PSA PEUGEOT CITROËN

BACK IN THE RACE

PSA Peugeot Citroën

Autonomous Driving

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Mars 2016

▮ What are our customers expectations ? Market trends

▮ What are the main functions for level 2 & 3 : movies

▮ What are the technologies and who will develop them ?

▮ To conclude : eco system is key

BACK IN THE RACE

Aging population

A digital & connected world

increasing urbanization

From ownership to experience

EVOLUTION OF USES
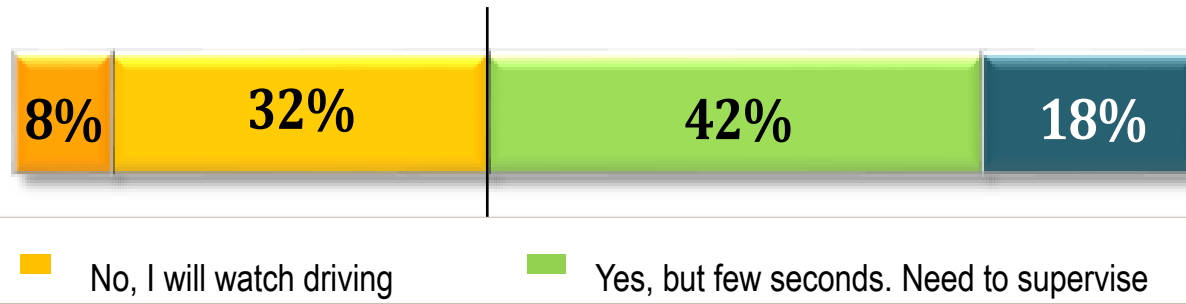
AND

EXPECTATIONS

BACK IN THE RACE

Why a self driving car ? (customers whish)

Imagine that technology of next cars and driving regulation allow in the coming years an autonomous driving by the car systems. In these conditions, would you be ready to delegate driving while doing something else ?

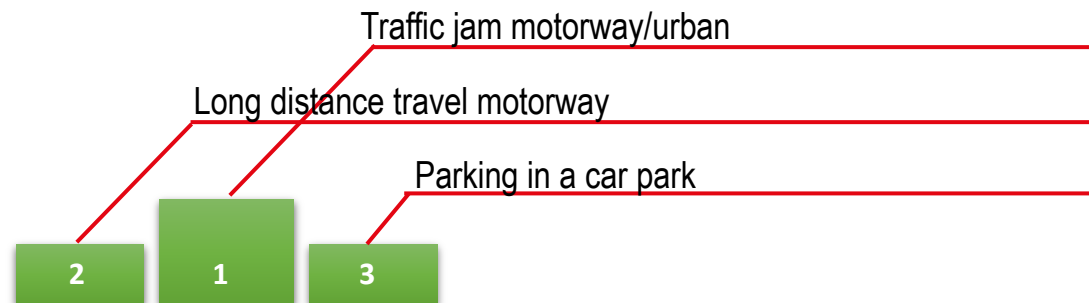**5 000 people – G5 with a new car registered between 2012 and 2014**

18% are willing to delegate driving –
42% are open to driving delegation but need reinsurance

8%	32%	42%	18%

**60% are positive
Toward Driving automation**

- 🟧 No
- 🟨 No, I will watch driving
- 🟩 Yes, but few seconds. Need to supervise
- 🟩 Yes, I will delegate

Accepted driving situations for automated/ piloted driving

Traffic jam motorway/urban

Long distance travel motorway

Parking in a car park

| 2 | 1 | 3 |

Why a self driving car ? (customers whish)

Under these circumstances, would you be ready to do the following tasks. Please indicate whether you imagine to have these activities and to what extend you would be ready to pay fo it.

Base : = 3015 (total yes)

	Not useful	INTERESTED but not ready to pay for it	INTERESTED and ready to pay for it	This is a MUST
Use a GPS	7%	32%	27%	34%
Have a phone call	10%	34%	25%	31%
More interaction with other passengers	22%	39%	25%	14%
SMS, tweet, …	26%	37%	22%	15%
Internet	39%	29%	21%	11%
e-mail	34%	34%	20%	12%
Work	54%	21%	16%	9%
Read	54%	24%	14%	8%
Watch a movie	55%	23%	15%	6%
Sleep	63%	16%	14%	7%
Play a game	64%	20%	10%	6%
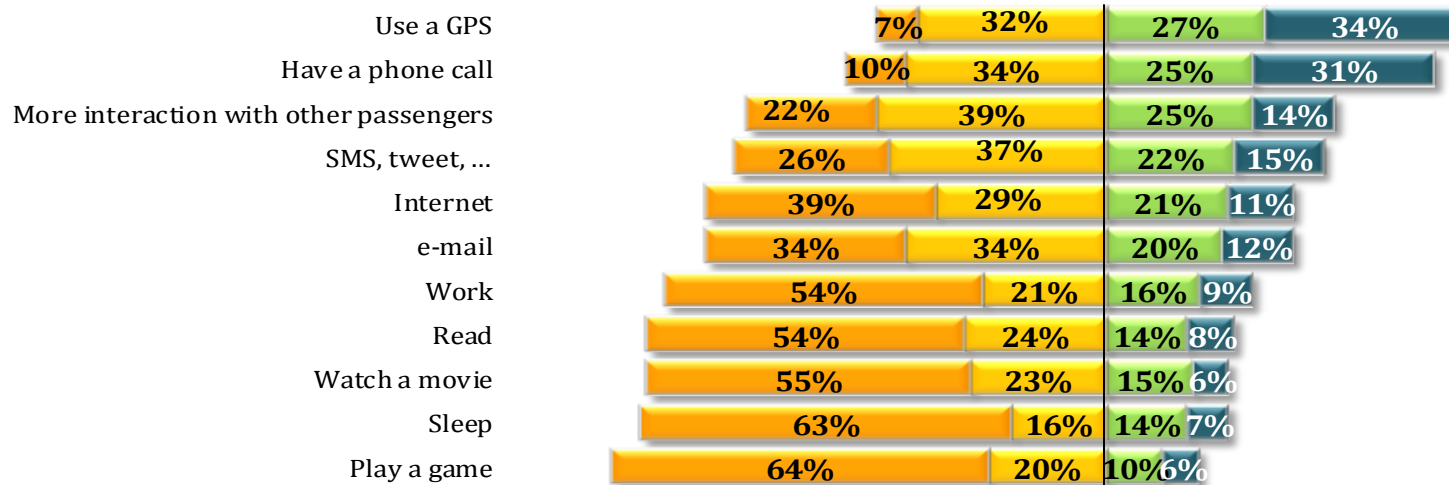
Relax while Driving ! (but not working…)

- Not useful
- INTERESTED but not ready to pay for it
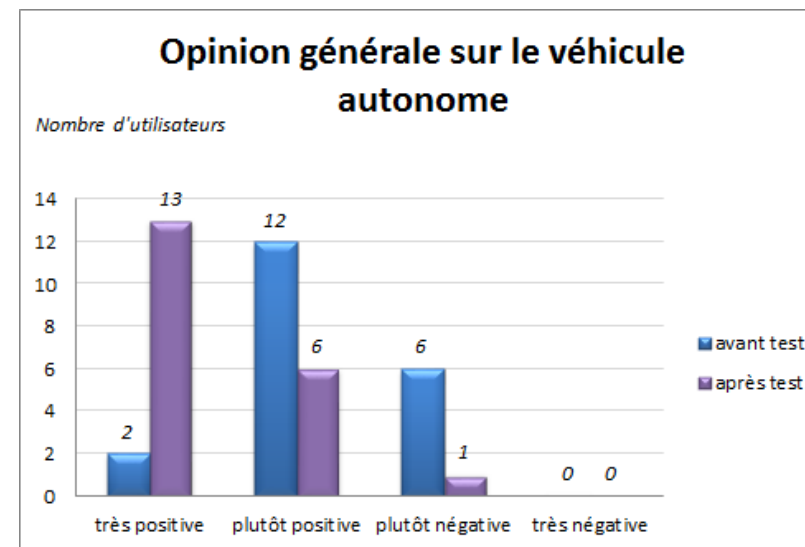- INTERESTED and ready to pay for it
- This is a MUST

- Some differences according to country but tendancy is consistent

- In China willingness to have these technologies but some fears

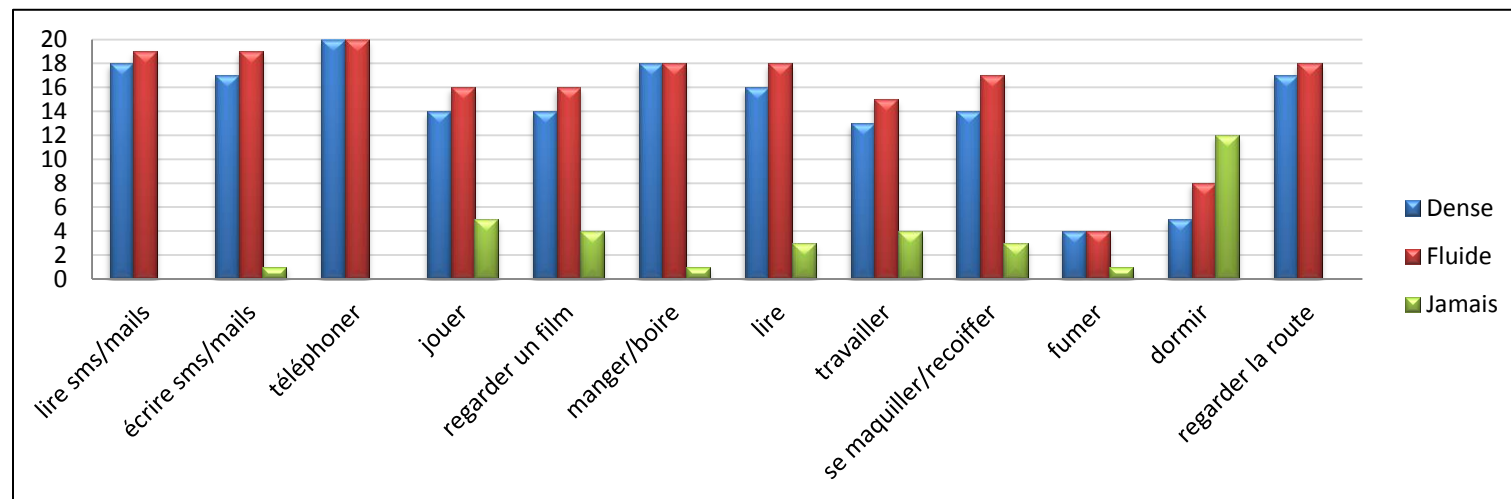- In Brazil willingness is much lower

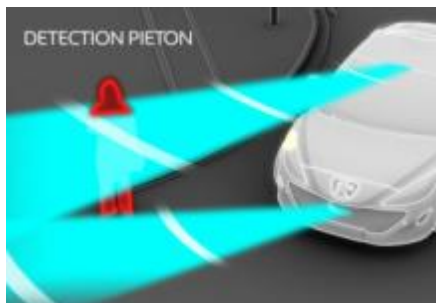# *How does this evolve after real trials*

After a Wizard of Oz test

- Strong increase in user acceptance

Opinion générale sur le véhicule autonome

Nombre d'utilisateurs

avant test / après test

très positive — 2 / 13
plutôt positive — 12 / 6
plutôt négative — 6 / 1
très négative — 0 / 0

- High demand to have other activities

Dense / Fluide / Jamais

lire sms/mails, écrire sms/mails, téléphoner, jouer, regarder un film, manger/boire, lire, travailler, se maquiller/recoiffer, fumer, dormir, regarder la route

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Why a self driving car ?

- For more **safety**
  (80-90% of accidents are caused by human errors)

- To **have time for doing something else** in monotonous or unpleasing driving situations

- For simplifying driving *(ex : parking)*

BACK IN THE RACE

2 different approaches of the global market

From our existing customers point of view

- Prioritization of use case according to customer wishes

- Safety, save time, simplifying driving

- Design & cost are major concerns

From new mobility use cases point of view

- Taxis, shuttles … automomous driverless ➜ level 5

- Design & cost are not major concerns

- Tele-operation, fleet monitoring, …

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Progressive implementation of Autonomous Driving

5 levels of automation, not all authorized by current regulation

Change in regulation needed

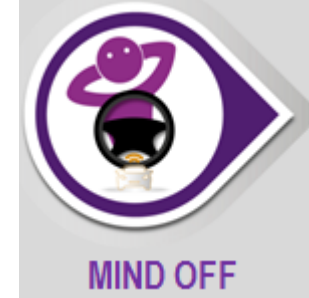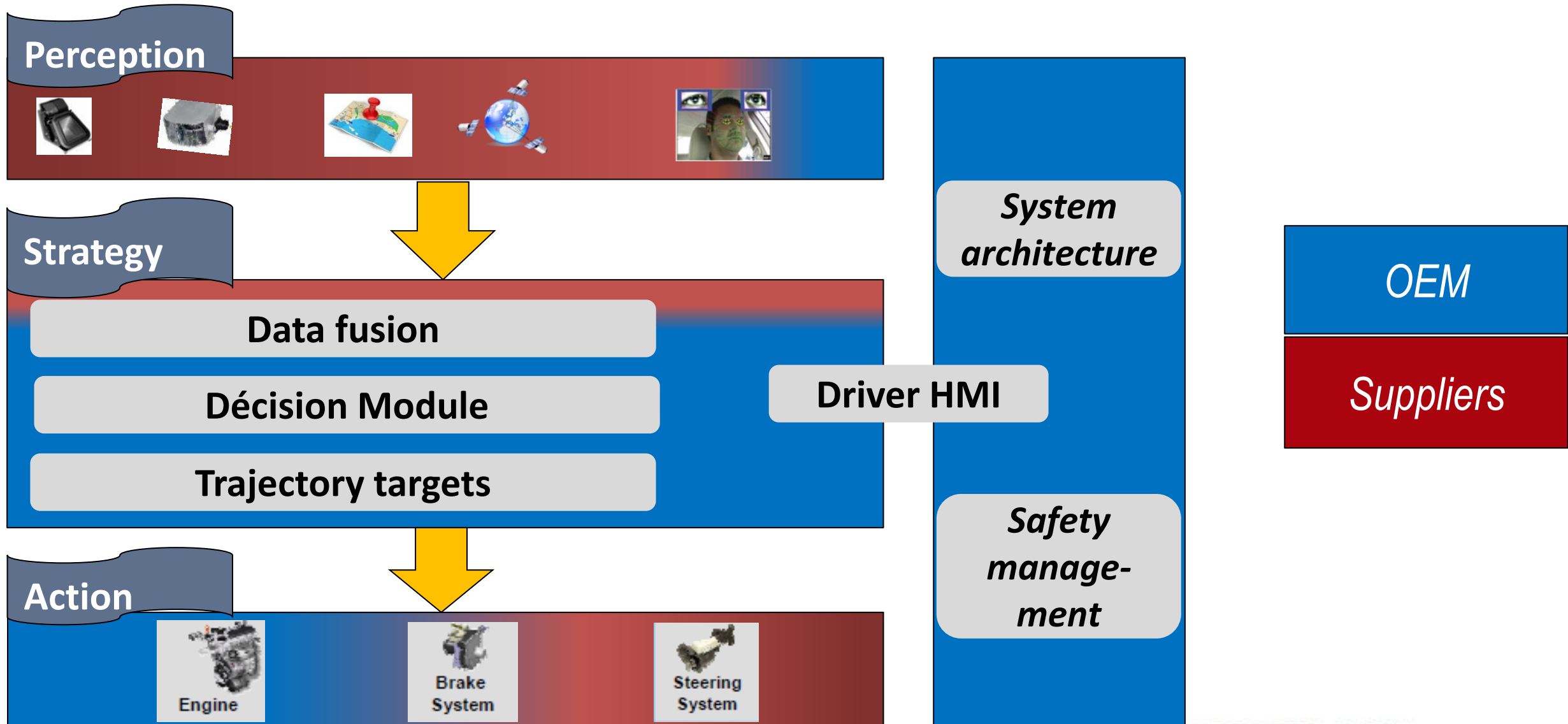| ASSISTED DRIVING Level 1	AUTOMATED DRIVING Level 2	AUTONOMOUS VEHICLE Level 3	AUTONOMOUS VEHICLE Level 4	AUTONOMOUS VEHICLE Level 5
DRIVER ASSISTANCE	**WITH DRIVER SUPERVISION**	**WITHOUT SUPERVISION (TEMPORARILY)**	**WITHOUT SUPERVISION ON ENTIRE USE CASE**	
HANDS ON	HANDS ON or OFF	EYES OFF	MIND OFF	DRIVERLESS
CRUISE CONTROL LANE KEEPING	**PARTIAL AUTOMATED DRIVING**	**TRAFFIC JAM CHAUFFEUR HIGHWAY CHAUFFEUR**	**TRAFFIC JAM PILOT HIGHWAY PILOT**	**VALET PARKING ROBOT TAXI**
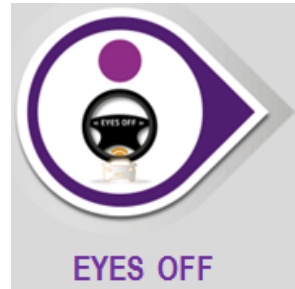
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BACK IN THE RACE

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Perception

Strategy

Data fusion

Décision Module

Trajectory targets

Action

System architecture

Driver HMI

Safety manage-ment

OEM

Suppliers

BACK IN THE RACE

- Design safe autonomous driving

  - From level 3 driver doesn't monitor driving

  - System needs to be « fails operational » until driver takes back

- Main consequences

  - Safety in case of failure: redundancy for braking, steering, power supply

  - Safe function for dysfunctional ➔ ISO 26262

  - « Safety of the intended functionality » … still work in progress

- Some methods

  - Safety goals by analysis of accidents

  - Optimization of driving validations ➔ simulations, computations

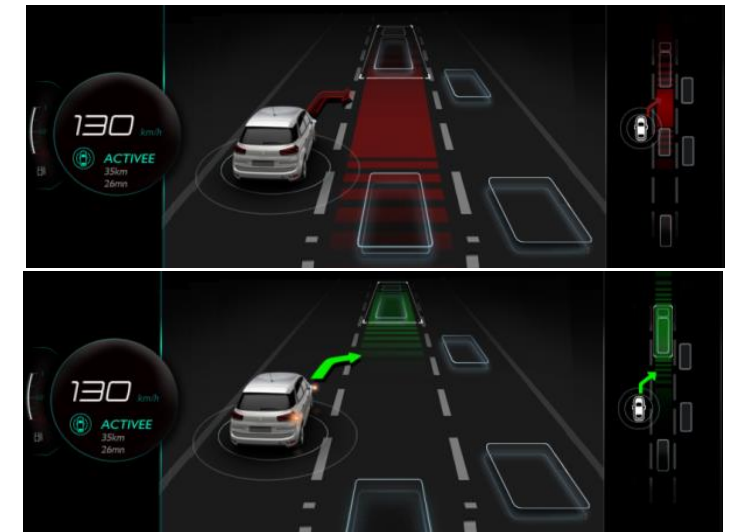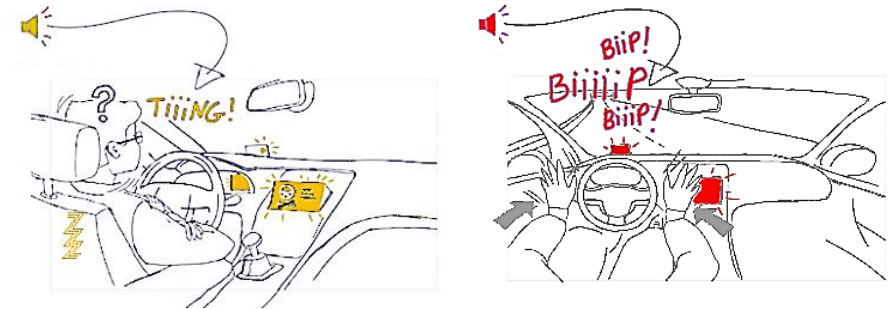 - Extend ISO 26262 to manage « safe functions » and « fail operative »
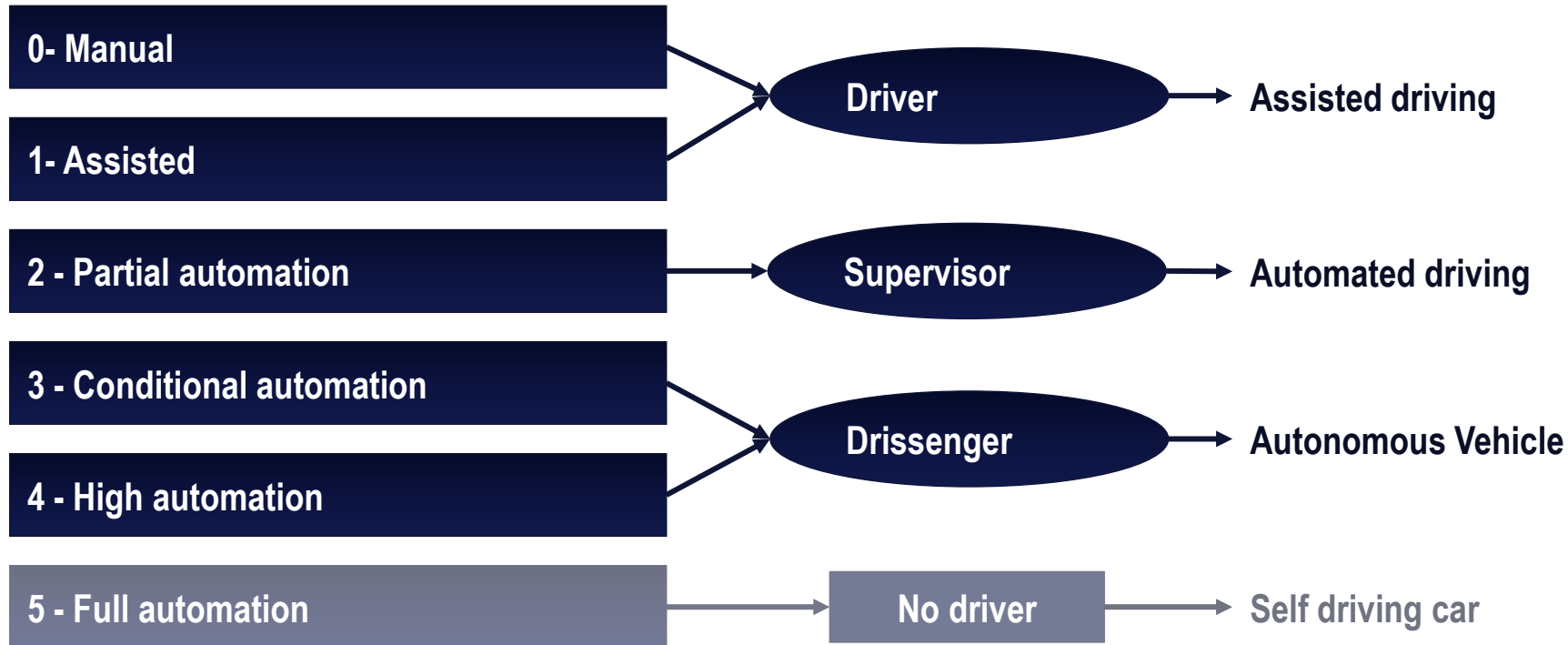
Manage the complexity
Give confidence to user
➔ **safe and intuitive Human Machine Interface**

- For System activation and desactivation

- For Driver's takeover when the system request him to resume control

- To give the right information to the driver: which function is activated and what are the functions available

- To explain the vehicle behavior and to give confidence in the function with a specific ADAS view

According the level of automation the drivers status and needs are different

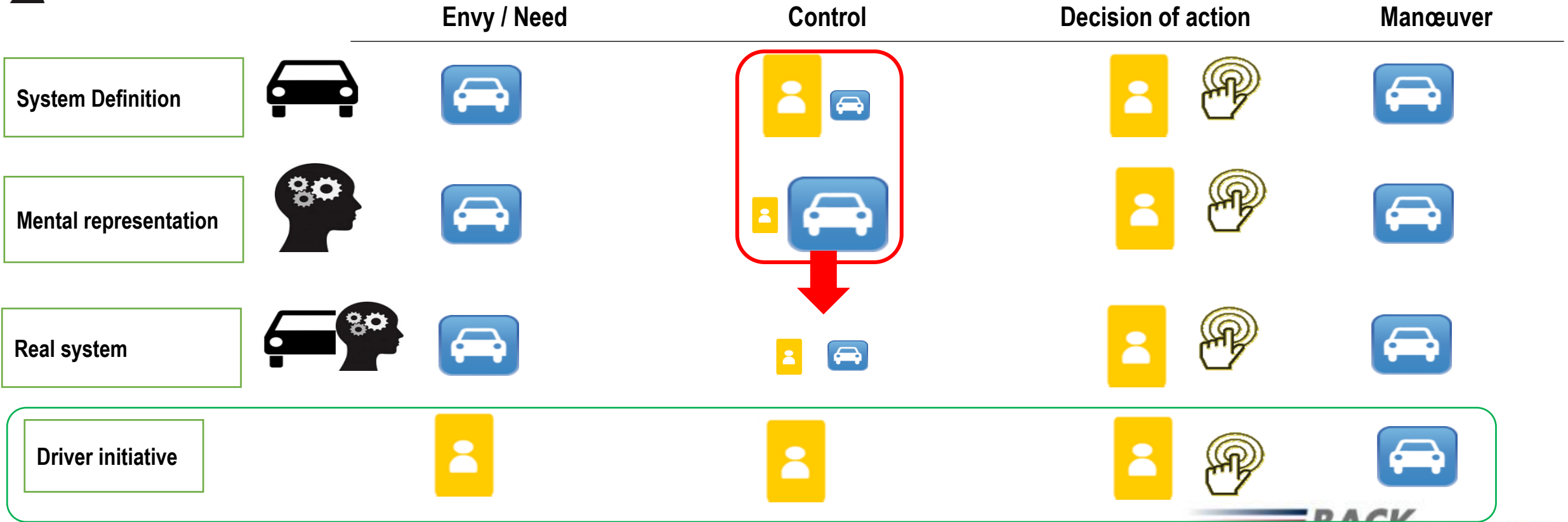|		
0- Manual		
1- Assisted	Driver	Assisted driving
2 - Partial automation	Supervisor	Automated driving
3 - Conditional automation		
4 - High automation	Drissenger	Autonomous Vehicle
5 - Full automation	No driver	Self driving car

Each category of automation has its own HMI challenges

HMI Challenges for level 2

In level 2 the main challenges concern the supervision and the tactical tasks sharing.

For example is the automated lane change maneuver.

**Automated system = Reliable system**

		Envy / Need	Control	Decision of action	Manœuver
System Definition		car	person + car	person + touch	car
Mental representation		car	person + car	person + touch	car
Real system		car	person + car	person + touch	car
Driver initiative		person	person	person + touch	car

For level 3 the main challenge is the take over request with a "*sufficient time margin*"

As the Drissenger reaction time is highly dependent of multiple factors
there is not a definitive value for the "sufficient time"

We make test with a 10 seconds warning time

- Test track – end of traffic jam situation

- 130 give back – 20 subjects
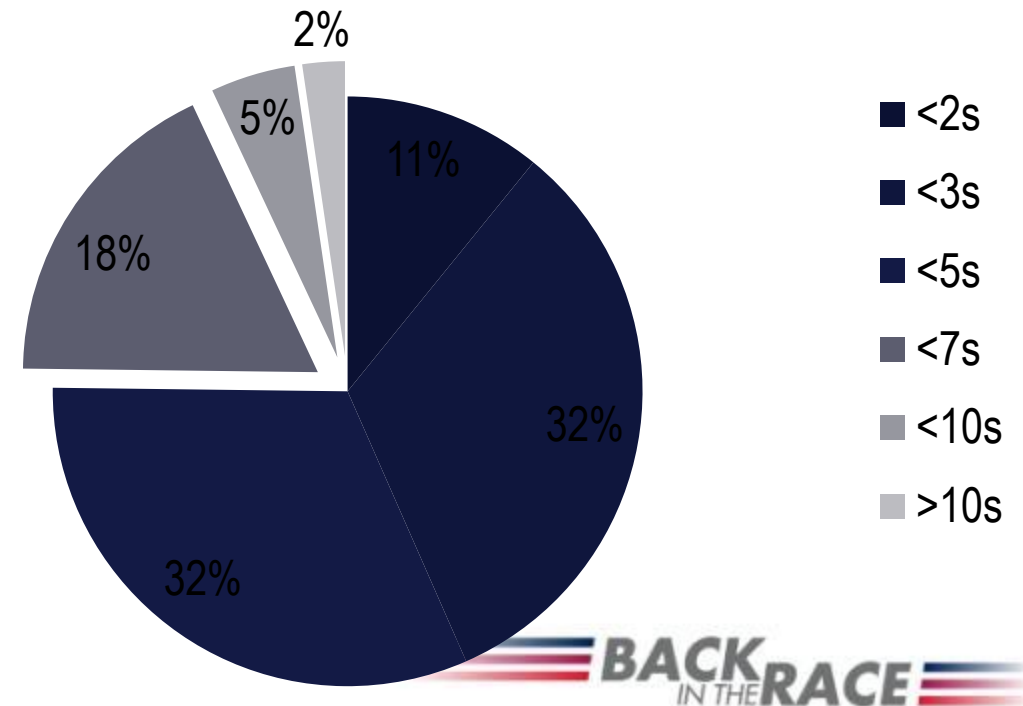
- ■ <2s
- ■ <3s
- ■ <5s
- ■ <7s
- ■ <10s
- ■ >10s

2%
5%
11%
18%
32%
32%

BACK IN THE **RACE**

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BACK IN THE RACE

Eco system is key

- Still a lot of work to be done and high investments : partnerships are required

- Innovation with numerous consequences : social, legal, insurances, infrastructures

- Testing is needed

Film_Paris_Bordeaux_ADN1_v8_Short.wmv

Vigo_Madrid_Final.mp4

France is moving

- "Nouvelle France Industrielle" plan

- "Plateforme Automobile Française"

- Precompetitive research in SystemX & Vedecom

- …

Human Driver will still be needed for a while !

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Thank you for your attention

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