Remote operation of heavy vehicles

– the need for a socio-technical systems approach

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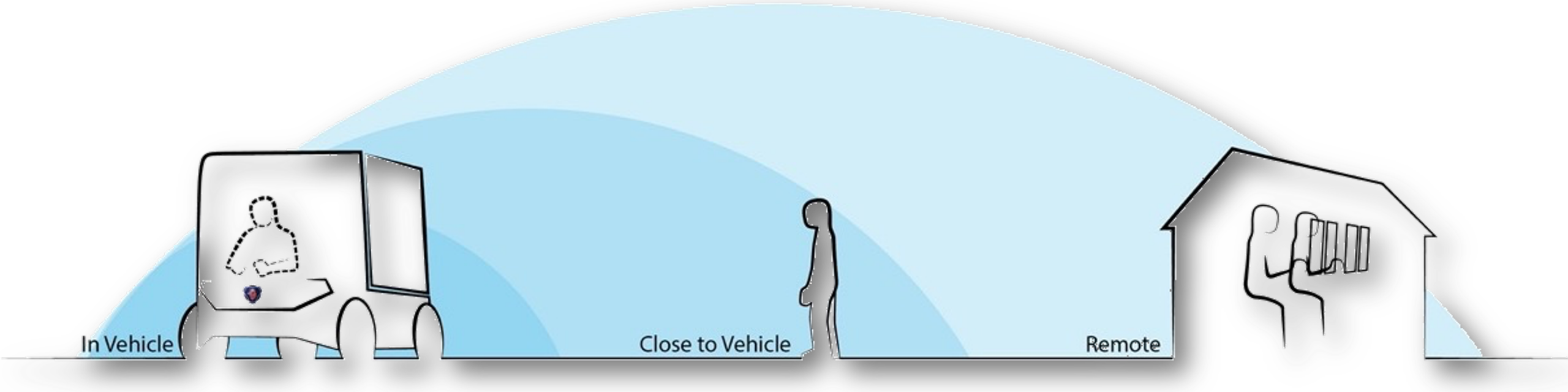
Who is a remote operator, or remote driver?

A driver who is not seated in a position to manually exercise in-vehicle braking, accelerating, steering, and transmission gear selection input devices (if any) but is able to operate the vehicle.

– SAE Recommended Practice J3016



A remote driver may include a user who is within the vehicle, within line-of-sight of the vehicle, or beyond line-of-sight of the vehicle.
– SAE Recommended Practice J3016

Strategical

Enables the remote operator to plan trips by feeding destination goals to the vehicle.

Tactical

Enables the remote operator to help the vehicle understand and handle a given situation, as well as to provide it with guidance on how to proceed.

Operational

Enables the remote operator to actively "drive" the vehicle (e.g., when the vehicle is stuck in a complex situation).

Habibovic, A., Andersson, J., Castor, M., Meiby, L. and Rizgary, D. **Final report on Human factors related to remote control of automated heavy vehicles.** SAFER, 2020. Link

Multiple roles and multiple vehicles

Link

HAVOC

Heavy Automated Vehicle Operator Center - Requirements and HMI

Link

Autonomous
Self-driving
Självkörande
iYaz'hambela
自動駕駛
स्व ड्राइवगि

DELIVERY
POD >>>

GLAD | GOODS DELIVERY UNDER THE LAST-MILE WITH AUTONOMOUS DRIVING VEHICLES

Multiple roles and multiple vehicles

Link

HAVOC

Heavy Automated Vehicle Operator Center - Requirements and HMI

1. How should a remote operation center be designed to allow the operator to swap between different remote operating roles?
2. How should a remote operation center be designed to allow the remote operator to operate multiple vehicles?

Control: Examples of challenges

- What are the differences between operational, tactical and strategical control levels?
- What is the maximum number of vehicles that can be operated by one human operator simultaneously, and how do we account for context variability?
- What is the procedure and criteria for transitions between control levels?

ODD: Examples of challenges

- How do we define Operational Design Domains (ODDs) for remote operation?
- What are the methodologies and tools required for describing properties of and prerequisites for different ODDs?
- Which information and support functions does a remote operator need for a given ODD?

Organization: Examples of challenges

- Team work of remote operators, and collaboration with on-site personnel
- What education and certification is needed for remote operators?
- How will certification for remote operators work with regard to practical and regulatory aspects, especially with ADS that are updated remotely "overnight”?
- Human well-being - what are requirements for a remote operation room and working hours of remote operators?

Operator: Examples of challenges

- Are there effects of psychological detachment when the vehicle operator is not physically present in the vehicle, and how can this be accounted for?
- How should classical human-centric automation issues like trust, responsibility, automation surprises, boredom and vigilance be handled in this domain?

HMI: Examples of challenges

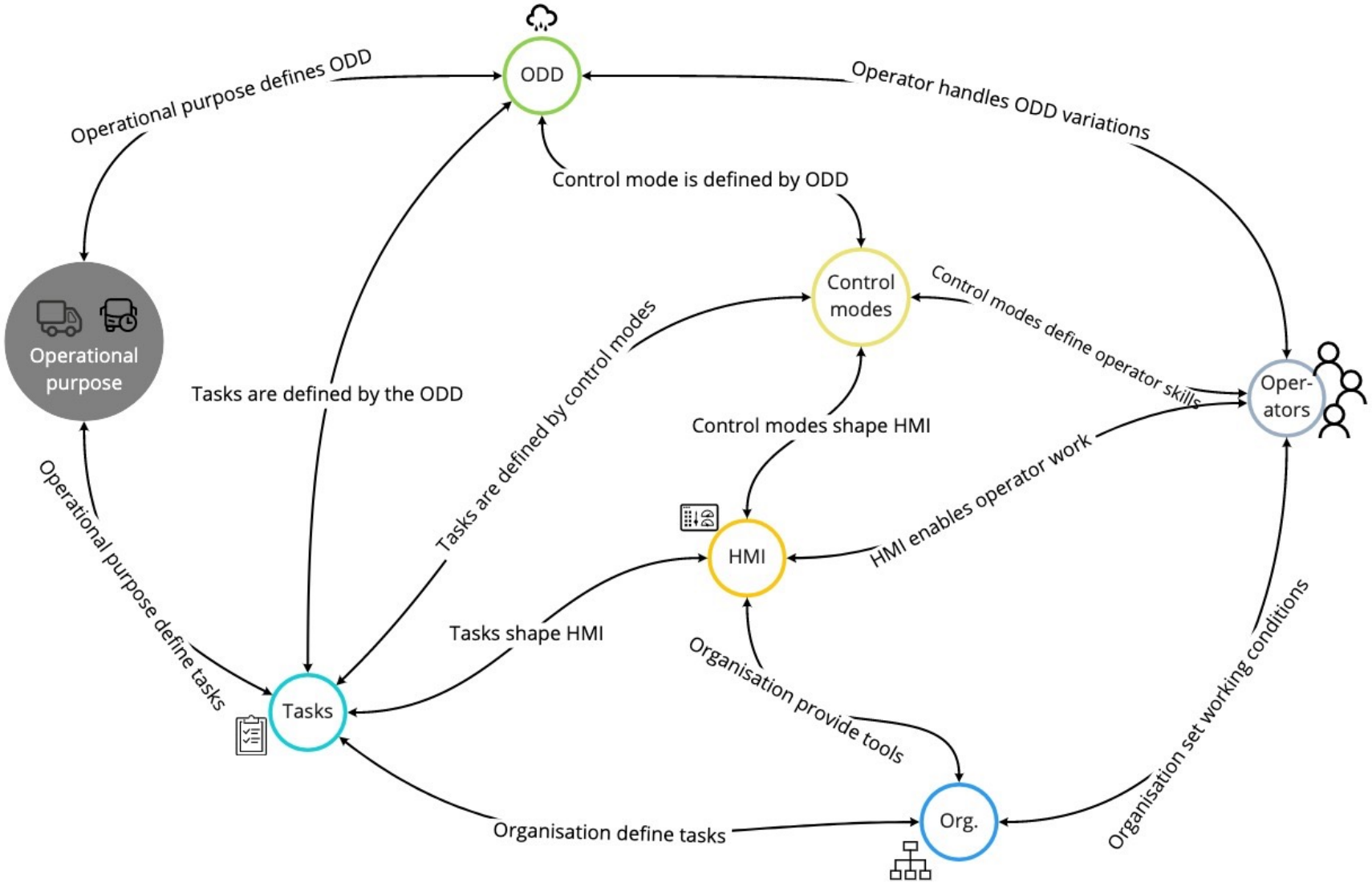
- How should a remote HMI be designed to accommodate transitions between control levels?
- Should remote operators be presented with raw or processed and fusioned sensor feeds (“driver” support)?
- How should a remote HMI be designed to reduce the latency effects, e.g., through predictive display elements?
- How should we design functionality and HMI that enable people physically present in a traffic situation to support a remote operator?

Tasks: Examples of challenges

- What are the tasks of remote operators for different ODDs? How much training is required for each task?
- What remote operation procedures need to be predefined, and to what extent?
- How to make a remote operator aware of ADS capabilities, especially when swapping between different vehicles?

Why do we need a socio-technical perspective?

The need of a socio-technical approach



- Habibovic, A., Andersson, J., Castor, M., Meiby, L. and Rizgary, D. **Final report on Human factors related to remote control of automated heavy vehicles.** SAFER, 2020. Link

- HF-IRADS. **Human Factors Challenges of Remote Support and Control A Position Paper from HF-IRADS**. Informal document GRVA-07-65 7th GRVA, 21-25 September 2020. Link

- **Question 1: What is the most important research question/challenge?**
  - Many questions… ☺
  - My argument here is not to forget the broader systems perspective and how to approach that complexity.

- **Question 2: What aspects should/can be internationally standardized?**
  - Methodologies for human factors related systems analysis could be recommended (and further developed), if not standardized