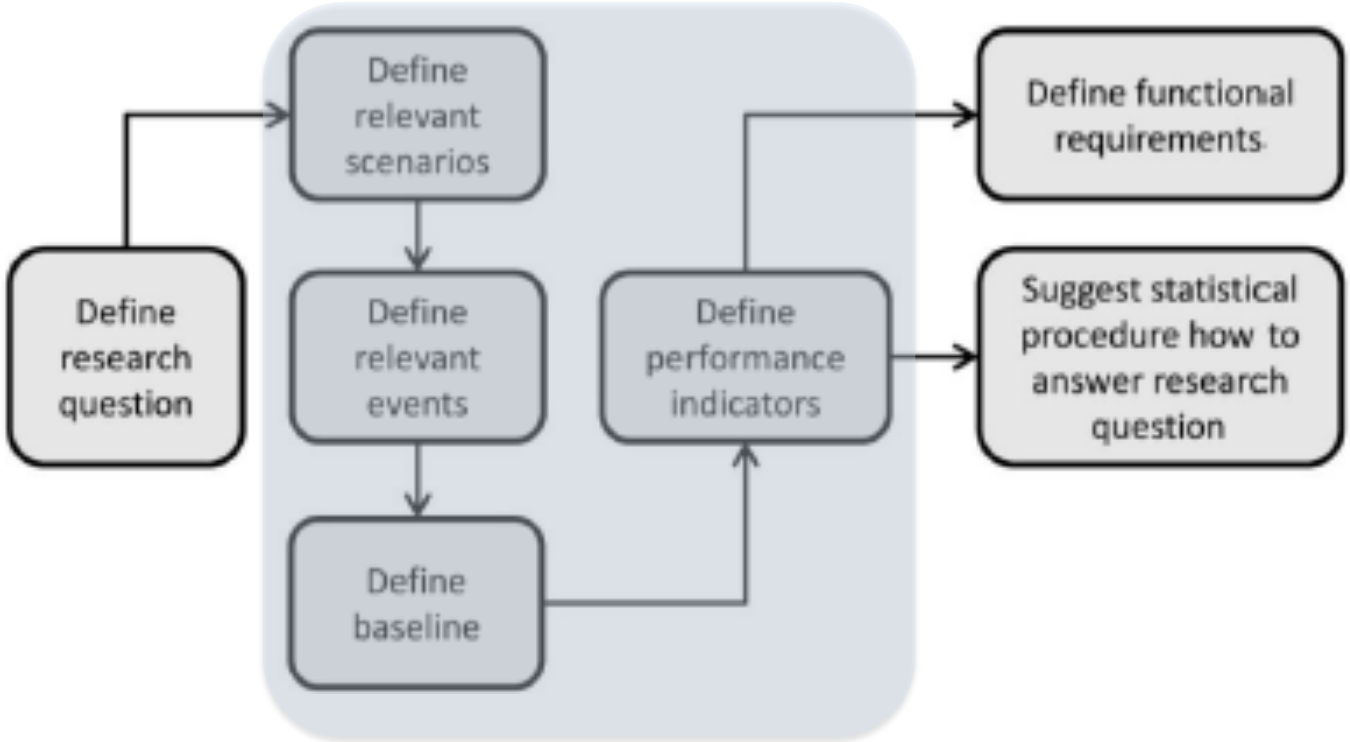
From research questions to study design



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Key Issues in Study Design
Main goals

- Ensure that relevant types of data are collected
  - Define main influencing factors and how to include them in the study
    - Explicitly controlled (e.g., sites of data collection, age of participants)
    - Measured scientifically to be included in data analysis (e.g., vehicle headways, drivers' personality characteristics)
    - Recorded for exclusion from analysis (e.g., heavy rain)
  - Performance indicators
- Ensure that relevant data sets are collected
  - Relevant scenarios and events
  - Relevant participants

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Key Issues in Study Design
Main goals

- Ensure that data collection follows the same procedures in each operation site
  - Comparability of data

➔ **Research questions can be addressed properly**

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Key Issues in Study Design
General procedure in UDRIVE

- Example: What are the risks related to engaging in different secondary tasks in different contexts?

- Influencing factors – Hypotheses about relations
  - Driver characteristics
  - Environmental factors
  - Type of secondary tasks

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Key Issues in Study Design
General procedure in UDRIVE

- Example: What are the risks related to engaging in different secondary tasks in different contexts?

- Relevant data sets
  - Scenarios
    - Relevant context for observing targeted driver behaviour
    - E.g., car following on motorways
  - Relevant events
    - E.g., texting
  - Baseline
    - E.g., car following on motorways without secondary task performance

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Key Issues in Study Design
General procedure in UDRIVE

- Example: What are the risks related to engaging in different secondary tasks in different contexts?

- Characteristics of participants / participant selection
  - Representativeness?
  - Relevant characteristics regarding research questions
    - Characteristics relevant with regard to engaging in secondary tasks while driving
  - High probability to record relevant data sets
    - Participants driving frequently on motorways and having opportunity to engage in secondary tasks

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Key Issues in Study Design
General procedure in UDRIVE

- Example: What are the risks related to engaging in different secondary tasks in different contexts?

- Sample size and duration of data collection :
  - Key question: How many drivers and driving years to record enough relevant events for statistical analyses?

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Key Issues in Study Design
General procedure in UDRIVE

- Example: What are the risks related to engaging in different secondary tasks in different contexts?

- Desired vehicle types
  - Vehicles possessed by relevant group of participants
    - Related to driving styles
  - Vehicles equipped with in-vehicle information systems (as source of secondary task engagement)

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Summary

- NDS means
  - Minimum experimental control and experimental design
  - Observational study of naturalistic driving behaviour with the chance to observe safety critical events
- Definition of research questions is an iterative process
- Study design involves
  - Definition of factors possibly influencing addressed driver behaviour
    - Only few influencing factors experimentally controlled
    - But measured for later analysis
  - Definition of scenarios, participant characteristics, sample size, vehicle types defined

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Thank you for your attention!

Martin Baumann

(contact: martin.baumann@dlr.de)