



# Code of Practice

**EUCAR Annual Conference 2018**

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**Robert Martinez v. Bülow, BMW Group**

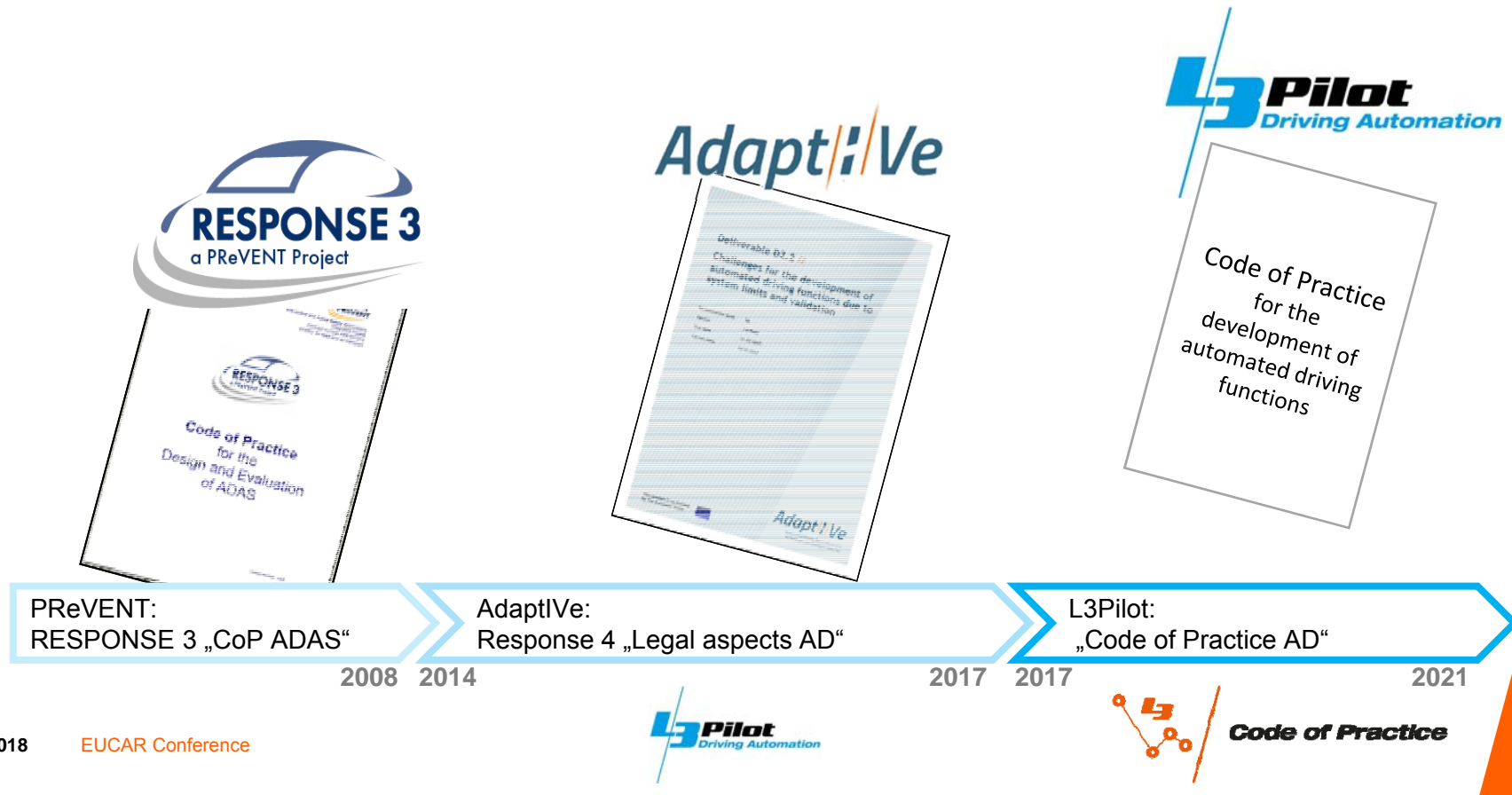


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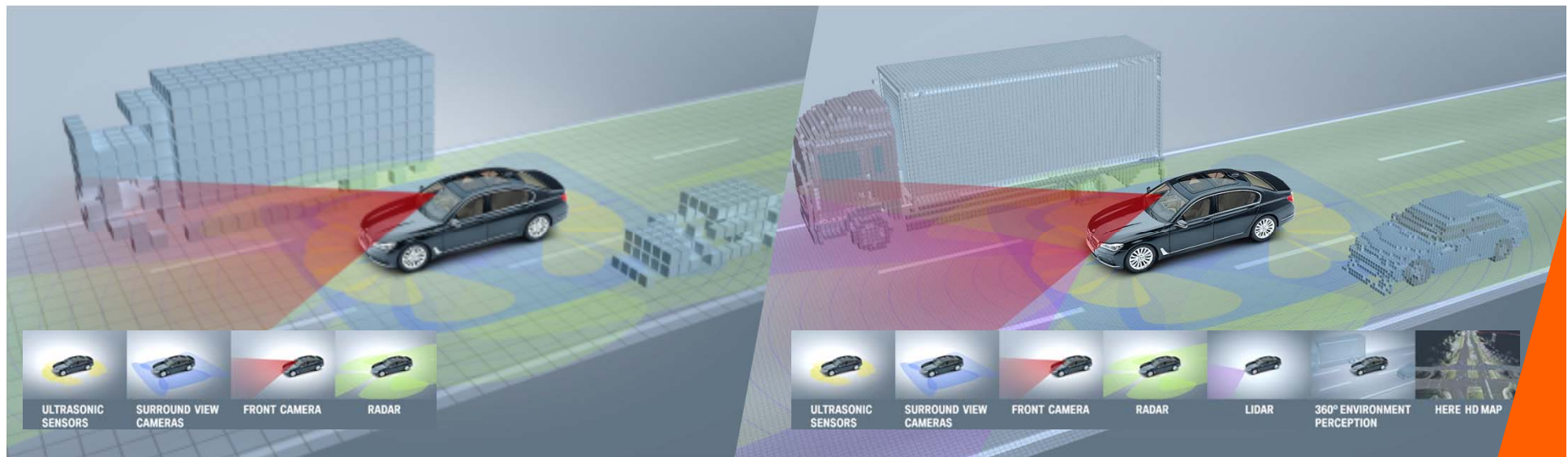
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# History of the Code of Practice (CoP).



## Why do we need a Code of Practice for automated driving?

- The transition from low level automation (ADAS) to high level automated driving requires significant technical developments involving new technologies.



## Why do we need a Code of Practice for automated driving?

- New challenges in development need to be addressed in order to ensure safest possible product for the users:



## What is our goal?

Provide a comprehensive guideline with best practices for the development of AD functions:

### Code of Practice for automated driving.

- Collect best practices on relevant topics.
- Describe a typical development process for an automated driving function.
- Include hands-on checklists for developers.

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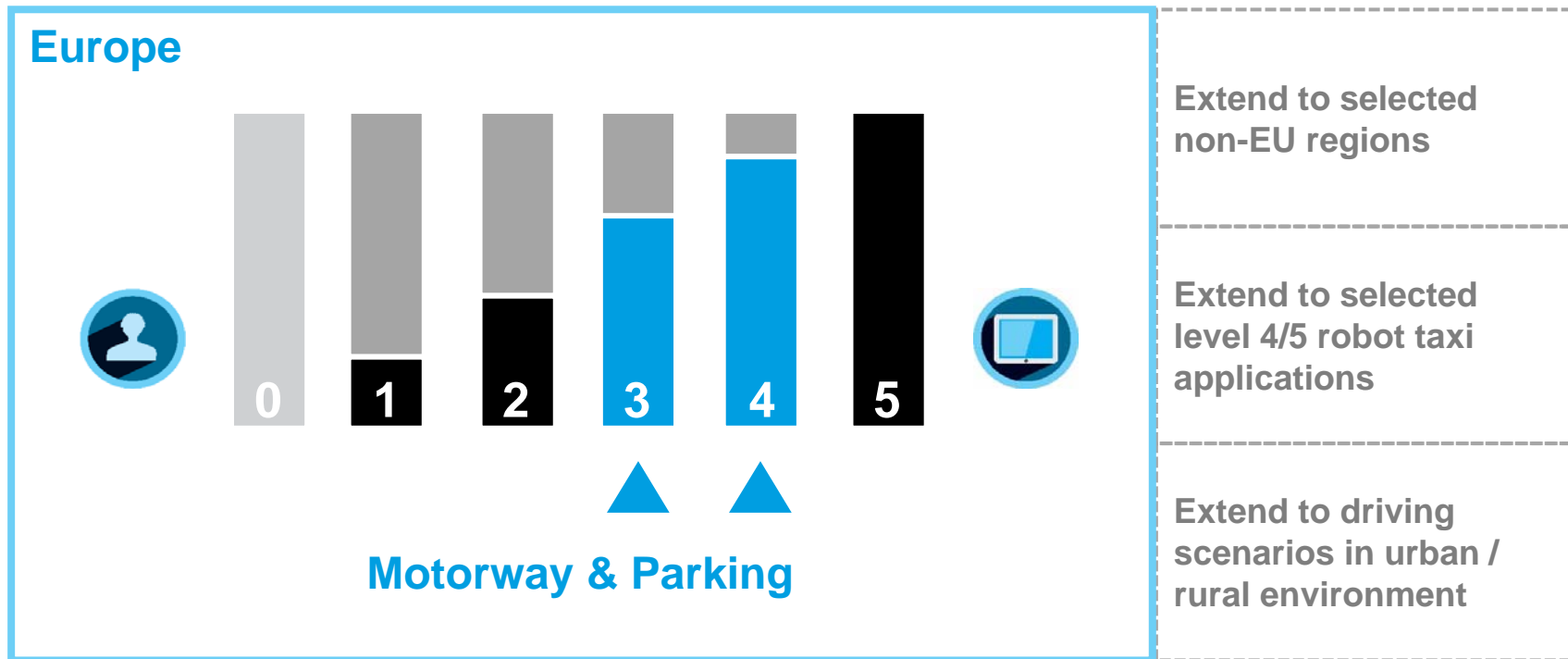
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**Code of Practice**






# Scope of the Code of Practice for Automated Driving.

According to SAE document J3016, "Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles", revised 2016-09-30, see also [http://standards.sae.org/j3016\\_201609](http://standards.sae.org/j3016_201609)



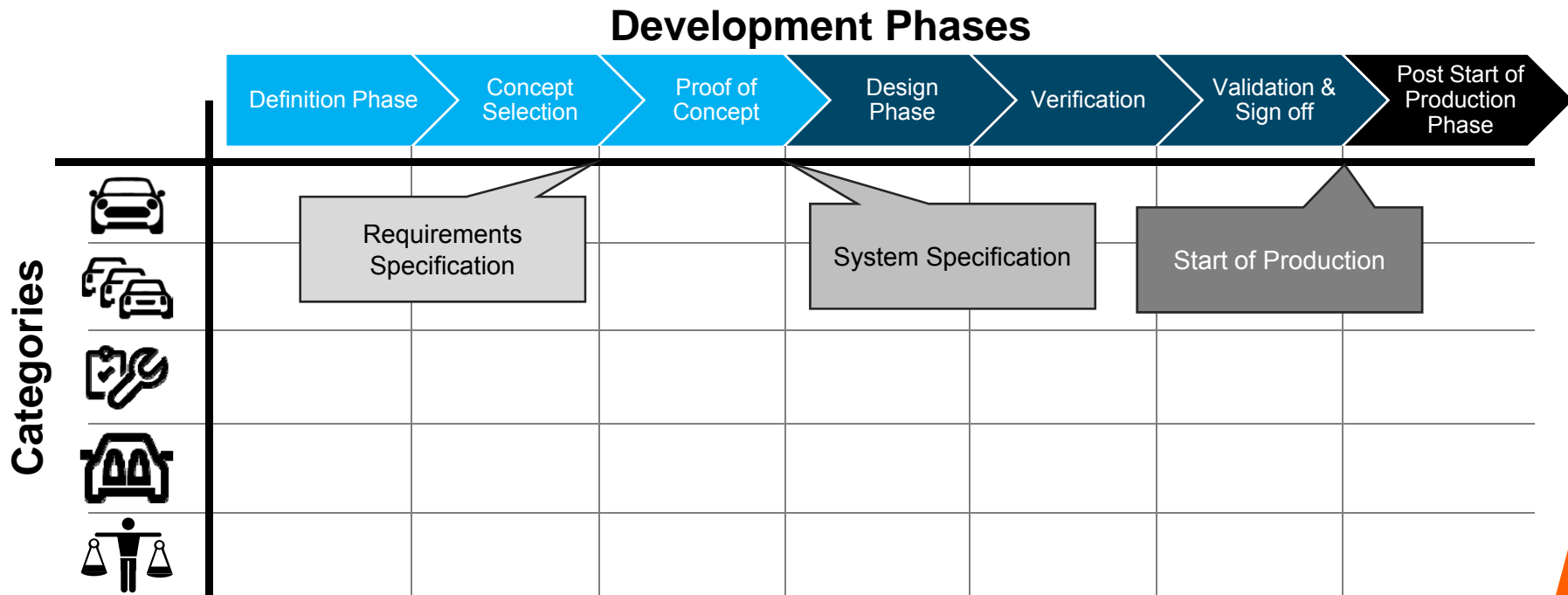
## Categories of the CoP.

- Categories of the CoP according to D2.1 „Code of Practice Framework“<sup>1</sup>:

<p><b>Operational Design Domain Vehicle Level</b></p>  <p>Function description, system limits, test-/scenario catalogue</p>	<p><b>Operational Design Domain Traffic System Level</b></p>  <p>Remote assistance, V2X, MRM etc.</p>	<p><b>Safe Guarding Automation</b></p>  <p>Functional safety, cyber security, SOTIF, updates (e.g. over the air) etc.</p>	<p><b>Human-Machine Interaction</b></p>  <p>Provide guidelines for HMI, mode awareness/confusion, controllability etc.</p>	<p><b>Behavioral Design</b></p>  <p>Traffic safety (mixed traffic), references to Ethics</p>
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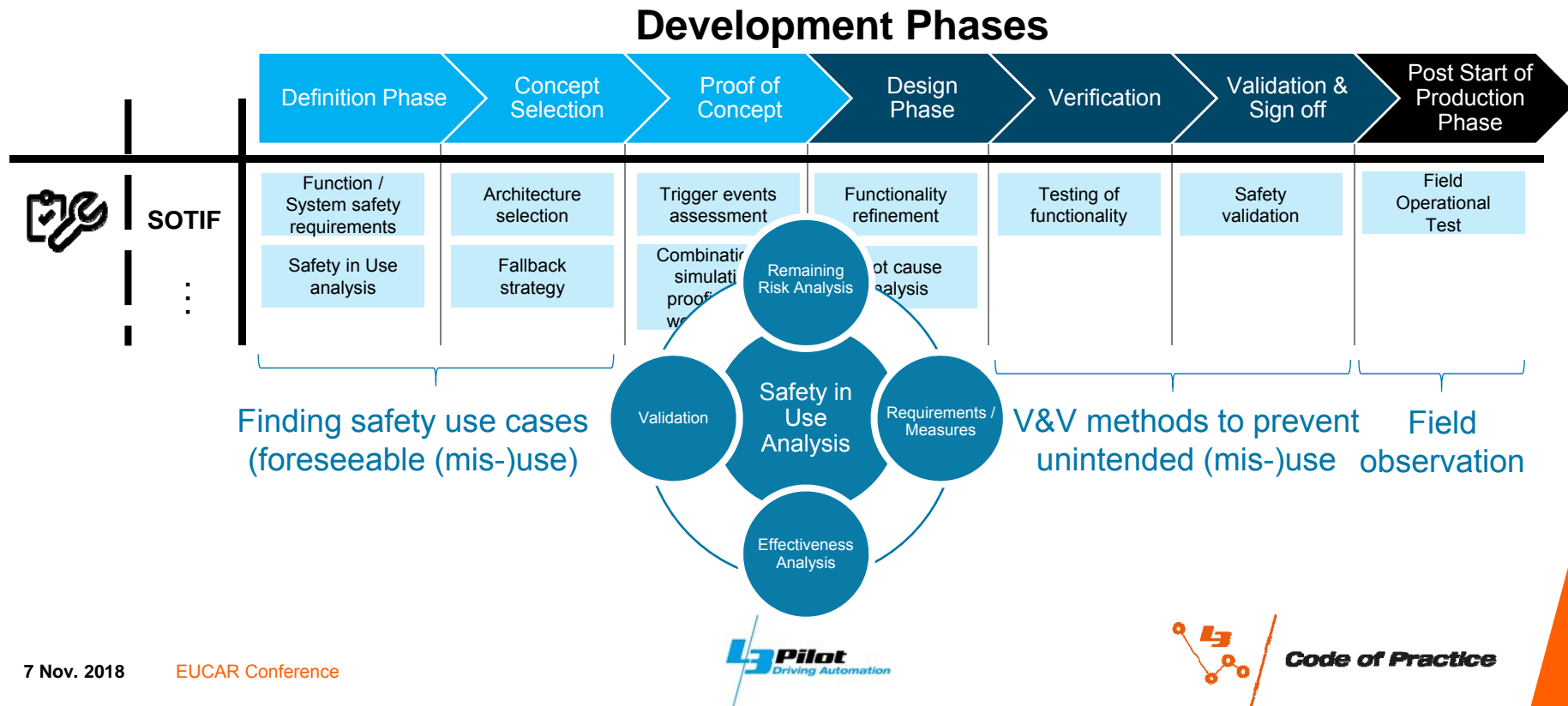
1: S. Wolter, A. Knapp, V. Jütten, M. Chen, F. Bonarens, U. Eberle, O. Schädler, Code of Practice Framework, L3Pilot Deliverable D2.1, 2018

# Code of Practice Framework.





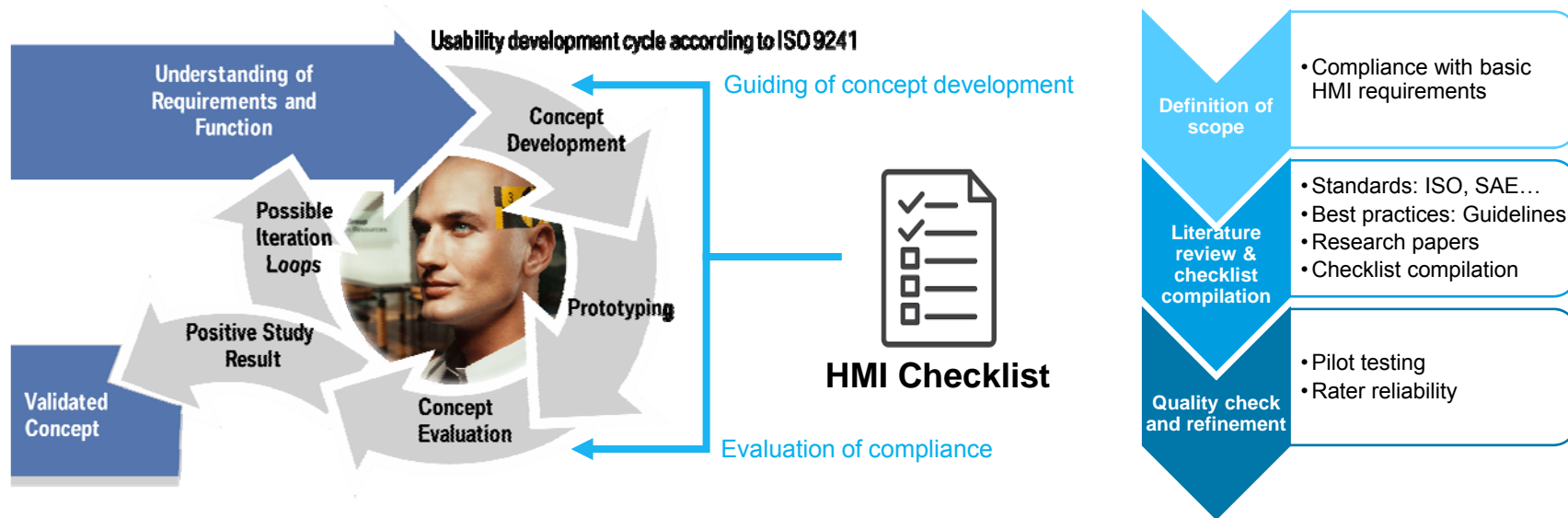
# Example 1: Safe Guarding Automation. SOTIF - Safety in Use Analysis.



## Example 2: Human-Machine Interaction. L3 HMI Checklist.



- **Goal:** Establishment of a comprehensive and easy-to-use checklist to assess the compliance of HMIs of AVs with most important best practices and standards.



## L3 HMI Checklist. Example: Colour Coding.



- **Guideline #15: Design for colour-blindness by redundant coding and avoidance of red/green and blue/yellow combinations.**

“Redundant coding is required (e.g. in case of colour-blind people).”	[18], S.48, NFR4A_UNI.4
“Red/green combinations are avoided. Blue/yellow colour combinations are avoided.”	[17], S.13
“Red/Green and Blue/Yellow codings should be avoided. Combinations of Blue and Red from the extreme end of the visible spectrum should also be avoided.”	[11], S.338
“Red/green and blue/yellow combinations should be avoided since these colour combinations might be confusing for people who are colour blind.”	[15], S.21

[11]: Ross, T., Midtland, K., Fuchs, M., Pauzié, A., Engert, A., Duncan, B., Vaughan, G., Vernet, M., Peters, H., Burnett, G., May, A.: Design Guidelines Handbook: Human Factors Guidelines for Safety Presentation by ATT Systems (1996)

[15]: Stevens, A., Quimby, A., Board, A., Kersloot, A., Burns, P.: Design Guidelines for safety in-vehicle information systems (2002)

[17]: Stevens, A., Cnyk, S.: Checklist for the assessment of in-Vehicle information systems, Research Laboratory (2011)

[18]: AdaptIVe D3.3 (2017)



Thank you for your kind attention.

**Robert Martinez v. Bülow, BMW**



Special thanks to all L3Pilot SP2 partners

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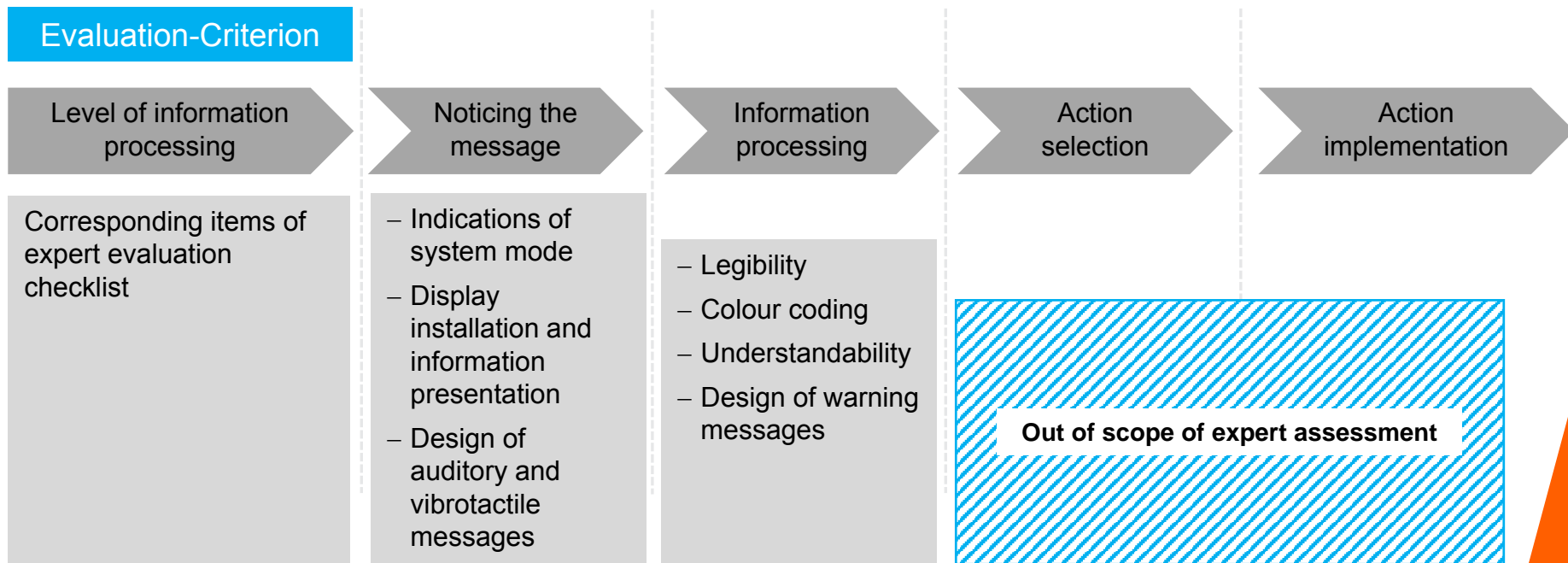
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# L3 HMI Checklist.

## Summary of checklist topics.



# L3 HMI Checklist.

## Expert Assessment Test Procedure - Checklist items.



Area / purpose	Item
<b>Operational principles:</b> <ul style="list-style-type: none"> <li>- System operation controlled by driver</li> <li>- Necessary mode indicators are present in the HMI</li> </ul>	Guideline #1: Unintentional activation and deactivation should be prevented.
	Guideline #2: The system mode should be continuously displayed.
	Guideline #3: Mode changes should be effectively communicated.
<b>Display installation and information presentation</b> <ul style="list-style-type: none"> <li>- Displays are mounted at suitable positions</li> <li>- Visual workload of information search is minimized</li> </ul>	Guideline #4: Visual interfaces used to communicate system states should be mounted to a suitable position and distance. High-priority information should be presented close to the driver's expected line of sight
	Guideline #5: HMI elements should be grouped together according to their function.
	Guideline #6: Time-critical interactions with the system should not afford continuous attention.
...	...
<b>Colour coding:</b> <ul style="list-style-type: none"> <li>- Promoting intuitive understanding</li> <li>- Avoiding colour blindness issues</li> </ul>	Guideline #13: Not more than five colours should be consistently used to code system states (excluding white and black).
	Guideline #14: The colours used to communicate system states should be in accordance with common conventions and stereotypes.
	Guideline #15: Design for colour-blindness by redundant coding and avoidance of red/green and blue/yellow combinations.