Human Factors Principles to Guide the Design, Standards and Policies for Automated Driving Systems

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HF-IRADS

"*Human Factors in International Regulations for Automated Driving Systems*" (HF-IRADS) operates under the auspices of the International Ergonomics Association (IEA). It brings together human factors experts from across the world to support UNECE activities on the safety of automated driving systems.

Background

- HF-IRADS started work on this (for it core) topic in response to Informal No. 11 of September 2021 submitted by Canada (call for key principles for AV safety and human-centred needs)

- We hold that good design that delivers safe user interaction is an essential part of automated vehicle safety

- The Functional Requirements subgroup under GRVA has produced some valuable and relevant input:

    1. *"The ADS should interact safely with the ADS vehicle user(s)."*

    2. *"The ADS shall interact safely with other road users."*

Principles (1)

1. **Usable:** Interaction with the ADS should be simple, discoverable and easy to learn.

2. **Transferable:** Users should be able to adapt with ease when shifting from the operation of one vehicle to another. This implies some high level of *commonality* of interface and interaction processes across vehicle makes and models.

3. **Consistent:** In similar circumstances, a specific ADS should perform in a consistent manner both in interaction logic and in the vehicle driving behaviour.

4. **Supporting user role awareness:** Users should understand their roles and responsibilities. This implies that there should be a limited set of modes in a vehicle, i.e. a limited set of levels of automation and variety of automation functions within those levels, and that the immediate role of the user, and any upcoming user role, should be obvious.

5. **Foreseeability/predictability:** Users should be able to anticipate system behaviour. When an ADS is driving, there should be no expectation of immediate intervention by the user to react and respond in an emergency.

Principles (2)

6. **Accessible:** In so far as possible, ADS design should accommodate the full range of prospective users.

7. **Equitable:** One group of ADS users or non-users (e.g., other road users) should not be disadvantaged in favour of another group (e.g., safety of ADS users should not be prioritised over non-users) .

8. **Enhancing driving quality:** automation should strengthen the joint capability of user and vehicle to achieve a specific effect (e.g., increase of traffic safety). This implies that automation must perform driving tasks competently and coordinate its activity with the human driver.

9. **Safe interaction with other road users:** The ADS interaction with other road users should be consistent and predictable and should not require other road users to have any special consideration for ADS-driven vehicles.

10. **Accurate depiction of system capabilities:** There should be no misleading names for ADS functions and no exaggeration in the description of system capabilities or operation.

11. **Trust and acceptance:** Users should trust and accept ADS to a degree that is consistent with its capabilities and limitations, and systems should be designed so as to earn appropriate acceptance and trust.

How to achieve these principles

- The application of ***human-centred design*** at every stage of system development is vital.

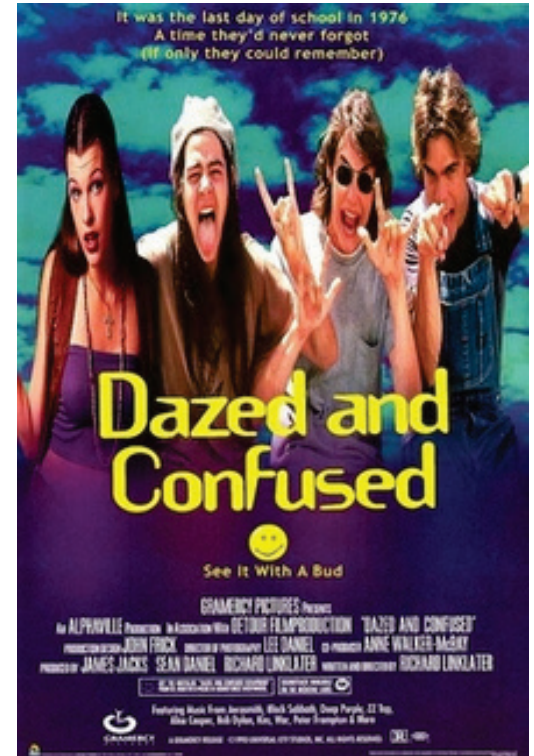- ISO 9241-210:2019 provides this definition:

"Human-centred design is an approach to interactive systems development that aims to make systems usable and useful by focusing on the users, their needs and requirements, and by applying human factors/ergonomics, and usability knowledge and techniques. This approach enhances effectiveness and efficiency, improves human well-being, user satisfaction, accessibility and sustainability; and counteracts possible adverse effects of use on human health, safety and performance."

Applying the principles to regulation

- Human factors considerations need to be embedded in the regulatory process wherever relevant

- It is vital to ensure that human factors are appropriately considered in vehicle design and approvals. Here the work of GRVA and its subgroups on Functional Requirements and Validation Methods is essential for ADS to achieve its potential to improve road safety

- On the user side, UNECE WP.1, has a similar duty to promote human factors considerations in the rules for ADS operation and use

Commonality in design of HMI

- This is currently not available for ADS. Such a commonality in design requires research and development to show what is the optimal level of commonality for ADS interaction and how that commonality can be realised

- It has to be noted that such an ADS interaction design also needs to encompass all the relevant interaction processes (including, if applicable, interaction with ADAS)

- Clearly, we need to apply user-centred design to the process of developing the common design

Thank you for your attention!

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