



Holistic Approach for
Driver Role Integration and
Automation Allocation for
European Mobility Needs

Human-Systems Integration
for Driving Automation Systems

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www.hadrianproject.eu/



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OVERVIEW

Give a general overview of current HSI discipline that is currently emerging

HSI challenges for automated driving

Introduction to the HADRIAN approach

In the remainder of this session and the next one, presenters will present different facets on this topic

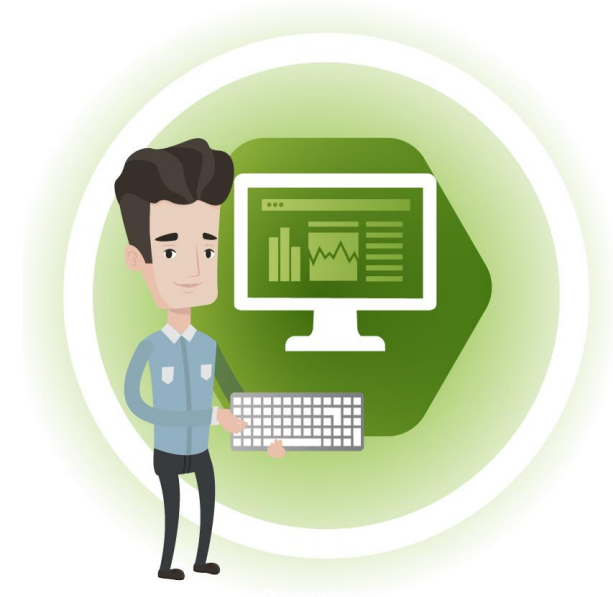
HUMAN SYSTEMS INTEGRATION

- ▶ Integrating humans and technical systems has a long tradition
 - **Human Factors Engineering (HFE): since World War II**



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 - Human Factors Engineering (HFE): since World War II
 - Human Computer Interaction (HCI): since 1980s
 - Human Centered Design (HCD): since 1990
 - **Human Systems Integration (HSI): since 2000's:**
 - INCOSE Working group to define HSI:
<https://www.incose.org/incose-member-resources/working-groups/analytic/human-systems-integration>
 - HSI is the transcultural and transdisciplinary technical and management process used **to ensure that the human elements of a system are appropriately addressed and integrated within the wider systems engineering lifecycle** and management approach to a project.



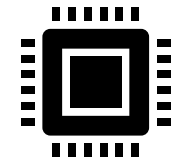
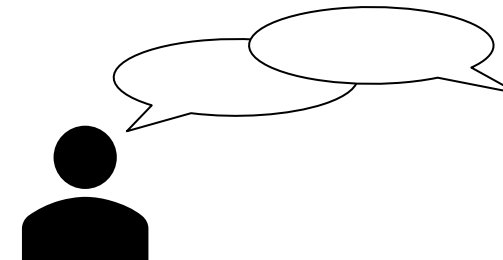
- ▶ **Monitoring automation**
 - Humans are good controllers but bad monitors, e.g. Endsley (2018)
- ▶ **Switching responsibilities**
 - Driver out-of-the loop problem, e.g. Hancock (2019)

Watching versus doing



- ▶ **Collaboration between human and automation**
 - Trust calibration, e.g. Hoff & Bashir (2015)
- ▶ **Understanding what is going on now**
 - Mode awareness, e.g. Abbott et al. (2013)
- ▶ **Understanding what will happen next**
 - Indicating intent, e.g. Merat et al. (2018)

Understanding Each Other



HADRIAN APPROACH FOR HSI IN AUTOMATED DRIVING

- ▶ Human needs as starting points for system development
- ▶ Holistic versus solipsistic system definition
- ▶ Iterative design and risk and opportunity management
- ▶ Naturalistic research with virtualization methods



PROJECT HADRIAN



► Response to call H2020-DT-ART-2018-2019-2020

- Human centred design for the new driver role in highly automated vehicles
- **Coordinator:** VIF
- **Duration:** 42 Months
- **Start:** Dec 2019
- **Funding:** 8 Mio EUR



National Technical University of Athens



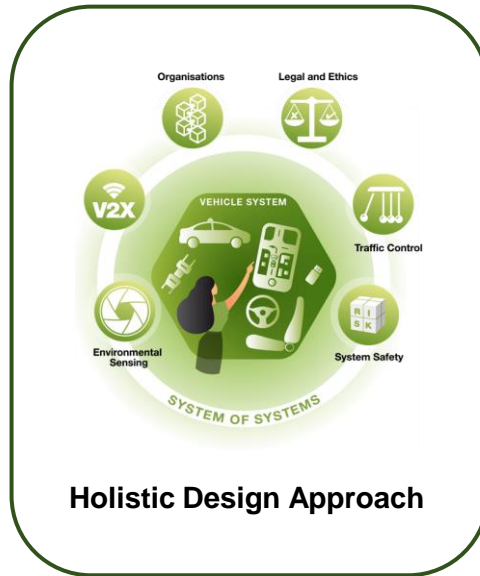
IESTA



UNIVERSIDAD DE GRANADA



MAIN HADRIAN INNOVATIONS



SAE INTERNATIONAL
SURFACE VEHICLE RECOMMENDED PRACTICE
J3016™
Issue 2014-01
Revised 2019-09
Superseding J3016 SEP2016
(R) Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles

Investigate Driver Role per SAE J3016 and possible Extensions

The document cover includes a table with the following information:

SAE INTERNATIONAL	J3016™	J3016R16
SURFACE VEHICLE RECOMMENDED PRACTICE	Issue 2014-01	
	Revised 2019-09	
	Superseding J3016 SEP2016	
(R) Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles		

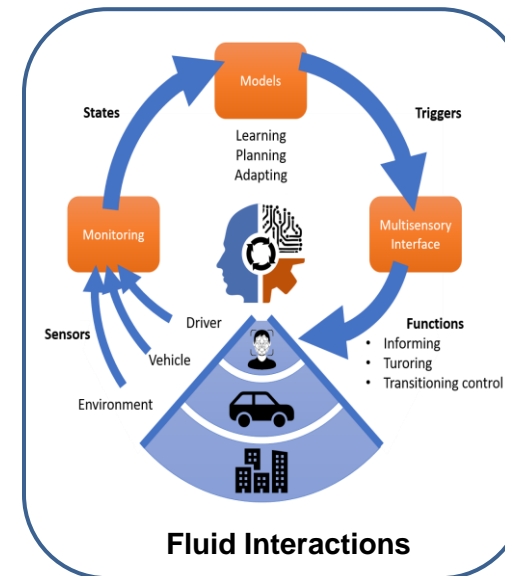
RATIONALE

The mission of Recommended Practice J3016 is to address frequently encountered concepts, but in the process, various functional definitions for related terms of driving automation and related terms and definitions. This Recommended Practice does not provide specifications, or otherwise impose requirements on, driving automation systems (for further information, see 1.1). Standardized language of driving automation and supporting terms across several disciplines, including:

- Clarifying the role of the (human) driver, if any, during driving automation system engagement.
- Answering questions of scope when it comes to developing laws, policies, regulations, and standards.
- Providing a useful framework for driving automation specifications and technical requirements.
- Providing clarity and stability to communications on the topic of driving automation, as well as a useful shorthand that serves communication time and effort.

This document has been developed according to the following guiding principles, namely, it should:

- Be descriptive and informative rather than normative.
- Provide functional definitions.
- Be consistent with current industry practice.
- Be consistent with prior art to the extent practicable.
- Be widely across disciplines, including engineering, law, media, public discussion.
- Be clear and succinct and, as such, it should avoid or define ambiguous terms.



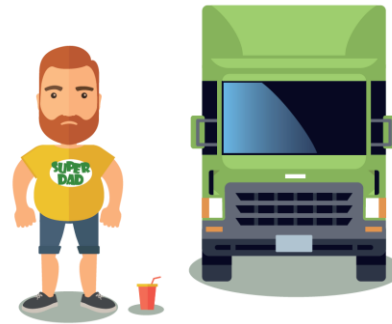
MOBILITY NEEDS AS START FOR CONCEPT DEVELOPMENT

- Mobility needs (e.g. Diehlmann & Häcker, 2013) as starting points for identifying how to integrate automated driving to improve people's lives



Harold

- Used to drive his whole life
- Recently received driver license restrictions
- Wants to stay mobile!



Sven

- Very good truck driver, hard to replace
- Stands under lots pressure while experiencing long stretches of monotonous driving
- Long times away from family



Florence

- Time pressure to run successful business
- Work during transport as productivity gain
- Public transport options limited and lack of confidentiality

HADRIAN INNOVATIONS FOR DRIVING AUTOMATION SYSTEM (DAS)



Harold

- Used to drive his whole life
- Recently received driver license restrictions
- Wants to stay mobile!

“DAS supports Harold so he can keep driving manually”

- Information assistant visually simplifies driving tasks so that driver can continue manual driving
- Guarding angel safety functionality
- Driver monitoring



Sven

- Very good truck driver, hard to replace
- Stands under lots pressure while experiencing long stretches of monotonous driving
- Long times away from family

“DAS to keep Sven connected, engaged, and optimize his time away”

- Active driving automation suggestion
- Predictable automated driving at level 3 and 3 + driving
- Driver monitoring and active, dynamic functionality offering



Florence

- Time pressure to run successful business
- Work during transport as productivity gain
- Public transport options limited and lack of confidentiality

“DAS tailored to predictably allow specific working tasks during automated driving”

- Plannable work through automated route selection
- Predictable automated level 3 and 3 + driving
- Driver monitoring and active, dynamic functionality offering

NEXT STEPS

Vorgangsname	2020		2021				2022				2023			
	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
Project HADRIAN	[Timeline bar from Q4 2020 to Q4 2023]													
▸ WP1 – Technical, human and environmental constraints for driver role characterization	[Timeline bar from Q4 2020 to Q1 2021]													
▸ WP2 – Development of Driver State Monitoring	[Timeline bar from Q4 2020 to Q1 2021]													
▸ WP3 – HMI Development and Evaluation	[Timeline bar from Q4 2020 to Q1 2021]													
▸ WP4 – Field Demonstration	[Timeline bar from Q4 2020 to Q3 2021]													
▸ WP5 – Safety and Impact Assessment	[Timeline bar from Q4 2020 to Q3 2021]													
▸ WP6 – Ethical and legal considerations	[Timeline bar from Q4 2020 to Q3 2021]													
▸ WP7 - Project Management & External Liaison	[Timeline bar from Q4 2020 to Q4 2023]													



Fit2Drive

- Detects hazardous driver states to anticipate unsafe acts

Head-Up Display

- Highlights critical information or provides explanatory information necessary for safety and comfort

Fluid Tutoring

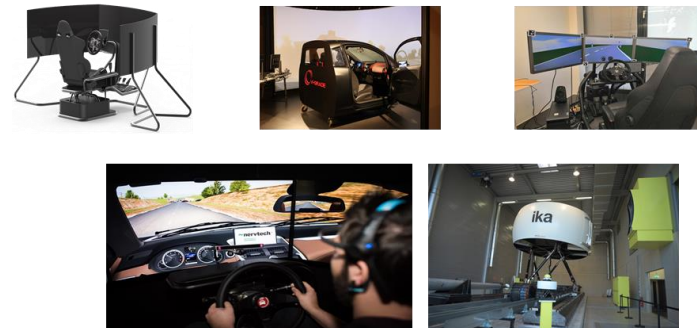
- Context sensitive, step-wise driver education

Haptic steering wheel

- allowing active and passive signaling to help transitions between manual and automated driving

Turning seat and HMI concept

- allowing the driver to quicker and safer return to manual driving after periods of high-level automated driving.



<https://hadrianproject.eu/>

REMAINDER OF THIS SESSION

The following presentations in this session provide background from several HADRIAN consortium partners

Age-related Differences in the Interaction with Advanced Driver Assistance Systems - A Field Study (VIF): Neuhuber, Lechner, Emre, Stocker, Kubicek

A fluid-HMI approach for Haptic Steering Shared Control for the HADRIAN Project (Tecnalia): Vaca-Recalde, Marcano, Sarabia, González, Perez Diaz

Fluid Interface Concept for Automated Driving (ViF): Pretto, Mörtl, Neuhuber

Evaluating HMI-Development Approaches from an Automotive Perspective (IKA): Bavendiek, Ostad, Eckstein

Two more HADRIAN partners will present in HSI session 2 just after this one (plus other presenters):

Toward Driver State Models that Explain Interindividual Variability of Distraction for Adaptive Automation (ViF): Höfler, Mörtl

Hand-Skin Temperature Response to Driving Fatigue: an Exploratory Study (University of Granada): Gianfranchi, Di Stasi, Diaz-Pedra

Peter Mörtl – Virtual Vehicle Research Center

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REFERENCES

- ▶ Abbott, K., McKenney, D., & Railsback, P. (2013). *Operational Use of Flight Path Management Systems*. https://www.faa.gov/aircraft/air_cert/design_approvals/human_factors/media/OUFPMS_Report.pdf
- ▶ Diehlmann J. and Häcker J. (2013), *Automotive management*, 2. ed. München: Oldenbourg.
- ▶ Endsley, M. R. (2019). Situation Awareness in Future Autonomous Vehicles: Beware of the Unexpected. In S. Bagnara, R. Tartaglia, S. Albolino, T. Alexander, & Y. Fujita (Eds.), *Proceedings of the 20th Congress of the International Ergonomics Association (IEA 2018)* (Vol. 824, pp. 303–309). Springer International Publishing. https://doi.org/10.1007/978-3-319-96071-5_32
- ▶ Hancock, P. A. (2019). Some pitfalls in the promises of automated and autonomous vehicles. *Ergonomics*, 1–17. <https://doi.org/10.1080/00140139.2018.1498136>.
- ▶ Hoff, K. A., & Bashir, M. (2015). Trust in automation integrating empirical evidence on factors that influence trust. *Human Factors: The Journal of the Human Factors and Ergonomics Society*, 57(3), 407–434.
- ▶ Merat, N., Louw, T., Madigan, R., Wilbrink, M., & Schieben, A. (2018). What externally presented information do VRUs require when interacting with fully Automated Road Transport Systems in shared space? *Accident Analysis & Prevention*, 118, 244–252. <https://doi.org/10.1016/j.aap.2018.03.018>