Human Factors

“What have we found? What’s the next?”

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SIP

Cabinet Office

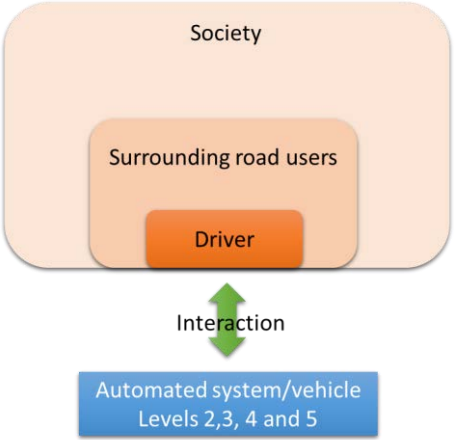
What have we found?

SIP-adus Human Factors Research Project

FY2016-FY2018

Extraction of Potential Human Factor problems

Interactions and related issues			Level 1	Level 2	Level 3	Level 4	Level 5
Vehicle - Driver	System use						
	A-1	Understanding system functions	How to avoid over trust, over reliance, misunderstanding of functional limitations?				
	A-2	Understanding system states	How to avoid misunderstandings of system's current state and future actions.				
	A-3	Understanding system operations	How to improve usability of complicated HMI (switches)?				
	A-4	Understanding system behavior	How to avoid worries and discomfort for system's driving manner differing from individual driver's manner?				
	Driver's state						
	B-1	Driver state with automation		How to maintain required driver's state with automation?			
	B-2	Transition from automation to fully manual		How to avoid degraded response action of the driver unready to take over the vehicle control?			
	B-3	User benefits of automation		How to overcome the negative benefit of fight against drowsiness /boredom?	How to overcome the negative benefit of interruption of non-driving related activities?	How to compensate for the decreased value of homogenized brands and car performance?	
Vehicle - Surrounding road users	C-1	Communication between the automated vehicles and surrounding drivers		How to enable automated vehicles to communicate with surrounding drivers in intersections, merging, lane change and others?			
	C-2	Communication between the automated vehicle and surrounding vulnerable road users		How to enable automated vehicles to communicate with presdtrians standing by a cross-walk, pedestrians in parking, in shared space and in other situations?			
	C-3	Mediation between formal rules and traffic efficiency			How to mediate conflicts between yielding and priority, traffic speed and speed limit regulation, and others?		
Vehicle - Society	D-1	Social value and acceptance of the automated vehicles		How to design functional deployment over time to raise social acceptance?			
	D-2	Liability		How to define liability for crashes considering limitation of human ability?			
	D-3	Licensing		Does licensing need to be modified?			



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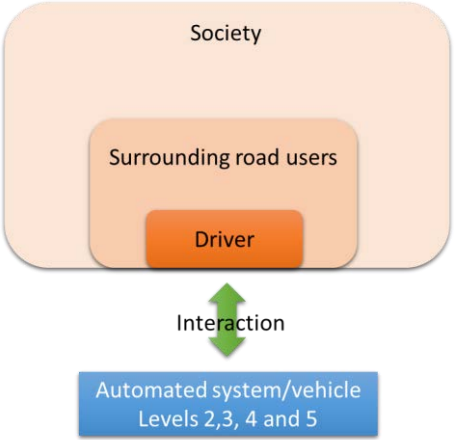
Task A

Task B

Task C

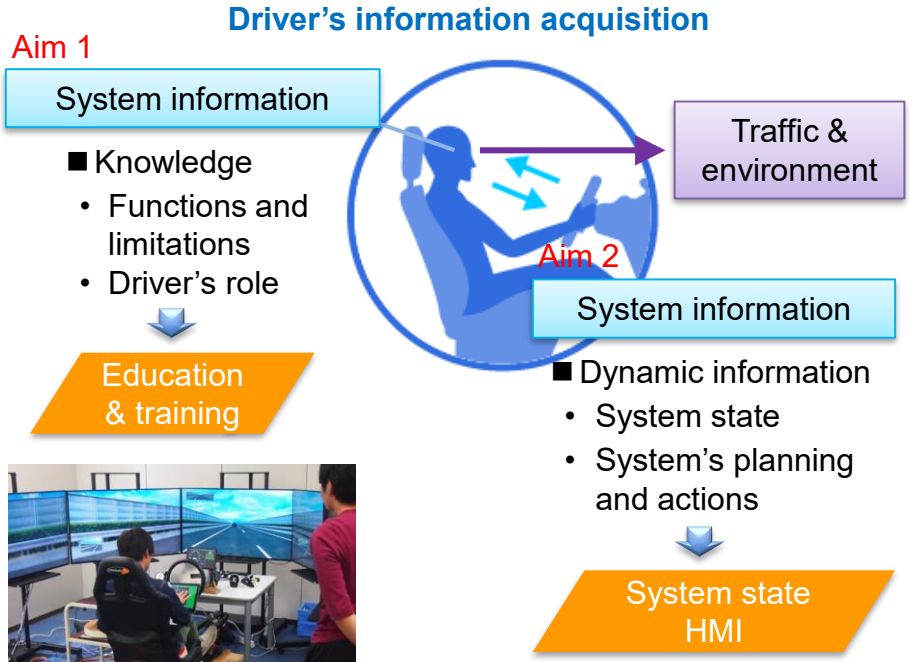


Summary of on-going SIP-adus HF research project

Task A investigates effects of system information (knowledge and dynamic state) on drivers' takeover performance for Levels 2 &3 (conducted at U of Tsukuba).

Findings

- **Aim 1: Knowledge**
  - Knowledge required for successful takeover was clarified.
  - Experiencing takeover situations improved performance of successive takeovers.
- **Aim 2: Dynamic information**
  - Some information of dynamic state of the system was found to be effective to improve takeover performance.
  - Fundamental requirements for HMIs to display the dynamic information of the system were clarified.

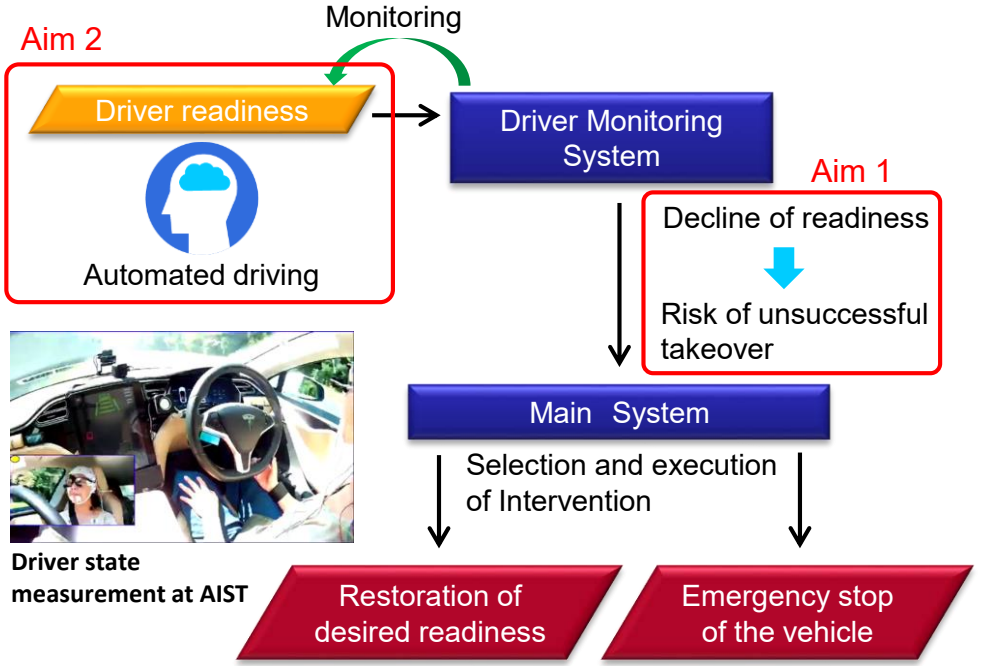


Summary of on-going SIP-adus HF research project

Task B investigates effects of driver state (readiness) on his/her takeover performance for Levels 2 & 3 and extracts metrics of readiness for driver monitoring (conducted at AIST).

Findings

- **Aim 1: Effects of driver state on takeover performance**
  - Low arousal, cognitively loaded and visually loaded state of the driver degraded driver's takeover performance in different ways.
- **Aim 2: Metrics of readiness**
  - Frequency of saccadic movements of the eyes, blinking frequency, percent time of forward looking, and Perclos were extracted as metrics of readiness for driver monitoring.



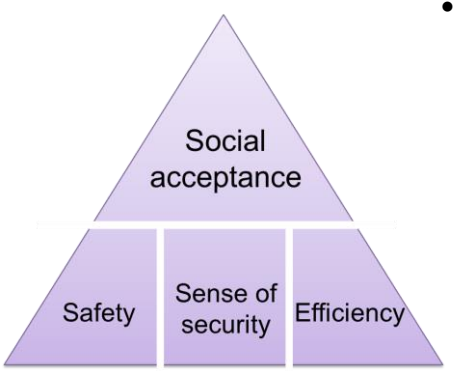
Summary of on-going SIP-adus HF research project

Task C investigates effective ways to functionalize the automated vehicle to communicate surrounding road users for Levels 2 & above (conducted at Keio U).

Findings

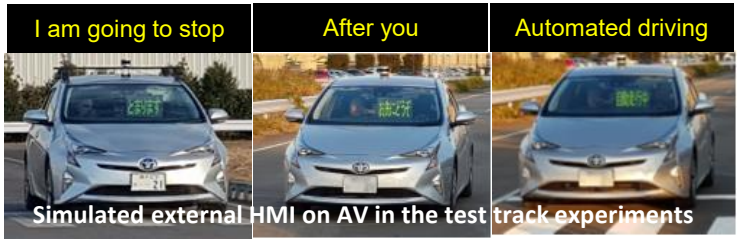
■ Aim 1: Current on-road communication

- Vehicle behavior was found to be the primary communication cue when yielding to other road users; the most frequent case.
- Benefits of on-road communication was defined as safety, sense of security, efficiency and social acceptance.



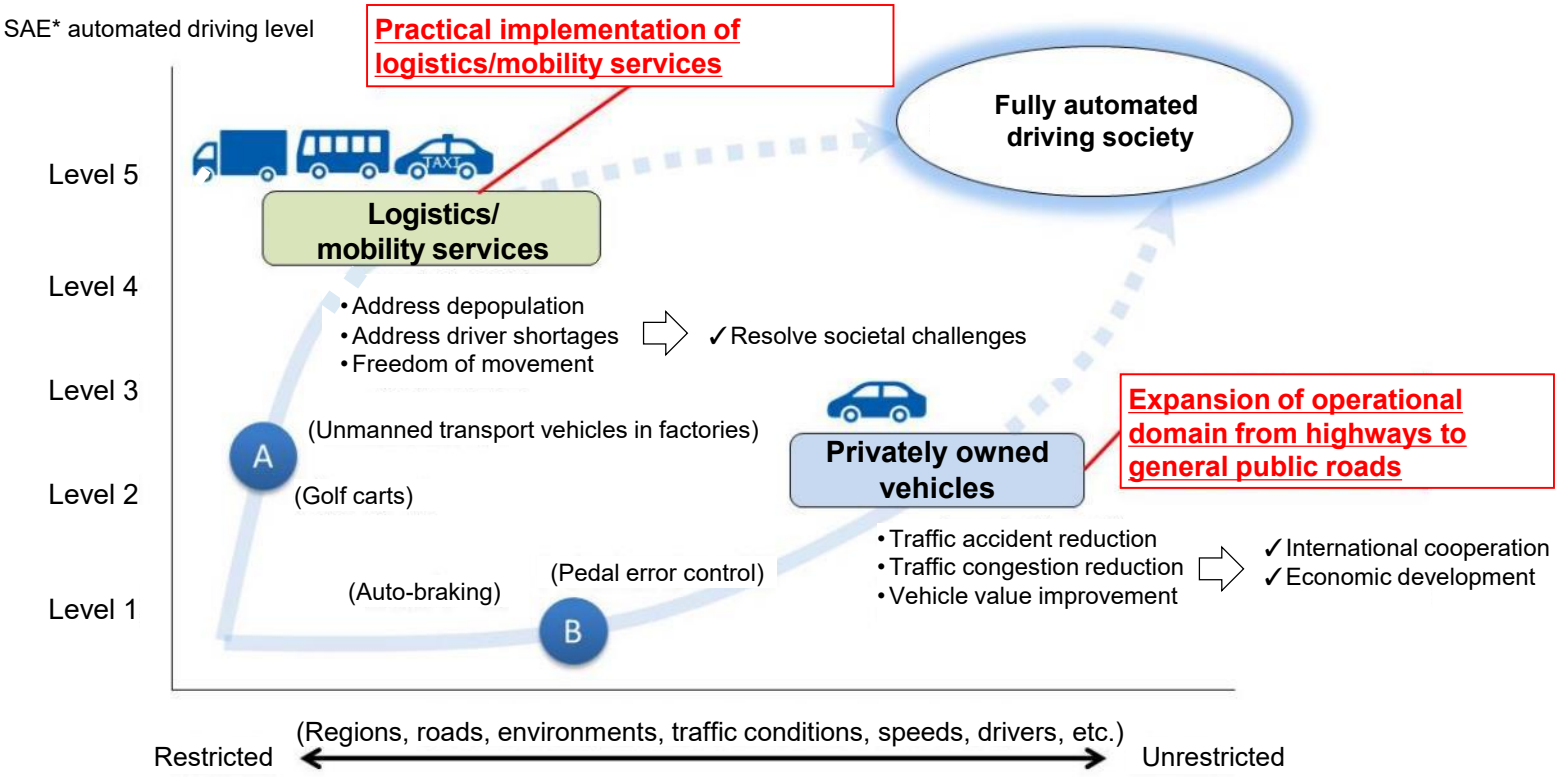
■ Aim 2: Considerations/recommendations for external communication of AV

- External HMI was found to be an additional cue and effective when deceleration was small.
- On-road communication was influenced by attributes of road users and social norms. Universal design and standardization of external HMI need to be considered.
- It was observed that some external HMI also induced unsafe behavior of some pedestrians. (further investigation is on-going).



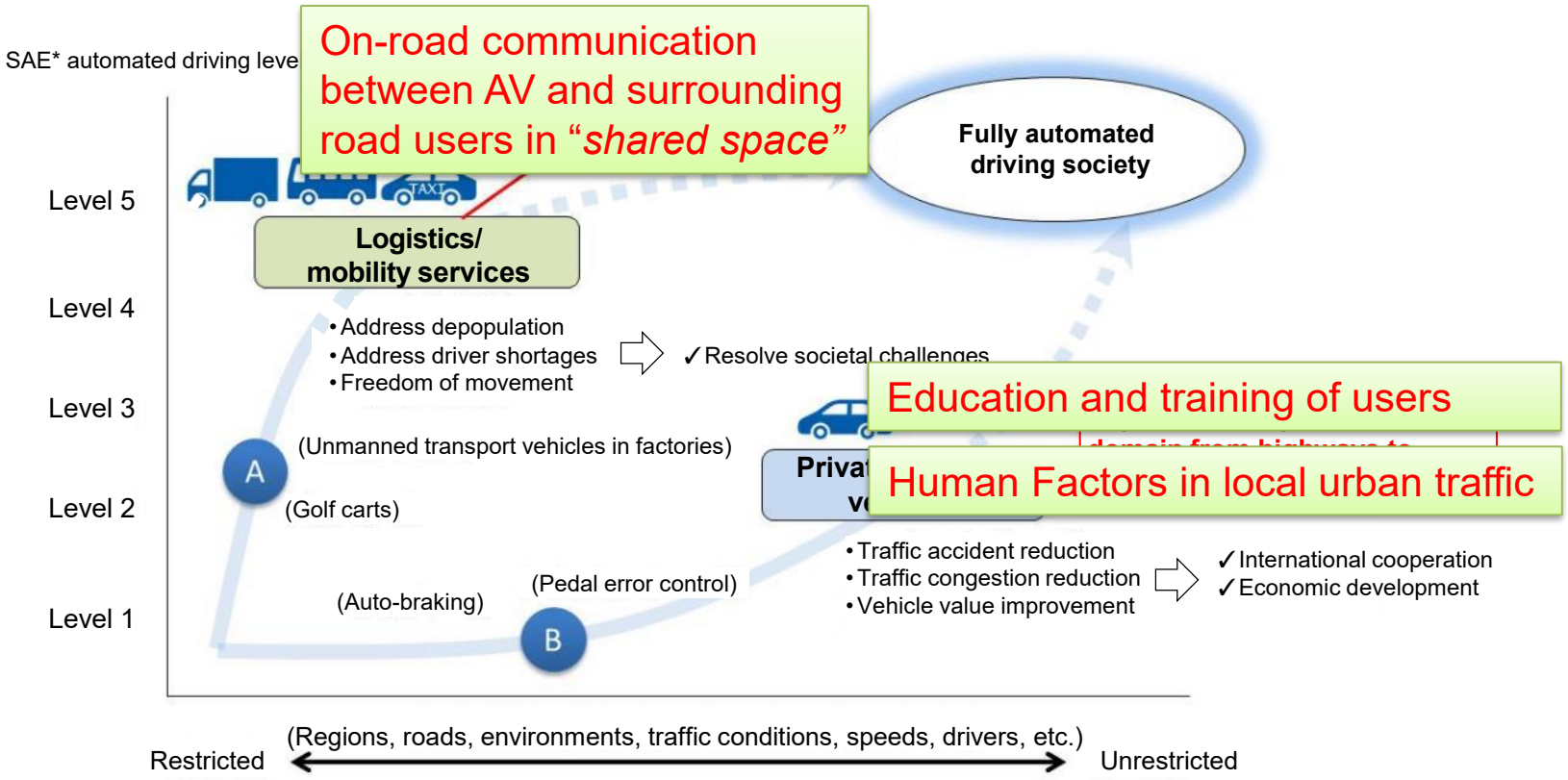
What’s the next?

SIP Phase II Roadmap



*SAE (Society of Automotive Engineers): Standardization body in the U.S.

Challenges on the SIP Phase II Roadmap



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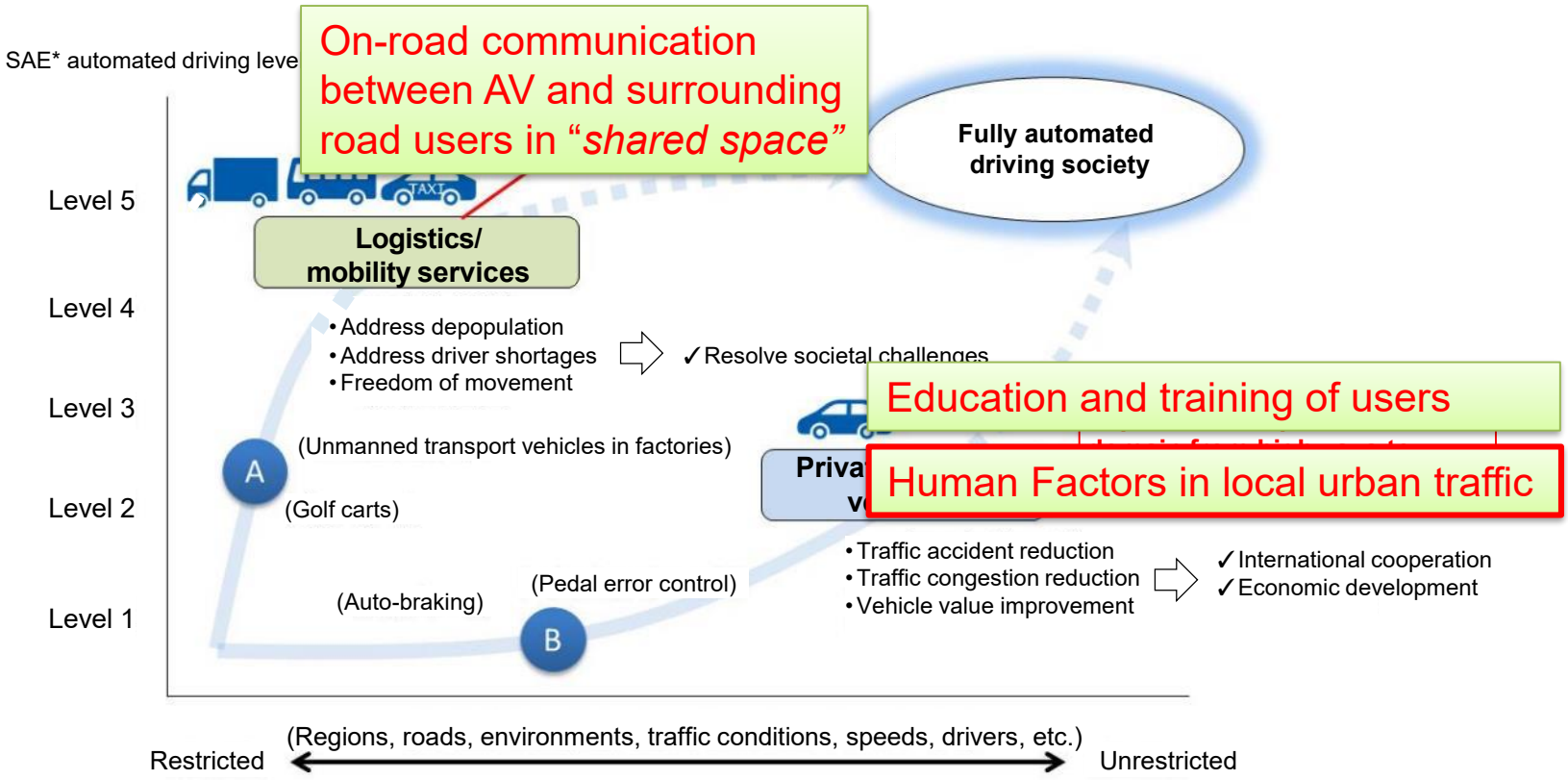

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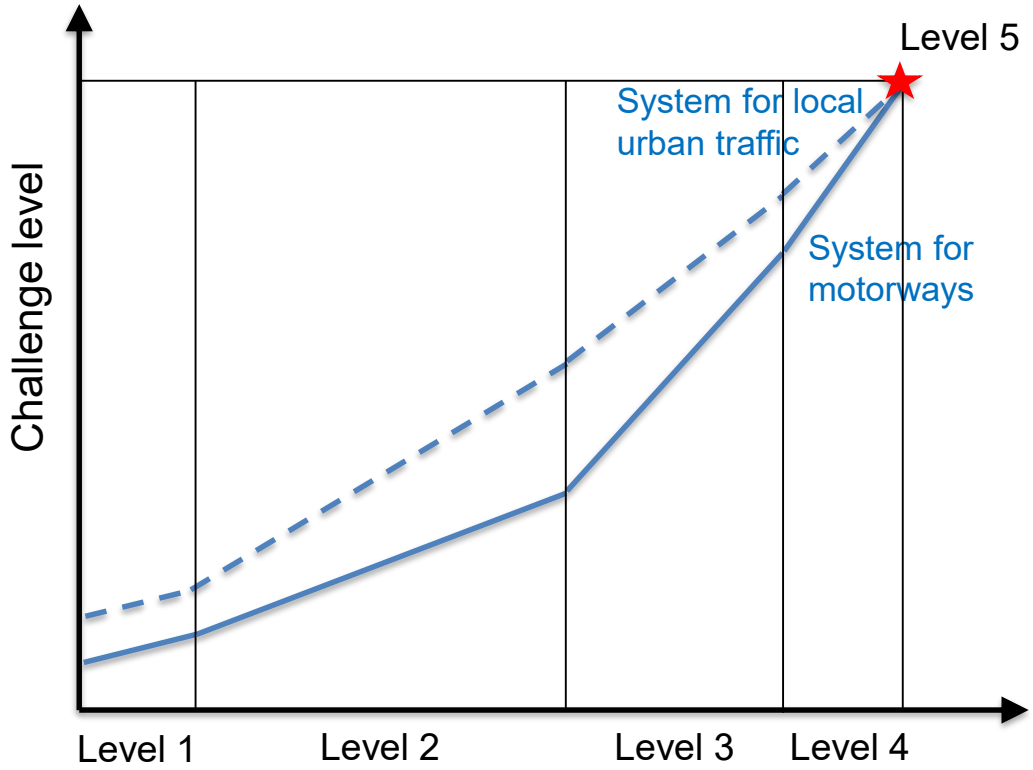
Challenges in System and Human Factors towards Level 5

Challenges in System development will increase towards Level 5 with more challenges for expanding ODD to local urban traffic.



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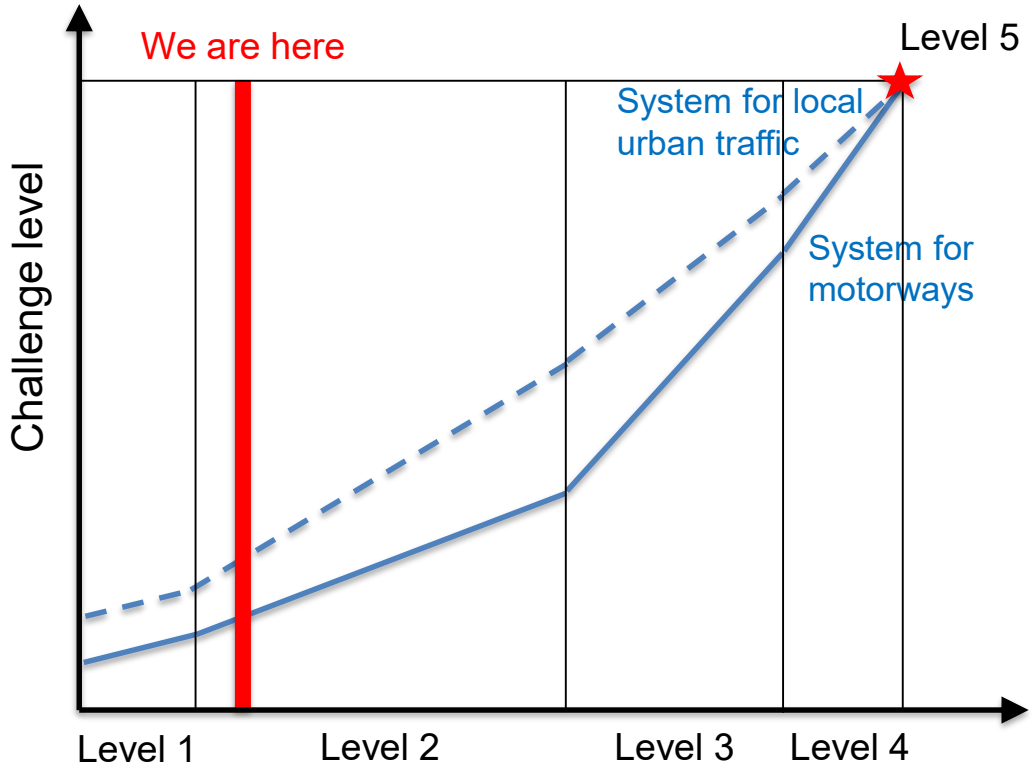
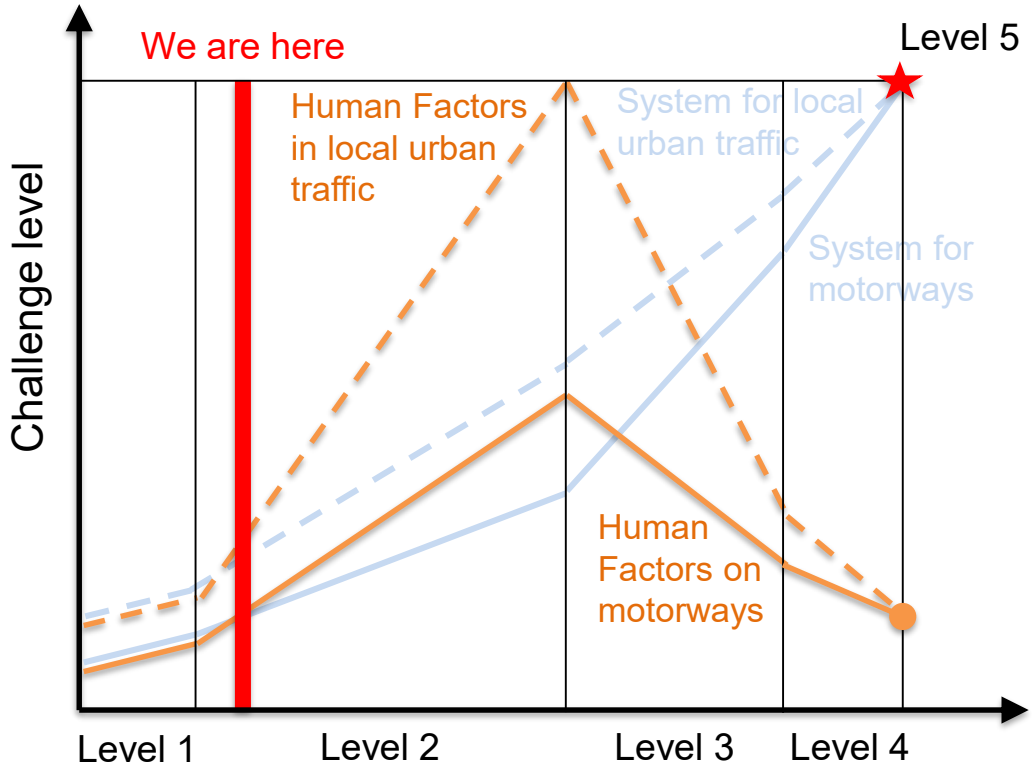


Challenges in System and Human Factors towards Level 5

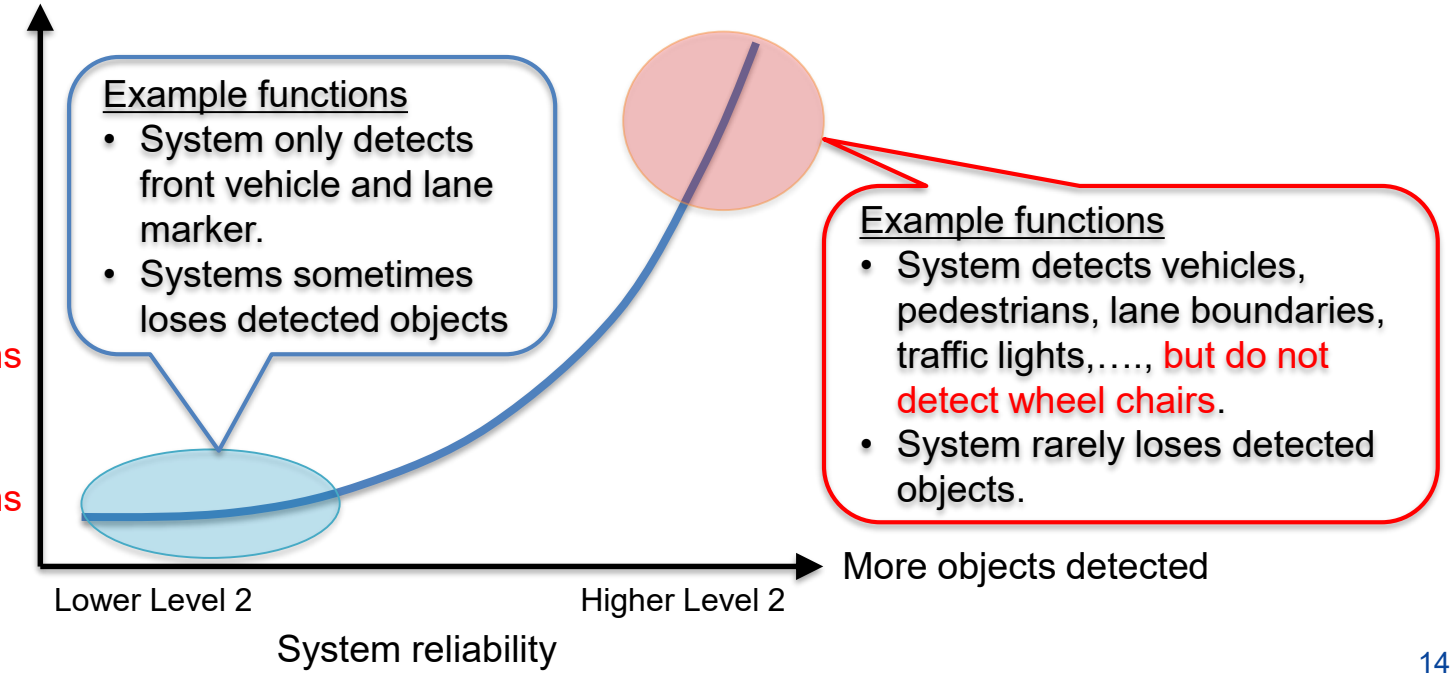
Challenges in human factors may be the largest with higher Level 2 especially for expanding ODD to local urban traffic.



OEDR in local urban traffic with Level 2 systems

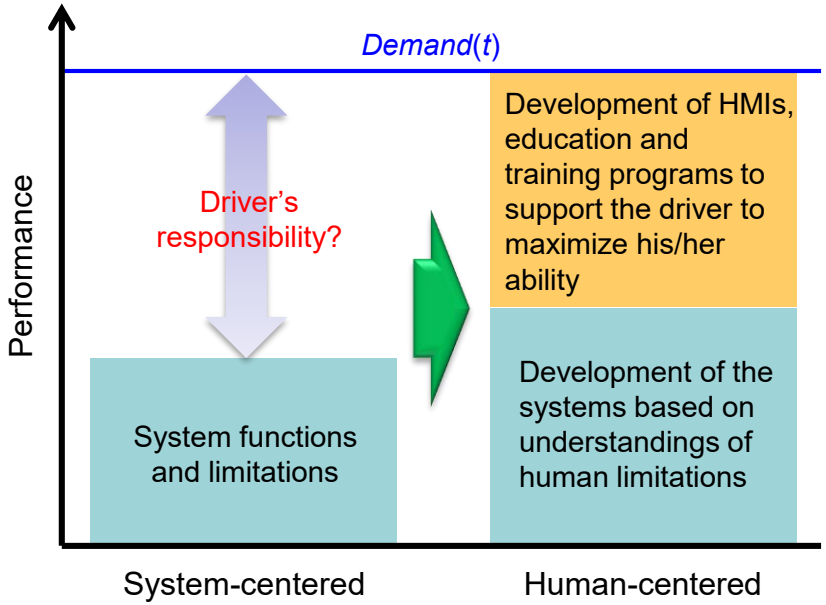
- How can human work with the system for OEDR?
- How HMIs, education and training can help the driver to understand system limitations and compensate for them?

- **Trust**
- Difficulty to generate an appropriate mental model
- Difficulty to understand system limitations
- Difficulty to respond for system limitations



Human-centered Strategy

- To understand human limitations in use of the systems and clarify requirements to the system based on the human limitations.
- To develop HMIs to support the driver to maximize his/her abilities.
- To consider education and training of users as well.




SIP-adus
Workshop
2018
Thank you
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