Recommendations for data collection
Derived from re-analyzing FOT-data

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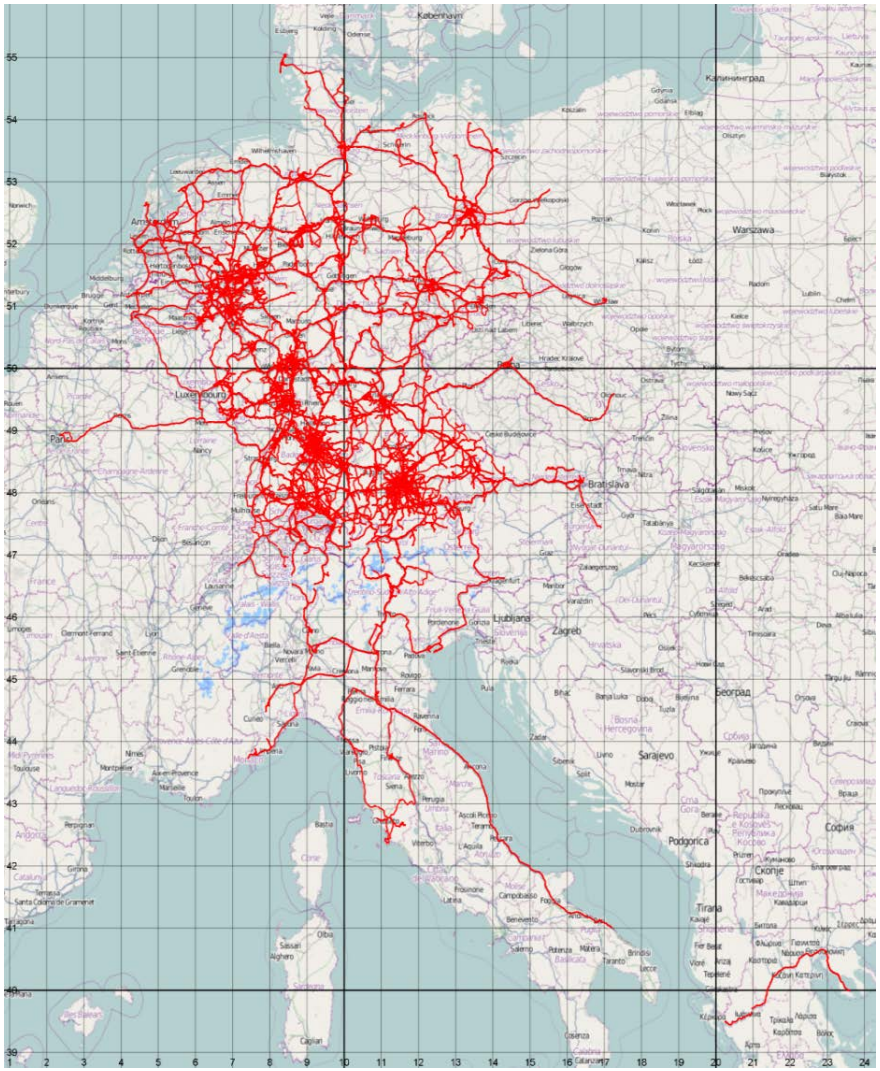
Database from euroFOT (German 2VMC)

Content of database	
2 vehicle types	Mercedes E-Class BMW 5series
Subjective data	Demographics, questionnaires
Video data	4 channels
Vehicle data (CAN, MOST, FlexRay)	> 300 signals
Data from digital map	

Size of database	
Number of Participants	115
Number of Trips	39 703
Observed Kilometers	1 013 262
Observed Hours	15 129



Research topics covered (examples)

euroFOT:

- Usage and acceptance of different navigation systems
- Impact of navigation systems on driving behavior, safety and efficiency

Project financed by FAT:

- Description of general driving behavior / driving style, relation to subjective data (e.g. DBQ)
- Frequency and impact of hands-free telephoning

Project financed by BMW:

- Frequency and impact of distracted driving

Analyzing hands-free telephoning

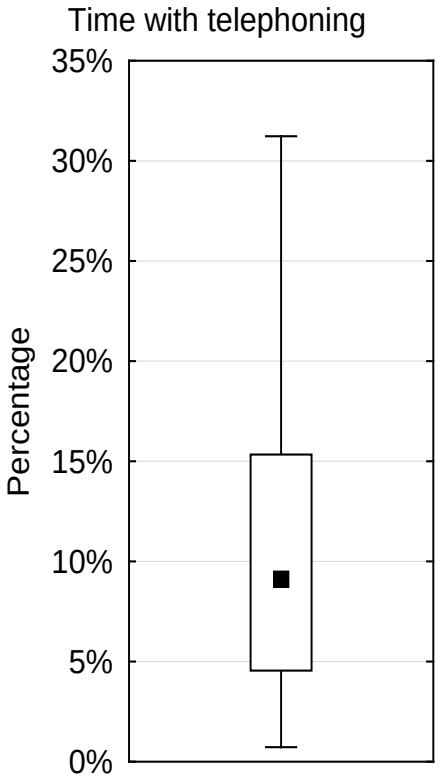
- CAN-signals are available that code the usage of hands-free phone system (e.g. microphone open)

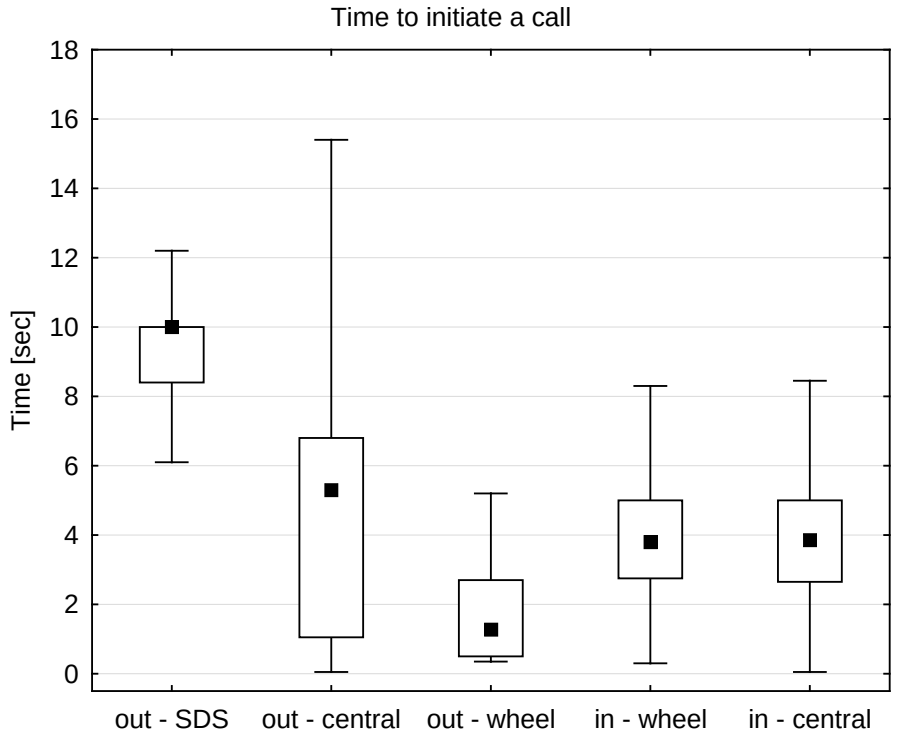
- Through combination with other signals different types of calls can be differentiated
  - Pattern and duration of button presses, usage of central controller
  - Validation of algorithms with video
  - Different algorithms for the two vehicle types

- Total database is include in analysis

	Number of Calls	Duration of Telephoning [hours]
Total	29874	1248
Outgoing	16910 (56,6%)	681 (54,6%)
Incoming	3163 (10,6%)	167 (13,4%)
No Button Pressed	8698 (29,1%)	343 (27,5%)
Unknown	1103 (3,7%)	57 (4,6%)

Usage of the hands-free telephone



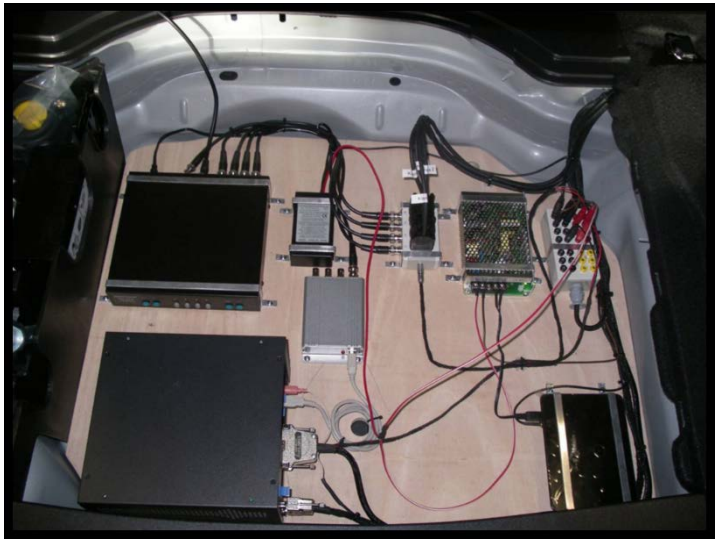


- Drivers differ largely in their frequency of phoning
- Voice control (SDS) takes the longest time
- To accept a call, drivers need less than 4 sec (including ringing)

Distracted driving - Data analysis

Distracted driving is assessed with two approaches. Analysis uses database from BMW (ca. 383 000 km).

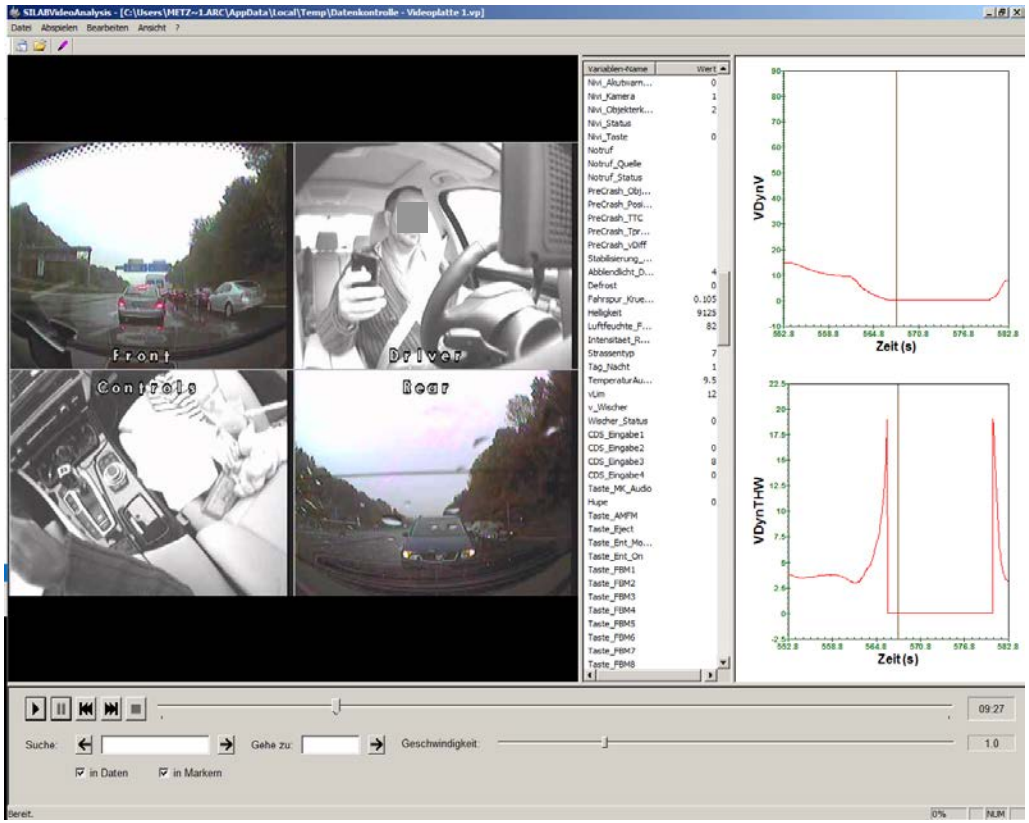
Based on CAN-data
(similar to hands-free phone)



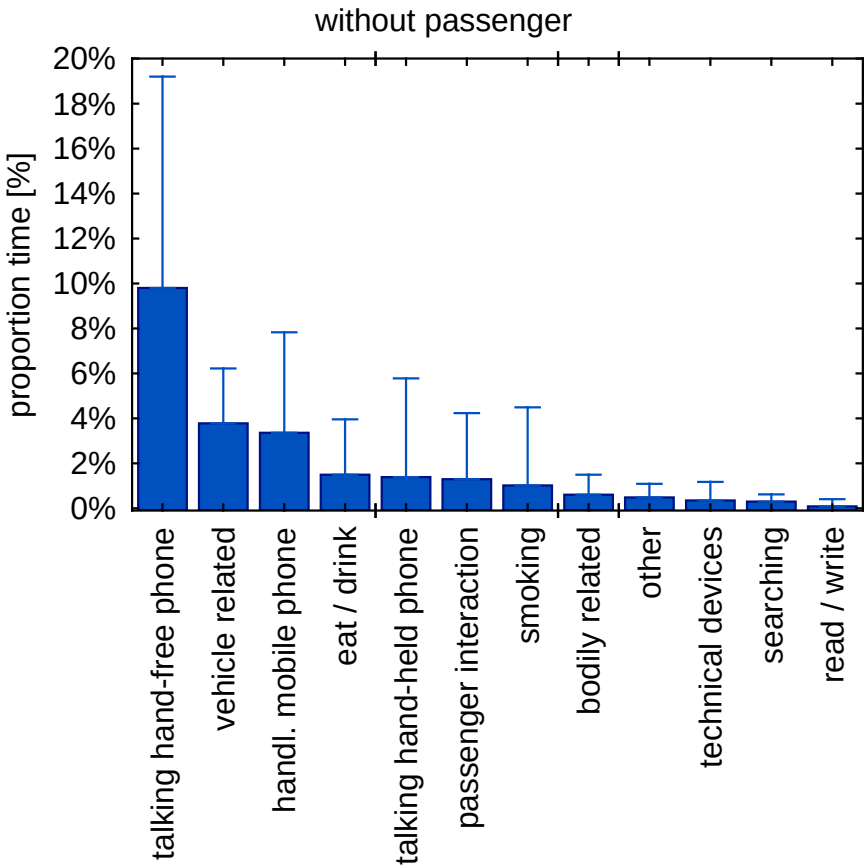
Based on video

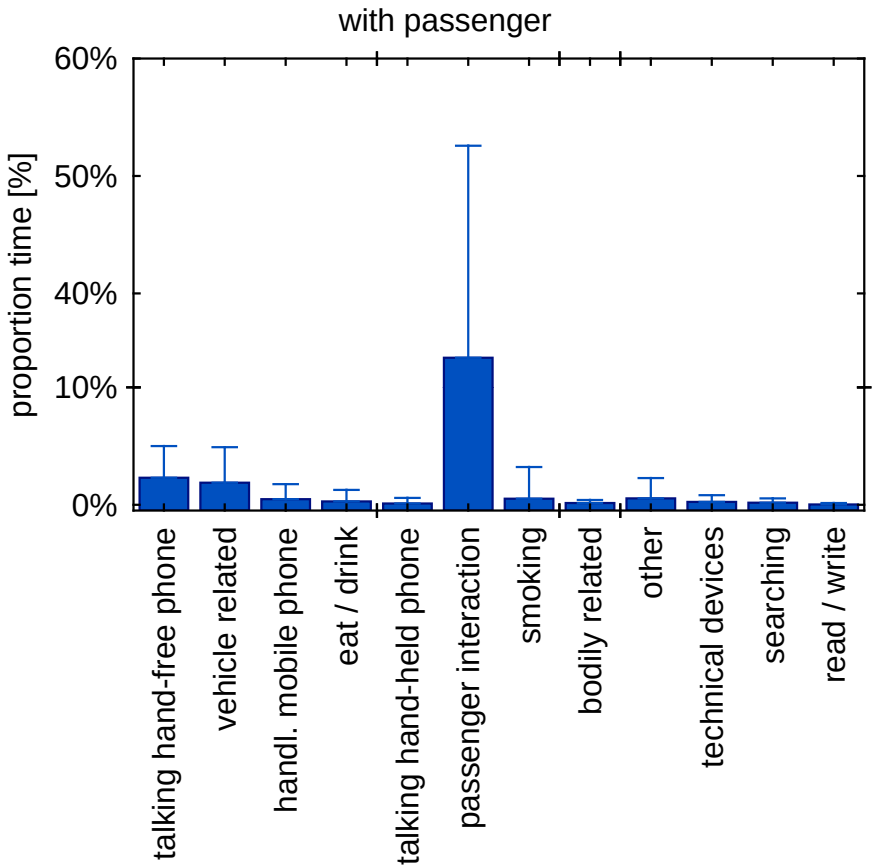
Video: Coding of distraction

- **Subsample of trips is coded**
- **Selection of trips based on several criteria:**
  - Sufficient number per driver
  - With & without passenger
- **Subsample:**
  - Between 7 and 9 trips per driver
  - Mean=446 km per driver
  - In total ~20 000 kilometers 256 hours coded



Time spent on different secondary tasks





Most frequent secondary tasks:

Without passenger: talking on hands-free phone (10%), vehicle related inputs (4%), handling mobile phone (3%)

With passenger: Interaction with passenger (35%), talking on hands-free phone (2%)

New approaches for data analysis

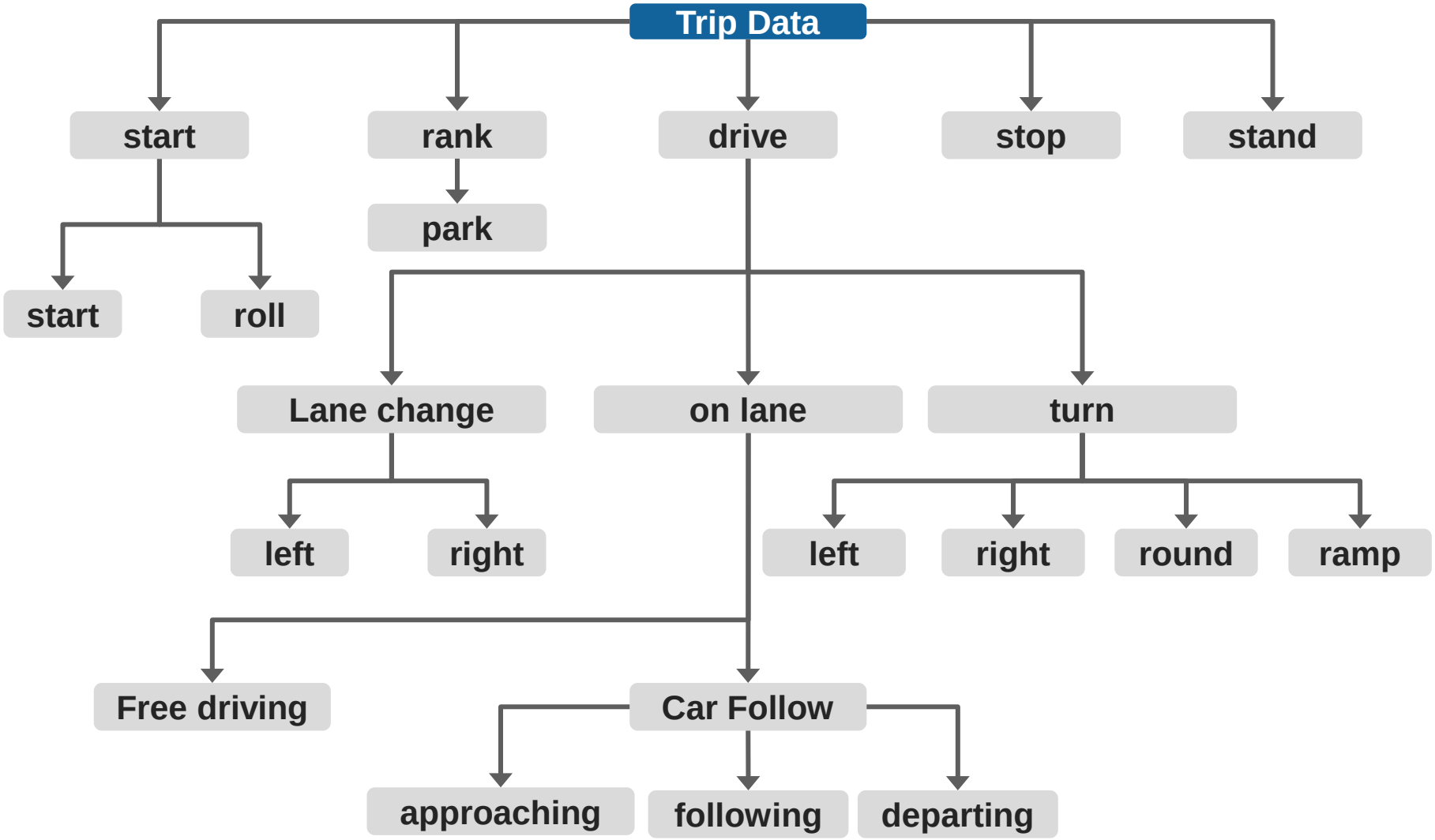
For many research questions, control of situational variance is needed:

- Impact of road category
- Environmental impact (day / night, rain)
- Impact of current driving task (following, lane change etc)

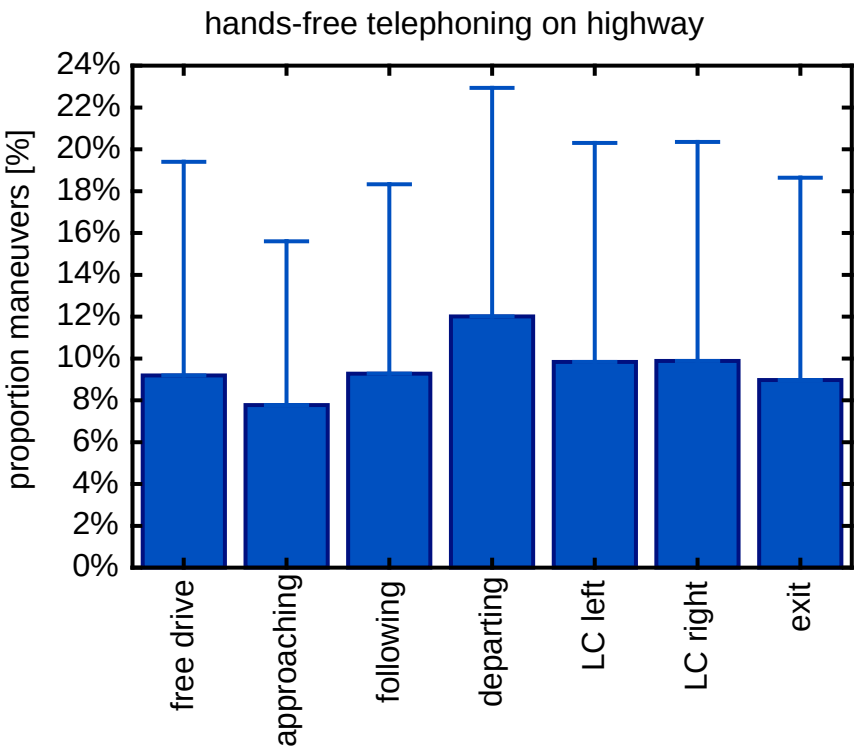
Development of a maneuver algorithm:

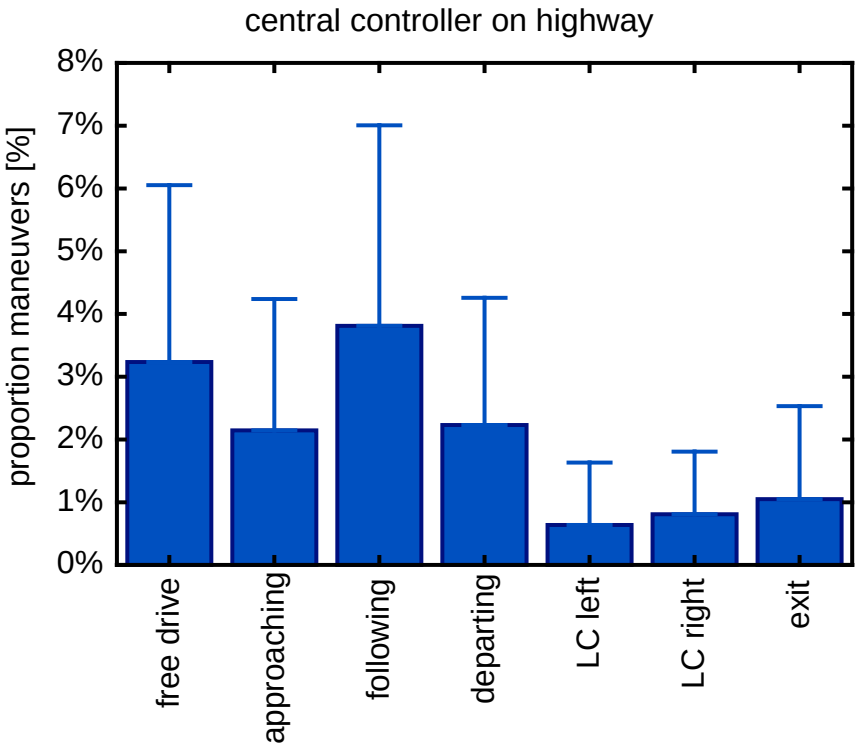
- Trips are divided into continuous sequence of driving maneuvers.
- Algorithm differentiates maneuvers based on objective time-series data:
  - Cleaning of data
  - Identification of maneuvers
  - Prioritization of maneuvers
- Validation based on video for 12 trips

Distinguished maneuver types



Distraction in maneuvers: highway





Frequency of distraction differs significantly between maneuver types:

- Telephoning most frequent during departing, least frequent during approaching and exits;
- Inputs via central controller most frequent during following and free drive, least frequent during lane changes and exits;

Needs for re-use of data

For efficient and valuable re-use of FOT / NDS data:

- More signals should be recorded than needed for primary analysis.
- Signals should also cover aspects of driving that are not in the scope of the original project (e.g. signals for all available ADAS, air condition, …).
- Video data is essential:
  - Video is necessary to develop and validate algorithms for new research questions.
  - Some research questions require (at least partly) video coding.

Challenges in using FOT / NDS data

Analysis of NDS / FOT data requires new approaches:

- Control of situational variance not through experimental design but through selection of relevant data sections.

- Algorithms need to be developed that divide the data into meaningful sections (e.g. driving maneuvers).

- Mostly, algorithms need to be adapted and validated for every vehicle type:
  - Systems and therefore signals differ between vehicle types.
  - Sensors differ between vehicle types. Signals and signal errors differ.

For most research questions, we use a combined analysis of continuous driving data and video data.

Thank you!

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