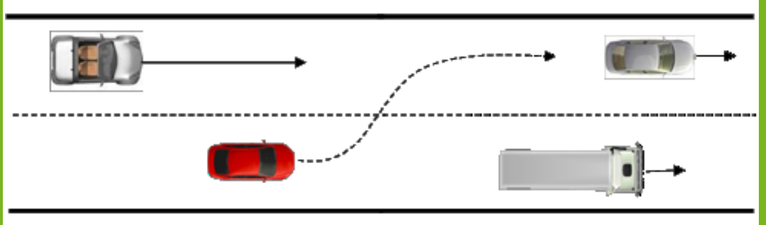
WP9: CRF Lane Change Assistant

HOLISTIC HUMAN FACTORS AND SYSTEM DESIGN OF ADAPTIVE COOPERATIVE HUMAN-MACHINE SYSTEMS

Domain

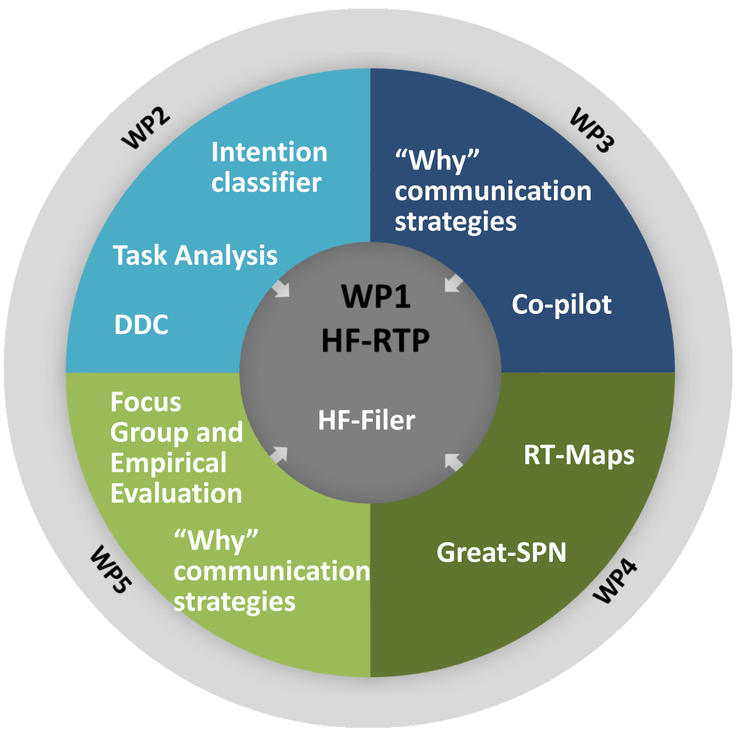
Motivation

- **Time to collision** (TTC) in safety-critical lane changes (LCs) are normally less than **3s**. Since mean driver's reaction time (RT) is about 1s, **there is very little time** for a driver to react properly.

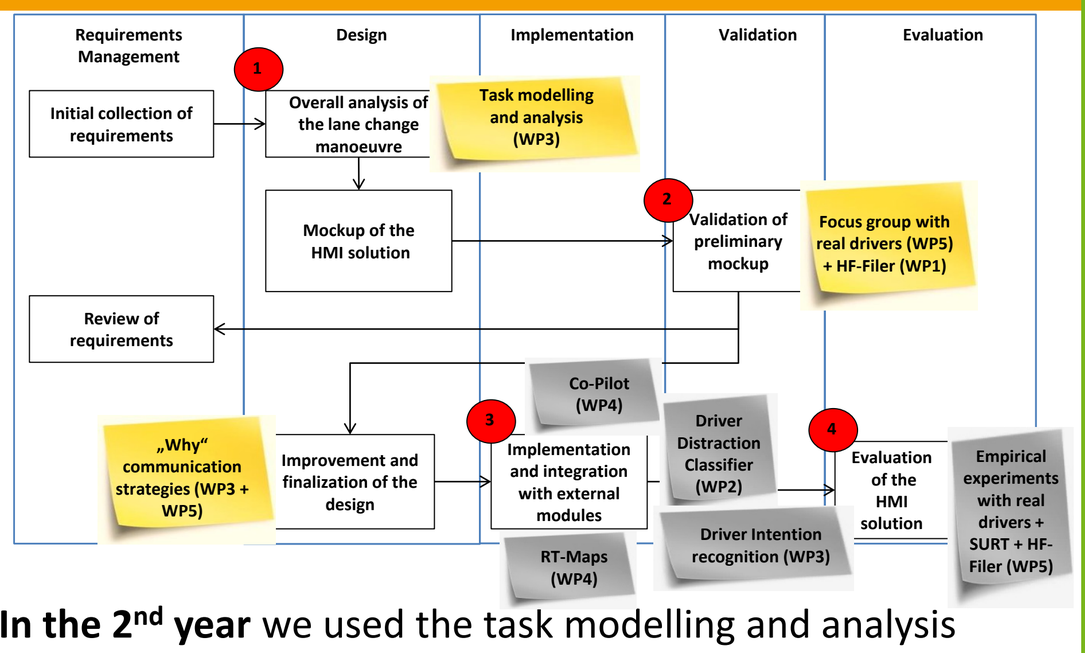


- Delivering information in a way that allows the driver processing it in continuously changing conditions could **decrease the RT**.
- Recent studies have shown the importance of providing information on the "**why**", considering user's intention and status, to increase the operator's trust in the automation and achieve a better driving experience in adaptive vehicles.

Applied MTTs



Current State: Tailored HF-RTP



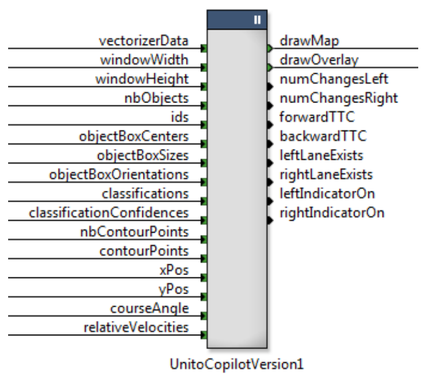
In the 2nd year we used the task modelling and analysis provided by WP2 to identify all tasks the driver performs during the lane change manoeuvre and where his/her visual attention is focus on.

	Decision	Preparation	Execution
Task modelling	Scan mirrors (C, L, R)	Scan mirrors (L, R)	Initiate LC manoeuvre
	Check frontal distance	Maintain safe gap in original lane	Steering (L)
	Check memory	Activate turn signal (L)	Deactivate turn signal (L)
	Check assumptions	Scan mirrors (C, L)	Scan mirrors (R, C, L)
Cognitive load	medium	medium	medium
Visual load	high	high	medium
Driver **NOT distracted** AND **car NOT approaching** on the left **Interaction modality: visual**			
Driver NOT distracted AND **car approaching on the left** **Interaction modality: visual**			
Driver distracted AND **car approaching on the left** **Interaction modality: visual + acoustic**			

We tested this preliminary concept with real drivers.

In collaboration with WP5 and WP3 we have also investigated multimodal interaction and communication modalities to provide the information on the "why" (e.g. not only "keep the lane", but "keep the lane because a car is approaching on the left ") to cope with the **sharing of authority** issue and increase trust in automation.

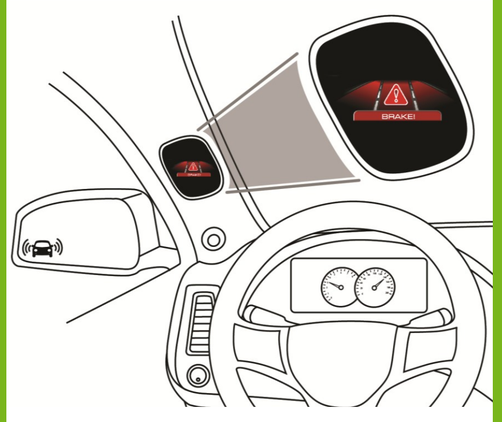
In order to integrate the HMI solution with the co-pilot (developed in WP3) and the modules that provide the intention and the distraction of the driver (developed in WP2), we defined a common interface (corresponding to the 3rd step of the tailoring process as defined in WP1) to share data with these modules.



In the 3rd year, we plan to integrate the external modules into the CRF prototype and then empirically evaluate the performance of the AdCos.

Results

Development of an **HMI prototype** that extends the existing "blind spot" concept by spatially distributing safety-critical information according to the expected visual attention of the driver on the left and right pillars, on the rearview mirror and on a central display.



The AdCoS **adapts in real-time** according to the commands received by the co-pilot whose decision is based on data from the environment, the status of the driver (distraction) and his/her intention.

Using the task analysis we could estimate the **almost 50% of the tasks** performed by the driver during the lane change involve a **shift of his/her visual attention** (e.g. to scan lateral mirrors).

Adapting the spatial distribution of information (taking into account if the driver is distracted) we expect to achieve a relevant improvement of the performance of the driver in terms of reduction of errors (e.g. avoiding changing the lane when a car is approaching on the left).

Contact

RE:Lab s.r.l.
Via Augusto Tamburini 5
Reggio Emilia

Elisa Landini
elisa.landini@re-lab.it
Research and Project Design

Consortium

Acknowledgments

This research has been performed with support from the EU ARTEMIS JU project HoliDes (http://www.holides.eu) Any contents herein are from the authors and do not necessarily reflect the views of ARTEMIS JU.