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

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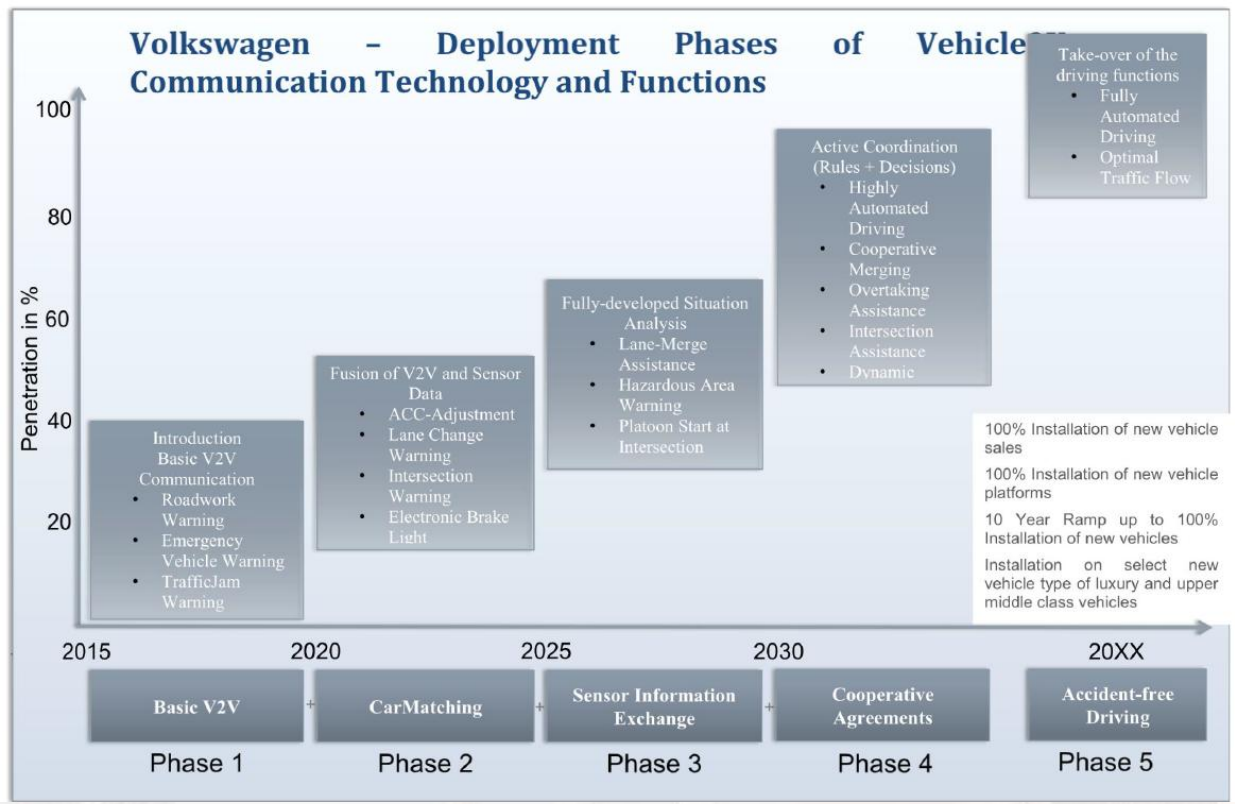
Introduction

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

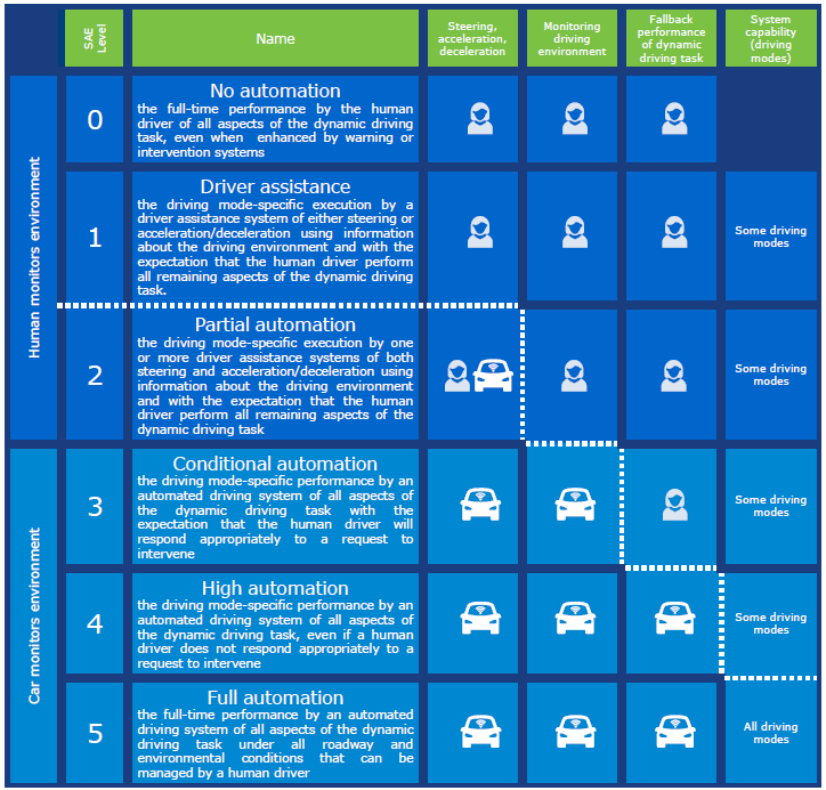
Introduction

- ¿Is there a place for human drivers?

Introduction



Introduction



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 necesary 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 coexists with manually driven vehicles: shared traffic.
- The autonomous vehicles driving behaviour must be compatile with human driving.

Integration of autonomous vehicles in shared traffic

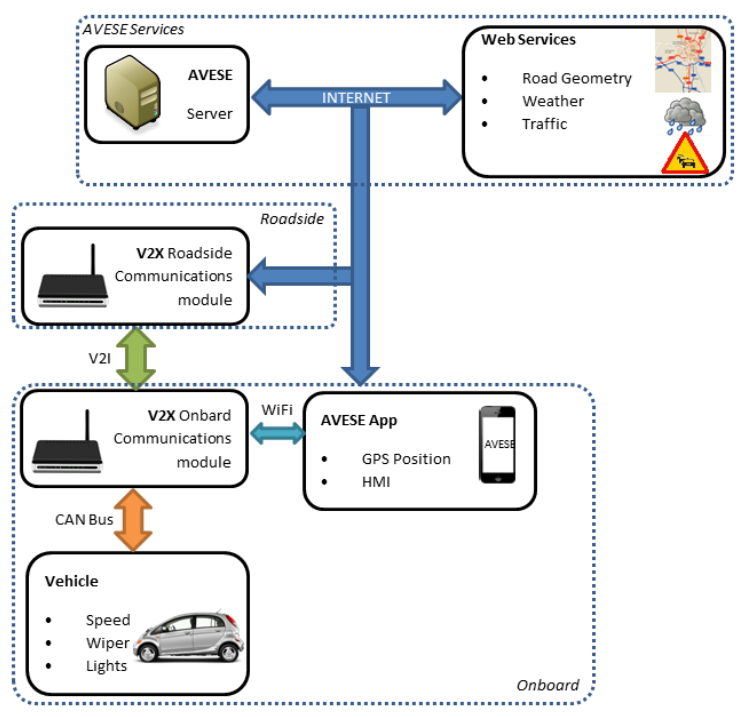
- Road train demonstration in Sartre Project.

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

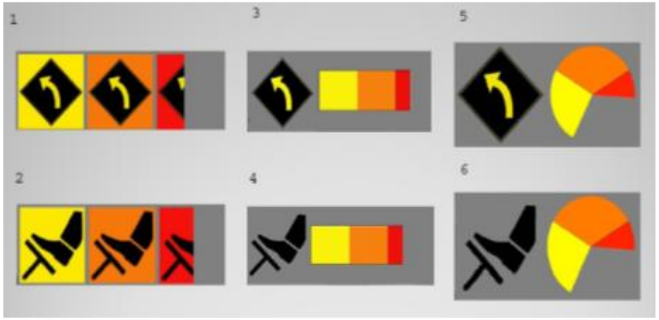
- Architecture



Cooperative Systems

- Design of the interfaces

a)

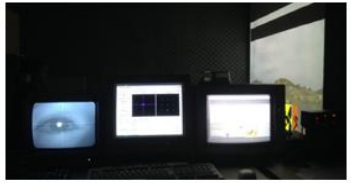


b)

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

a) 

b) 

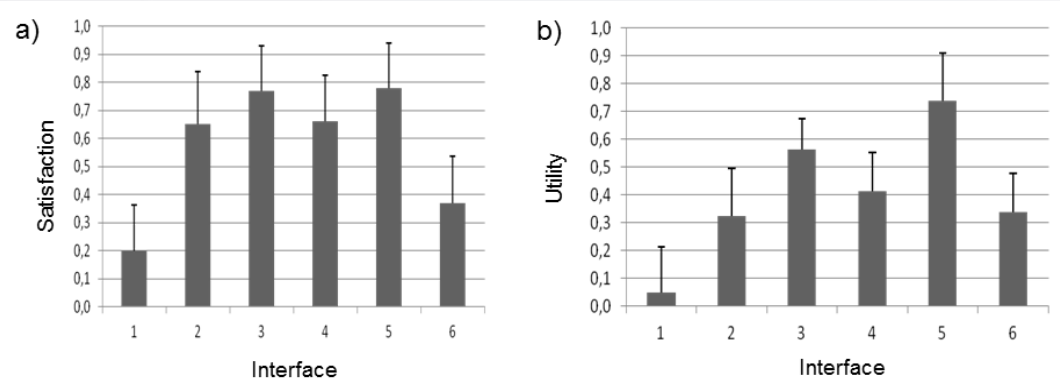
c) 

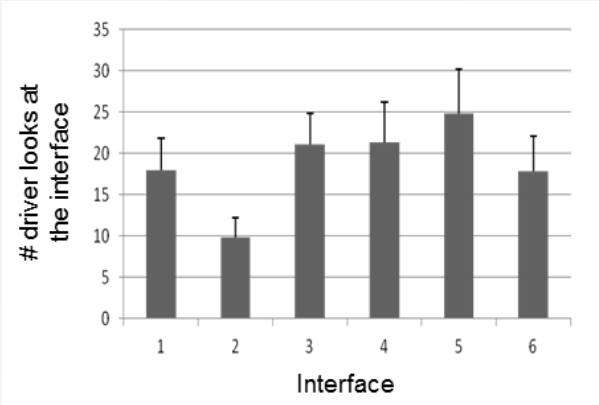
Cooperative Systems

- Laboratory tests.

Cooperative Systems

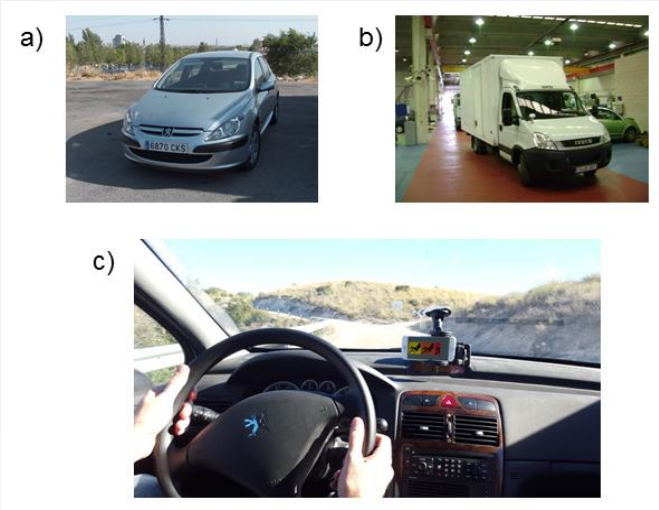
- Laboratory tests. Results
  - a) User satisfaction
  - b) Utility perception
  - c) Number of times the user looks at the interface

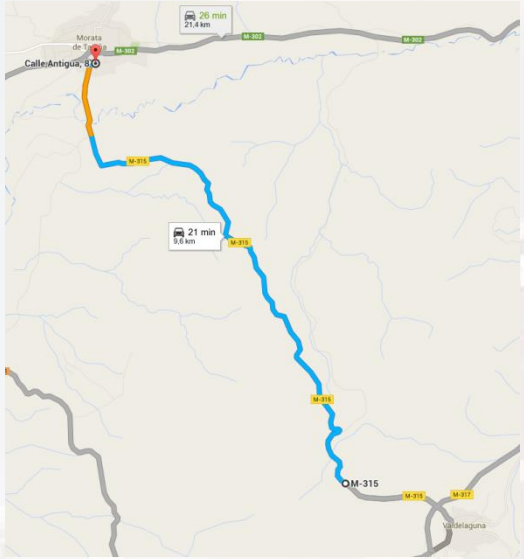




Cooperative Systems

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





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 analisys 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.