



How best to prepare young people to be safe and responsible drivers for now and for the future

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The Role of the Driver in the Introduction of new Technologies in Vehicles

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Introduction

- Technology is heavily impacting in the new generation of road vehicles





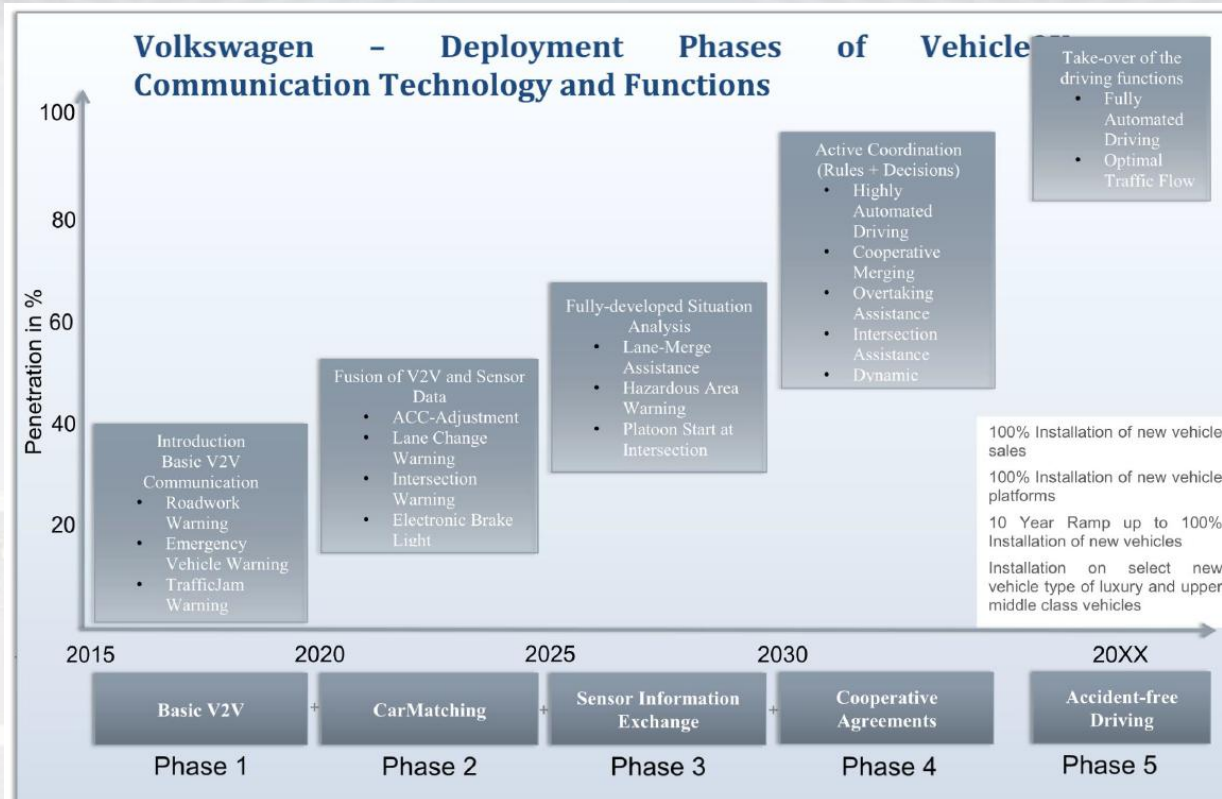
Introduction

- ¿Is there a place for human drivers?





Introduction





Introduction

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	SAE Level	Name	Steering, acceleration, deceleration	Monitoring driving environment	Fallback performance of dynamic driving task	System capability (driving modes)
Human monitors environment	0	No automation the full-time performance by the human driver of all aspects of the dynamic driving task, even when enhanced by warning or intervention systems				
	1	Driver assistance the driving mode-specific execution by a driver assistance system of either steering or acceleration/deceleration using information about the driving environment and with the expectation that the human driver perform all remaining aspects of the dynamic driving task.				Some driving modes
	2	Partial automation the driving mode-specific execution by one or more driver assistance systems of both steering and acceleration/deceleration using information about the driving environment and with the expectation that the human driver perform all remaining aspects of the dynamic driving task				Some driving modes
Car monitors environment	3	Conditional automation the driving mode-specific performance by an automated driving system of all aspects of the dynamic driving task with the expectation that the human driver will respond appropriately to a request to intervene				Some driving modes
	4	High automation the driving mode-specific performance by an automated driving system of all aspects of the dynamic driving task, even if a human driver does not respond appropriately to a request to intervene				Some driving modes
	5	Full automation the full-time performance by an automated driving system of all aspects of the dynamic driving task under all roadway and environmental conditions that can be managed by a human driver				All driving modes

Source: Adapted from SAE Standard J3016 (SAE, 2014).



Transition manual-automatic

- Is the transition of the driving task from the autonomous driving system to the human driver.
- It activates when the autonomous pilot cannot deal with a road scenario.
- Is necessary at automation levels 1-3.
- The self driving system must monitorize the driver, evaluate its attentional status and decide the best way to warn and transfer the control.



Integration of autonomous vehicles in shared traffic

- A massive impact of autonomous vehicles is not expected until 2030.
- In this transition time, the self driven vehicles must coexist with manually driven vehicles: shared traffic.
- The autonomous vehicles driving behaviour must be compatible with human driving.



Integration of autonomous vehicles in shared traffic

- Road train demonstration in Sartre Project.





Cooperative Systems

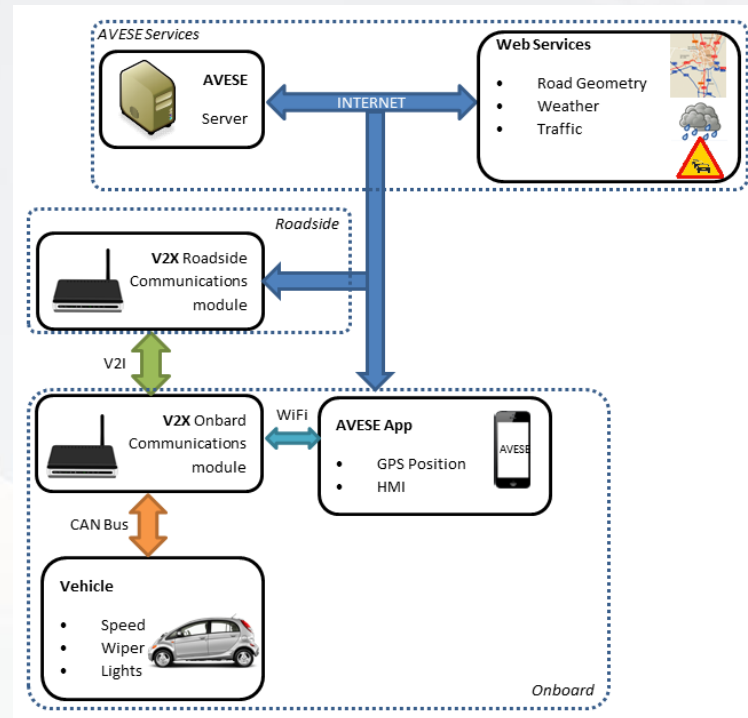
- AVESE DGT Project

- Safe speed warning system based on road geometry, traffic situation, weather, vehicle type and weight conditions.
- Design of a HMI → Human centered design. Usability
- Data provided from:
 - The ego vehicle
 - Internet
 - Cooperative systems (V2X Communications)

Cooperative Systems

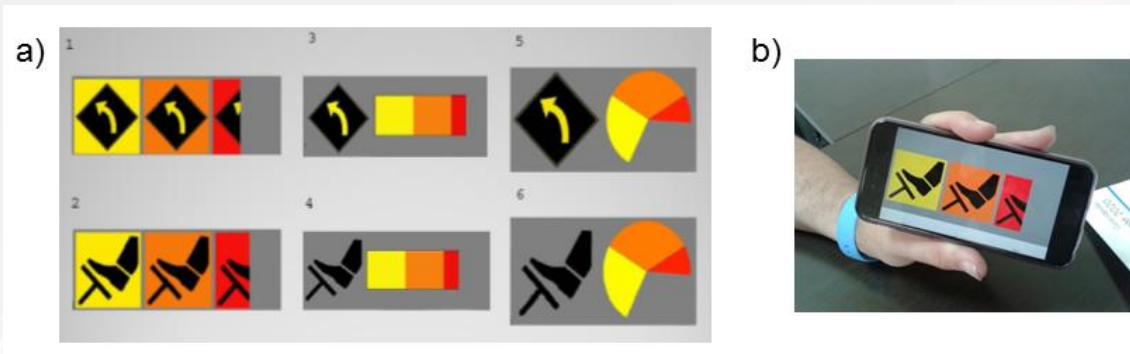
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- Architecture



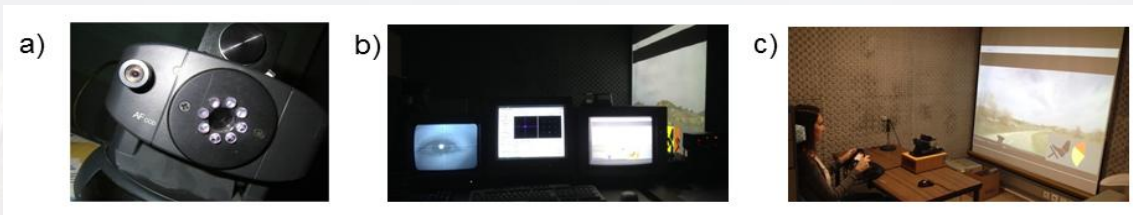
Cooperative Systems

- Design of the interfaces



Cooperative Systems

- Laboratory tests.
 - a) ASL Model 504 Ocular system log;
 - b) Control computers for running simulator and eye-tracking system;
 - c) Driver performing a simulation





Cooperative Systems

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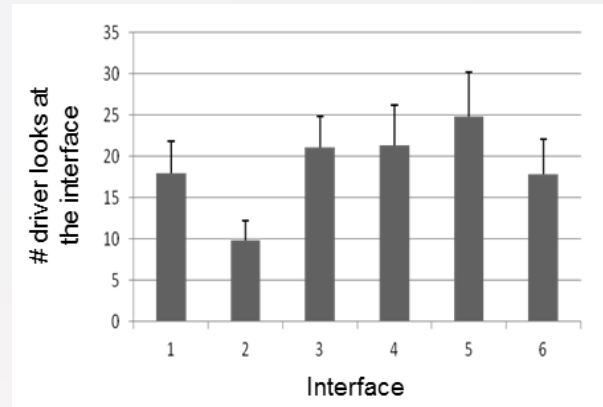
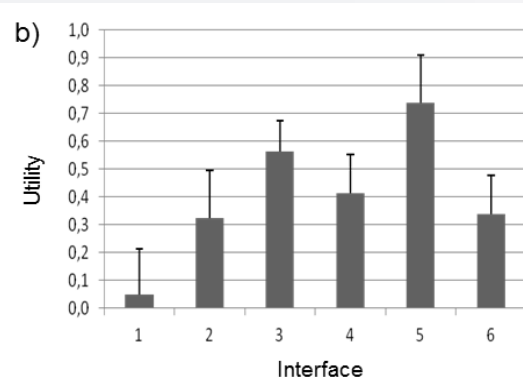
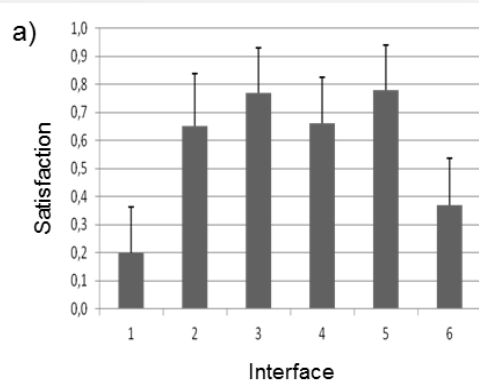
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- Laboratory tests.



Cooperative Systems

- Laboratory tests. Results
 - a) User satisfaction
 - b) Utility perception
 - c) Number of times the user looks at the interface



Cooperative Systems

- Testing in real vehicles. Test results on M-315 single-carriageway road (Madrid, Spain).

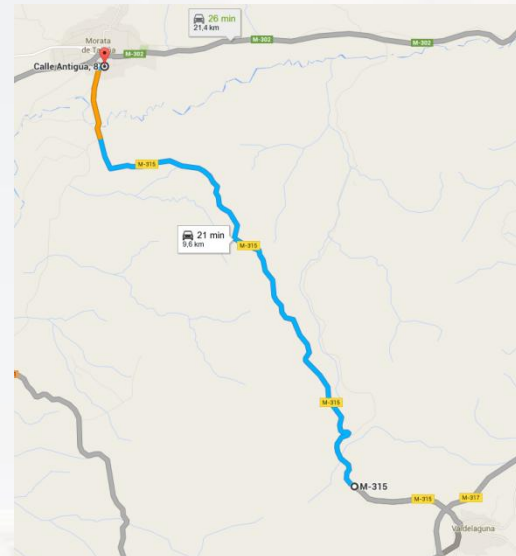
a)



b)



c)





Cooperative Systems

- Test results on M-315 single-carriageway road (Madrid, Spain) (N=10)

	Average value	Standard deviation		
Differences of average travel speed with and without the system (%)	-0.58	0.81		
Differences of travel time with and without the system (%)	0.81	0.79		
	Without the system		With the system	
	Average value	Standard deviation	Average value	Standard deviation
Frequency of safe speed exceeding (%)	18.25	-	9.625	-
Difference between maximum and safe speeds in Zones B (km/h)	6.53	8.36	2.50	5.95
Difference between median and safe speeds in Zones B (km/h)	-0.28	6.66	-2.96	5.14
Difference between maximum and minimum speeds in Zones B (km/h)	13.54	7.23	10.45	5.31
Maximum speed differences among drivers in Zones B (km/h)	18.22	3.56	11.78	5.83



Conclusions

- An analysis of the role of the human driver in the new technologies of the automotive sector has been presented : autonomous driving and cooperative systems.
- The complete design, implementation and testing of a cooperative system has been described, based in human – centered design.
- As final conclusion, is clear that the inclusion of the human factor in the design of new generation of driving aids and automation should be mandatory in order to assure a fast and reliable adaptation of humans and to improve their performance.