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Human Factors performance requirements

NL proposal for FRAV

Interaction is more than Interface

- FRAV will deliver requirements for the Human Machine System
  - Machine requirements (Proposal Germany, Japan, OICA)
  - Interaction requirements (OICA)
  - Human requirements (out of scope, but necessary, IGEAD/WP1)

- Human factors deals with the *understanding of interactions among humans and other elements of a system* to optimize system performance
- Human Factors Engineering requires a different perspective

	Traditional engineering	HF engineering
System design	Does it perform the function?	How can it be operated safely?
Sytem decomposition	Vehicle-system-subsystem	Goal- SubGoal-Task

HMI in FRAV

- FROM FRAV-02-06 Safety Elements in Policy documents (FRAV-01-13)

Human Machine Interface (HMI) /Operator information
Take-Over request (The vehicle should request the driver to hand over the driving tasks in case that the driver needs to regain a proper control of the vehicle.) System Status Malfunction Communication of Critical Messages Minimum Risk Manoeuvre in operation Automated mode active Driver availability and override possibility (if required, based on level of automation) (AV should include driver engagement monitoring in cases where drivers could be involved (e.g. take over requests) in the driving task to assess driver awareness and readiness to perform the full driving task) Signalling driving intentions to other road users (In addition, automated vehicle should allow interaction with other road users (e.g. by means of external HMI on operational status of the vehicle, etc.)

- FROM **ECE/TRANS/WP.29/2019/34/Rev.2**
  - Par 9.c HMI/Operator Information

- FROM FRAV-07-03 Review & Orientation

Slide 9

Agenda Item 4

Starting Points?

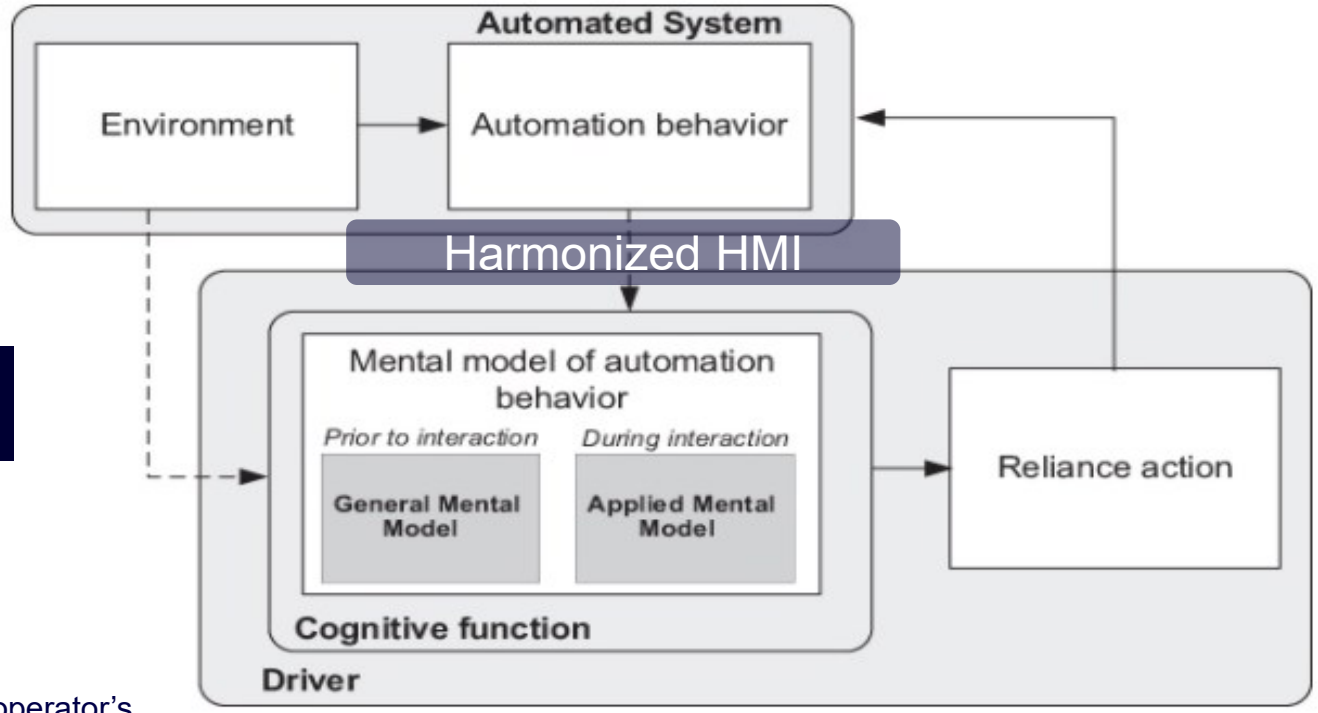
FRAV

1. ADS should drive safely. (Ensure safe behavior of the ADS as "the driver")
2. ADS should interact safely with the user. (Ensure safe use of ADS and safe interactions with the user such as transfers of control, user override, etc.)
3. ADS should manage safety-critical situations. (Differentiate between normal driving and emergency situations to ensure safe responses to the latter)
4. ADS should safely manage failure modes. (Ensure safe responses to system malfunction, physical damage, etc.)
5. ADS should maintain a safe operational state. (Ensure safety throughout the useful life of the ADS, such as safety critical updates, response to obsolescence)

Mental model and harmonized HMI

- One person → one mental model
- Different persons → different mental models
- Harmonized HMI
- Simple HMI
- Transparent information
- Useful driver training

More uniform mental model



- Accurate mental models are critical, because they influences the operator's expectations, attention, ability to make predictions, decisions and responses.
- Inaccurate mental models lead to operator misunderstandings, inappropriate use, and misuse

HMI requirements shall facilitate accurate mental models

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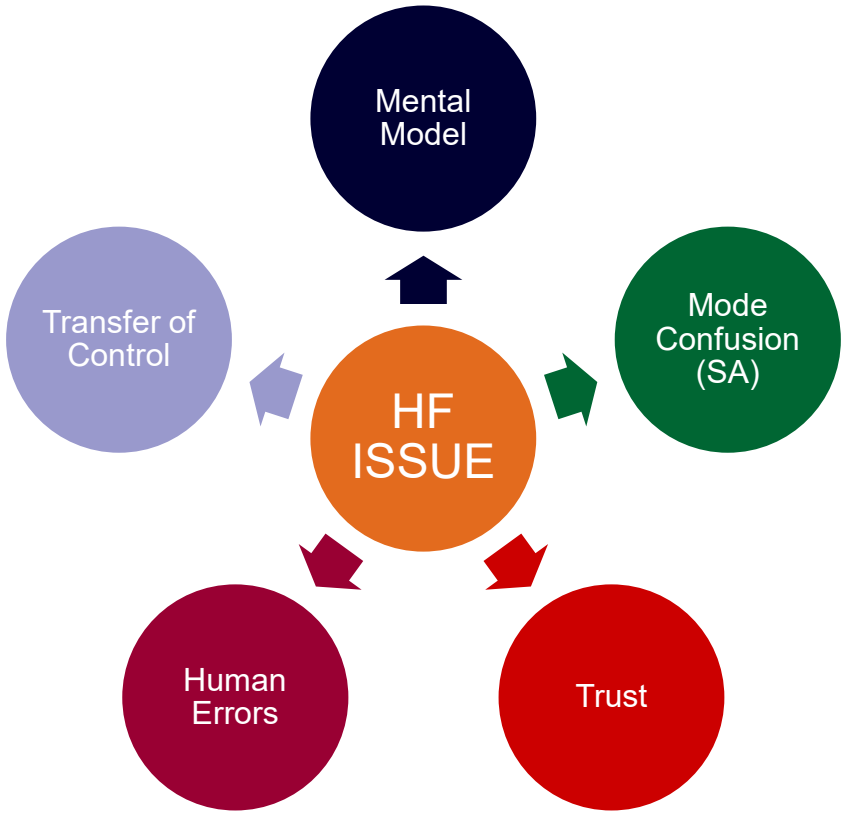
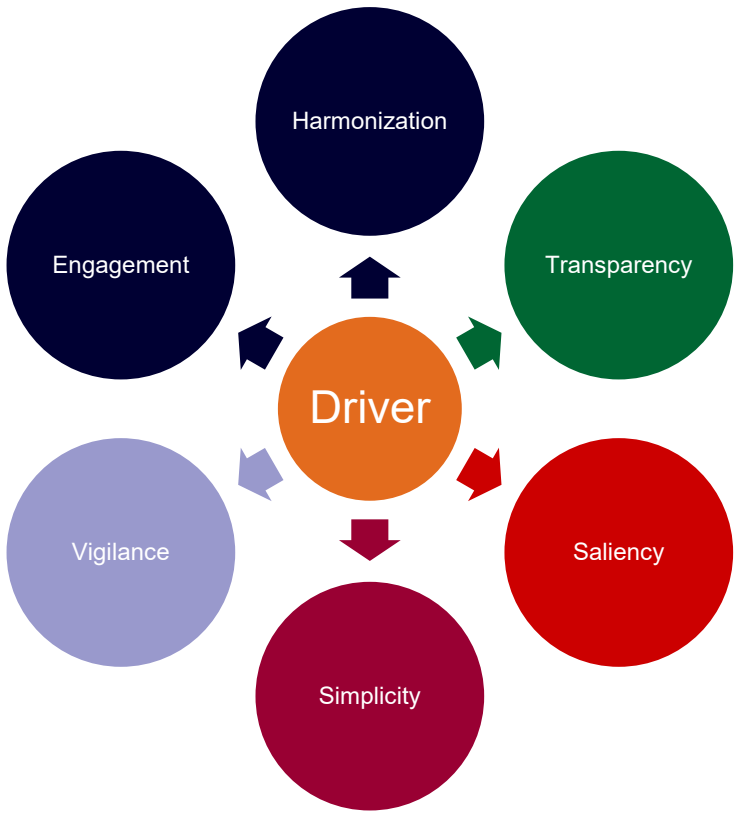
HF issues as principles to derive requirements

Understand the problem



Define the driver needs



DERIVE APPROPRIATE REQUIREMENTS

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Possibly bring this slide forward one step

EXAMPLE: From HF issue to HF requirements

MODE CONFUSION

- Mode confusion appears when the system does not behave according to the user's expectations.
- As consequence, the driver cannot understand the current automation mode or the automation status and system behavior.
- Mode confusion leads to safety critical issue(Mode errors)

HF EXPECTATION

Automation Harmonization
(common standard)

Automation Transparency
(clear, unambiguous and sufficient information)

Saliency of Information
(design according safety and urgency criteria)

Avoid Complexity
(Design simplicity)

Support for Vigilance
(Support driver attention limitations)

Engagement
(avoid out of the loop problems)

HF REQUIREMENT

Proposed performance requirements

- Design with mental model in mind
- Harmonized HMI for ADS
  - Transparent
  - Support (monitor) correct level of engagement
  - Simplicity
  - Salient
- Harmonized states for transition of control
  - Also for multiple features
- Driver engagement is gradual (not binary)
- Advice for harmonized driver training to WP1/IGEAD