AUTOMOTIVE USER EXPERIENCE

Dott. David Berti
HMI Design

AUTOMOTIVE USER EXPERIENCE

1. **Come siamo arrivati all'attuale evoluzione tecnologica?**
2. **Quale stato dell'arte per UX nell'Automotive oggi?**
3. **Come si disegna la UX nell'Automotive oggi?**
4. **Quale futuro per la UX in ambito automotive? Di cosa dovremo tenere conto?**

L'EVOLUZIONE TECNOLOGICA DAL 1800 AL 2020

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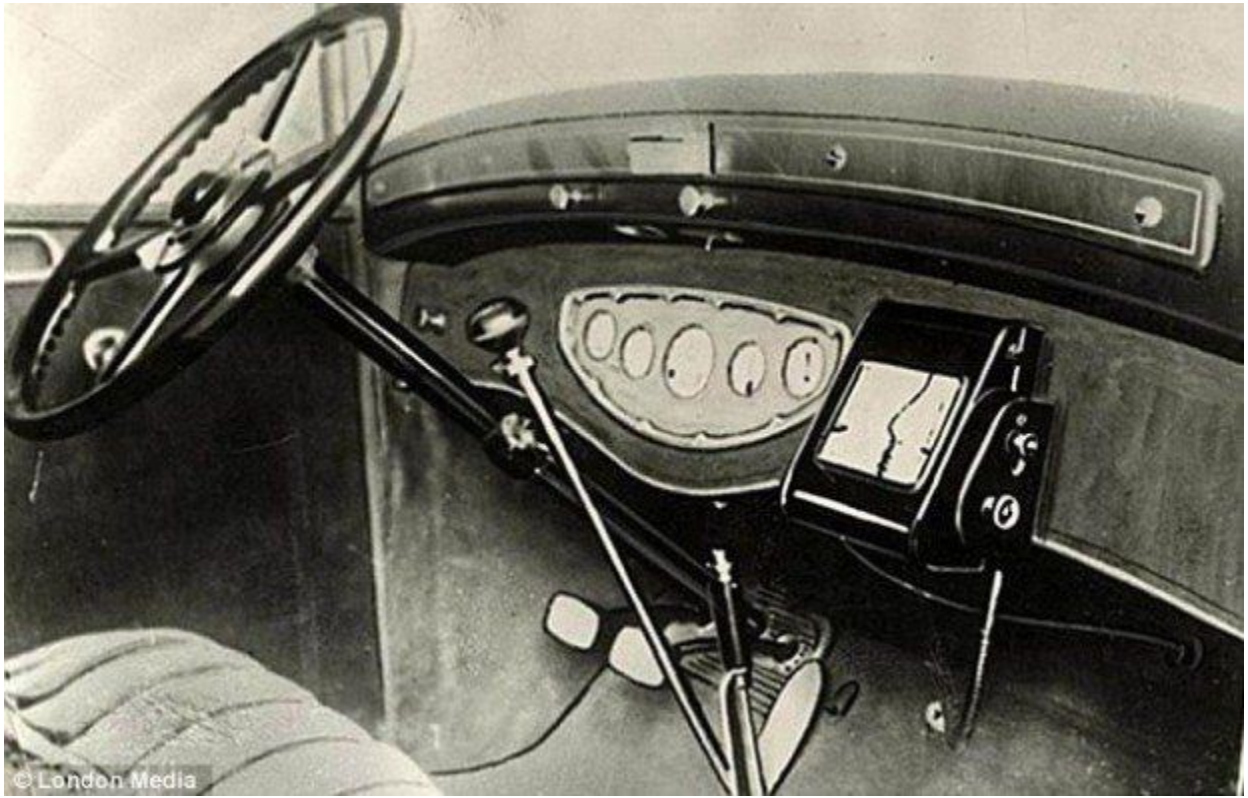

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USER EXPERIENCE an emerging job opportunity

Mercoledì 10 Giugno 2020

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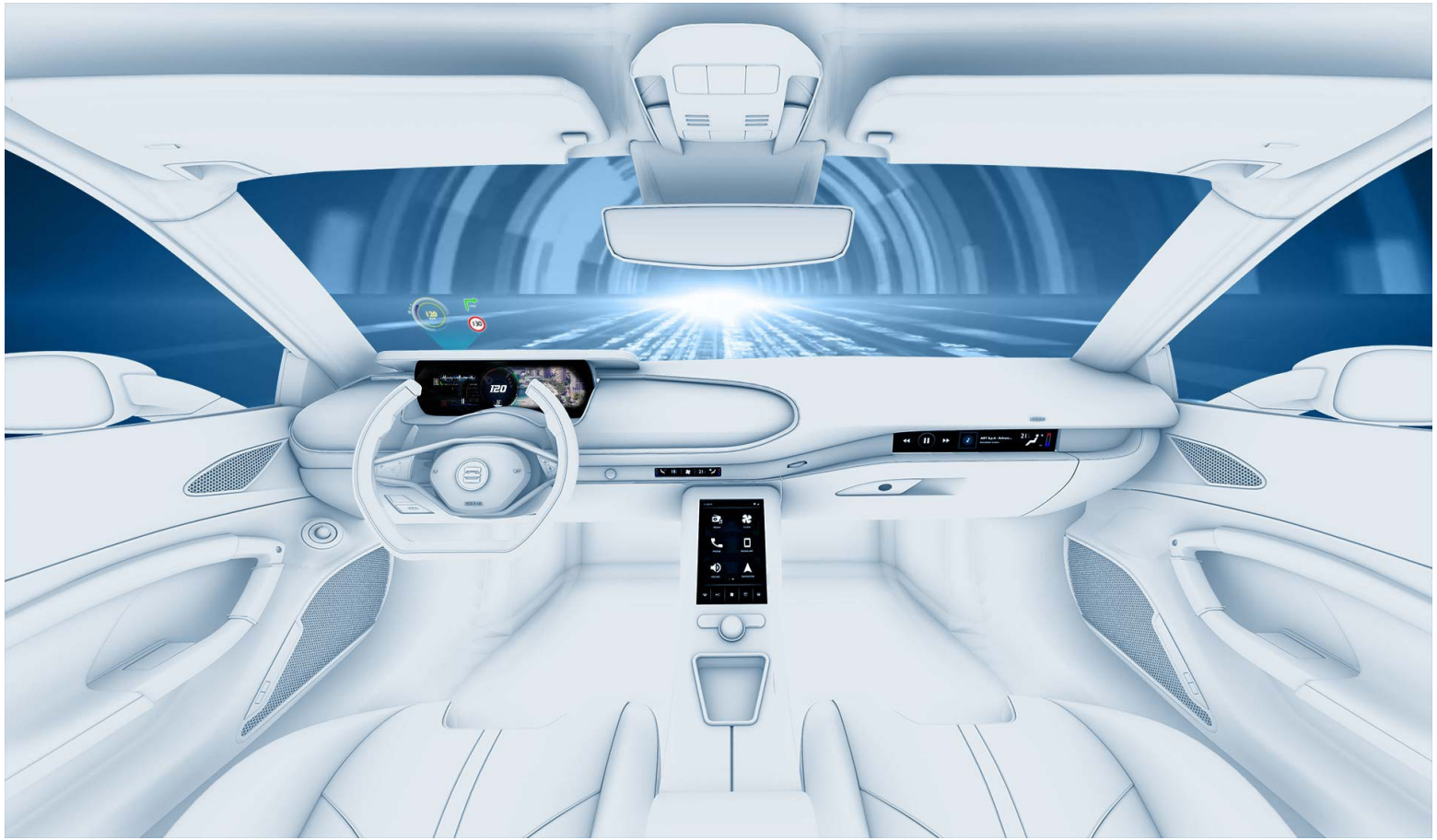
L'EVOLUZIONE TECNOLOGICA DAL 1800 AL 2020



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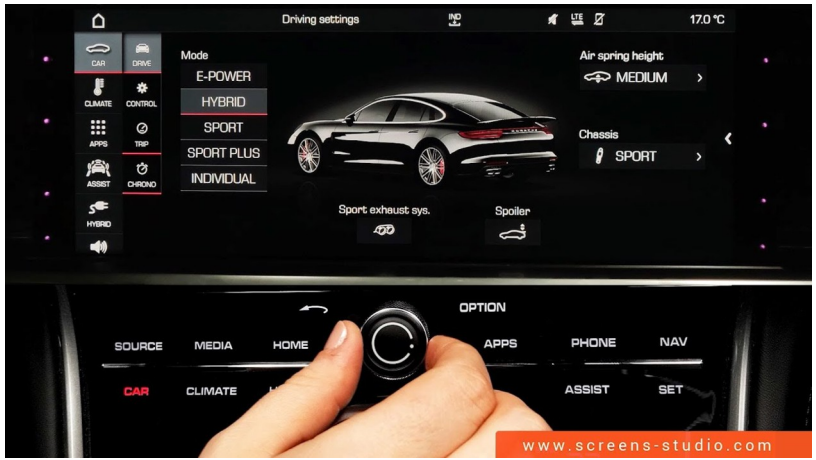

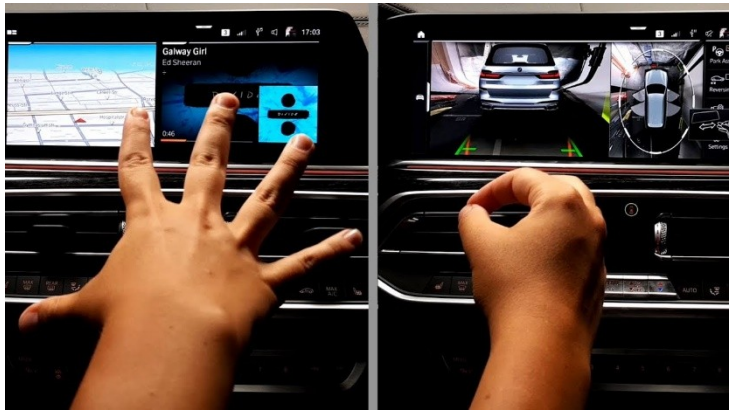

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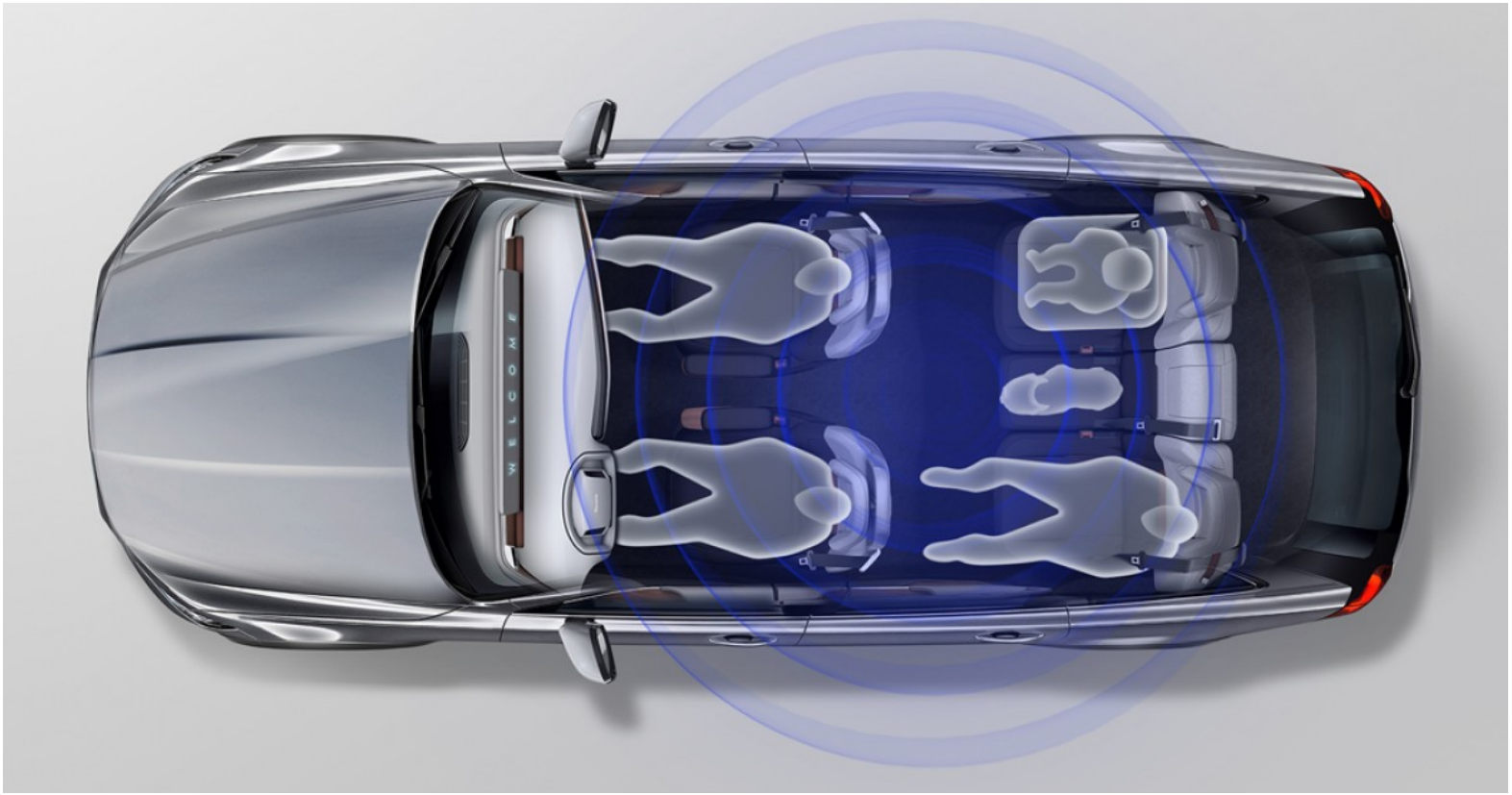
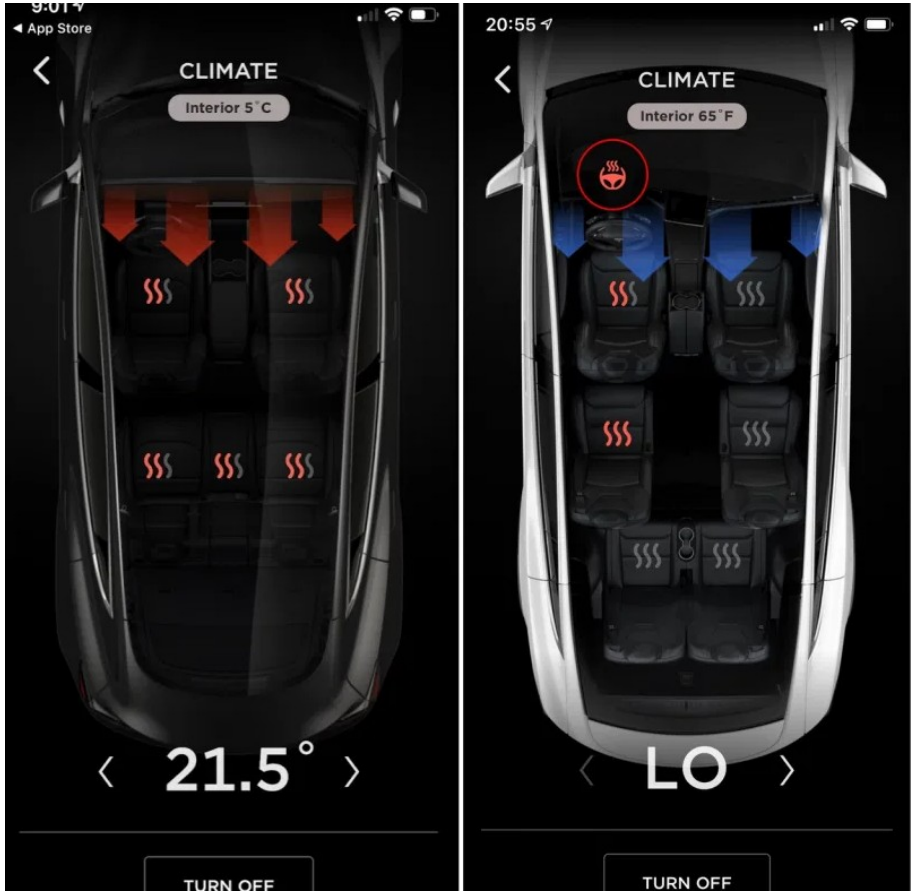
AUTOMOTIVE UX OGGI

CHILD PRESENCE SENSORS



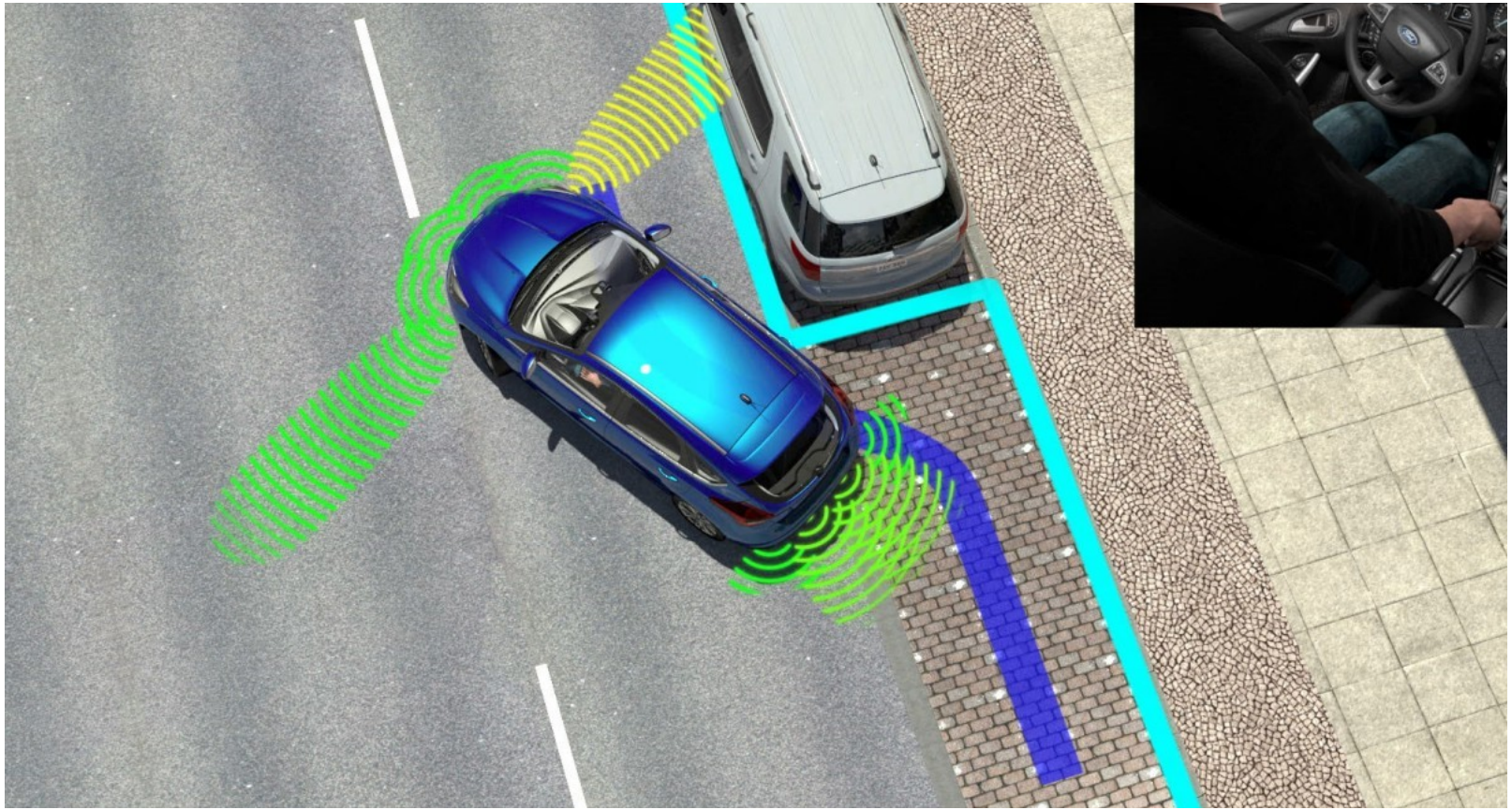
SEAT HEATING



PHONE AS A KEY

VOCAL ASSISTANCE

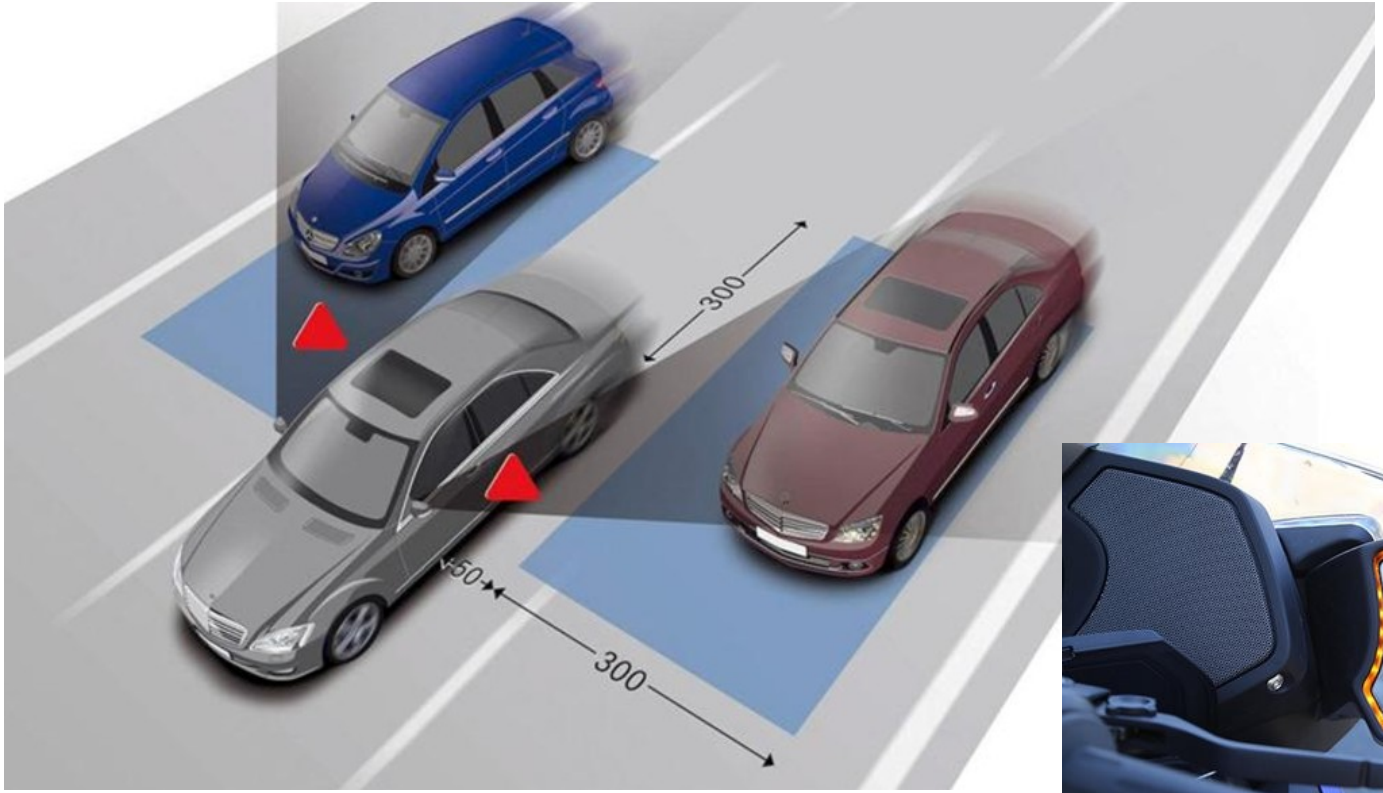
FULLY AUTONOMOUS PARKING



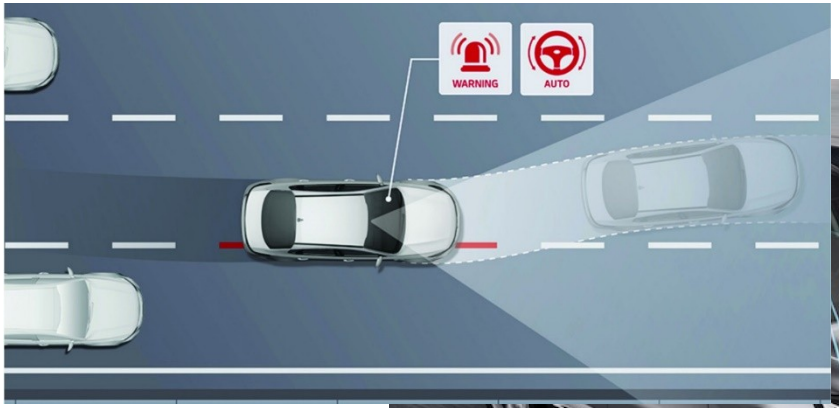
INTERFACE REPLICATION

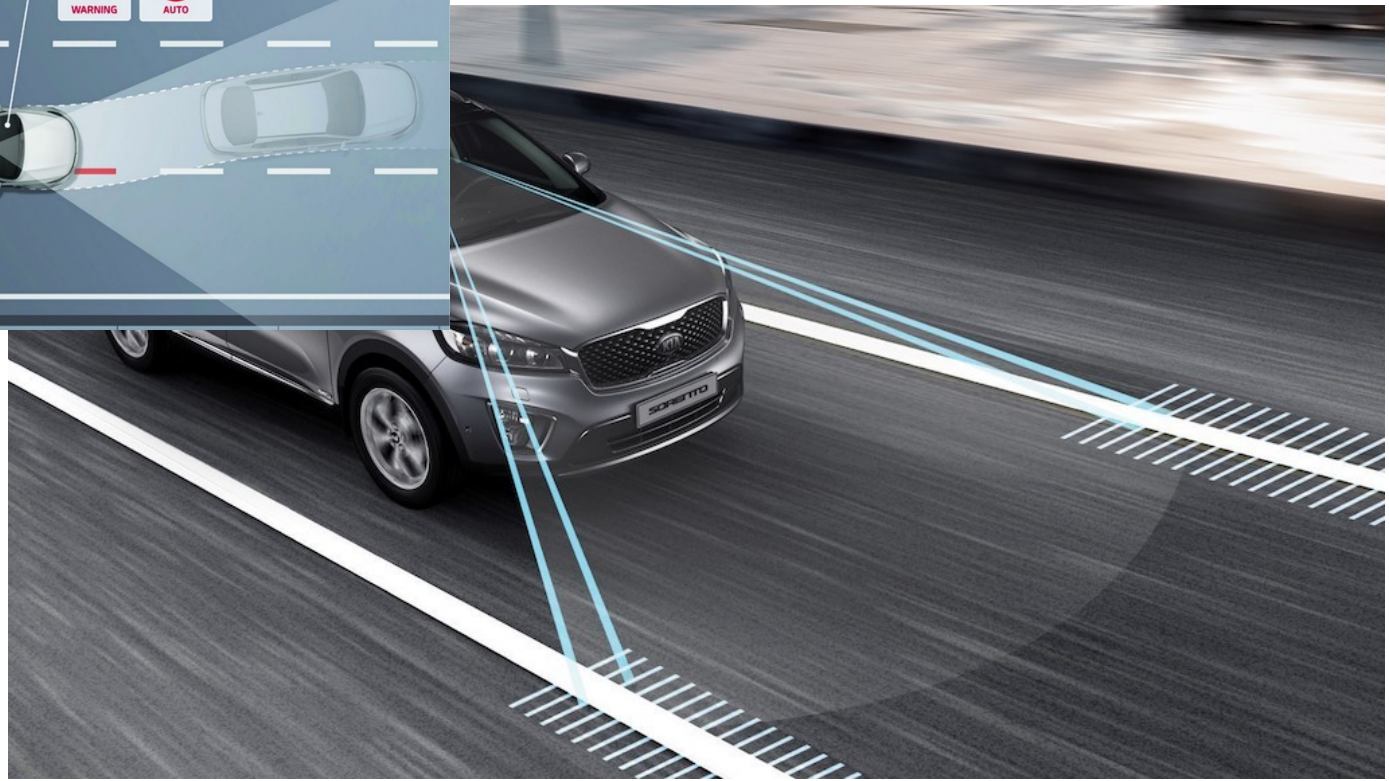
REVERSE AWARENESS

BLIND SPOT DETECTION

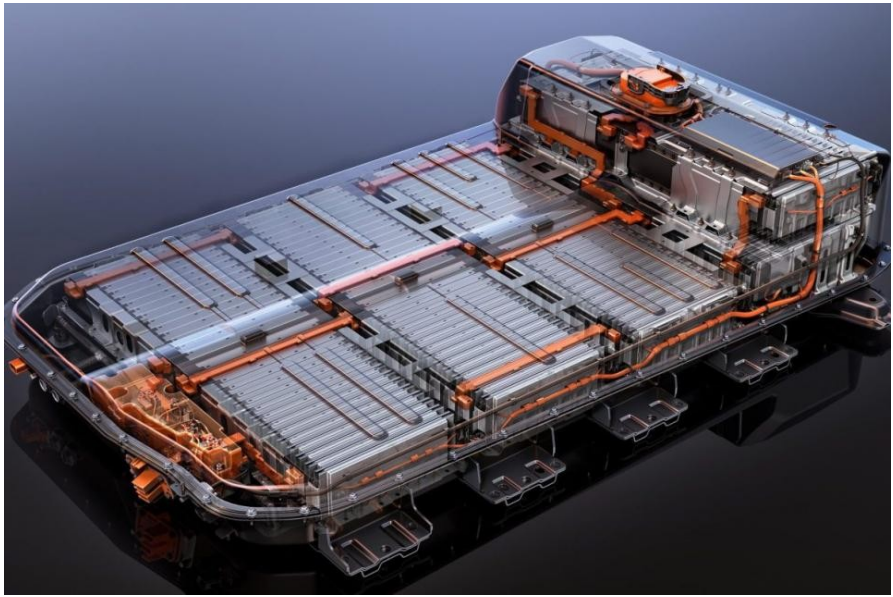


LANE-KEEPING





ELETTRIFICAZIONE DEL PARCO AUTO



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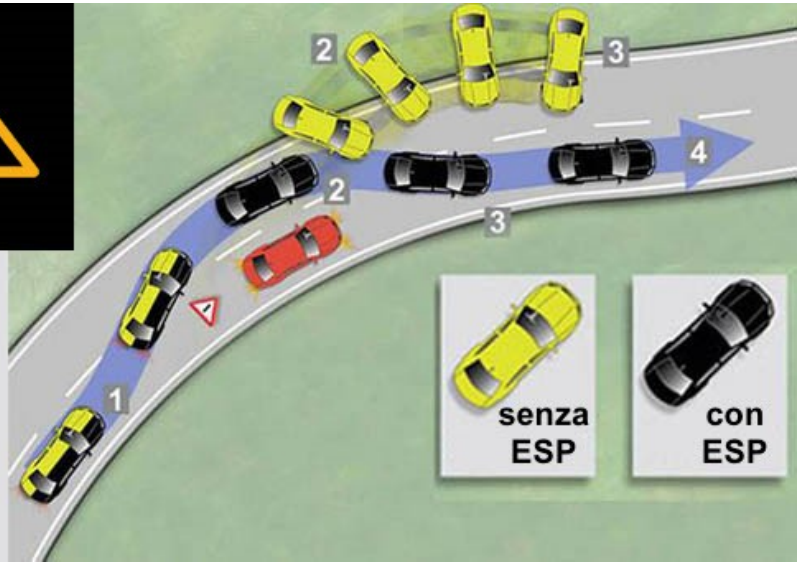
CONTROLLO ELETTRONICO DI STABILITA'

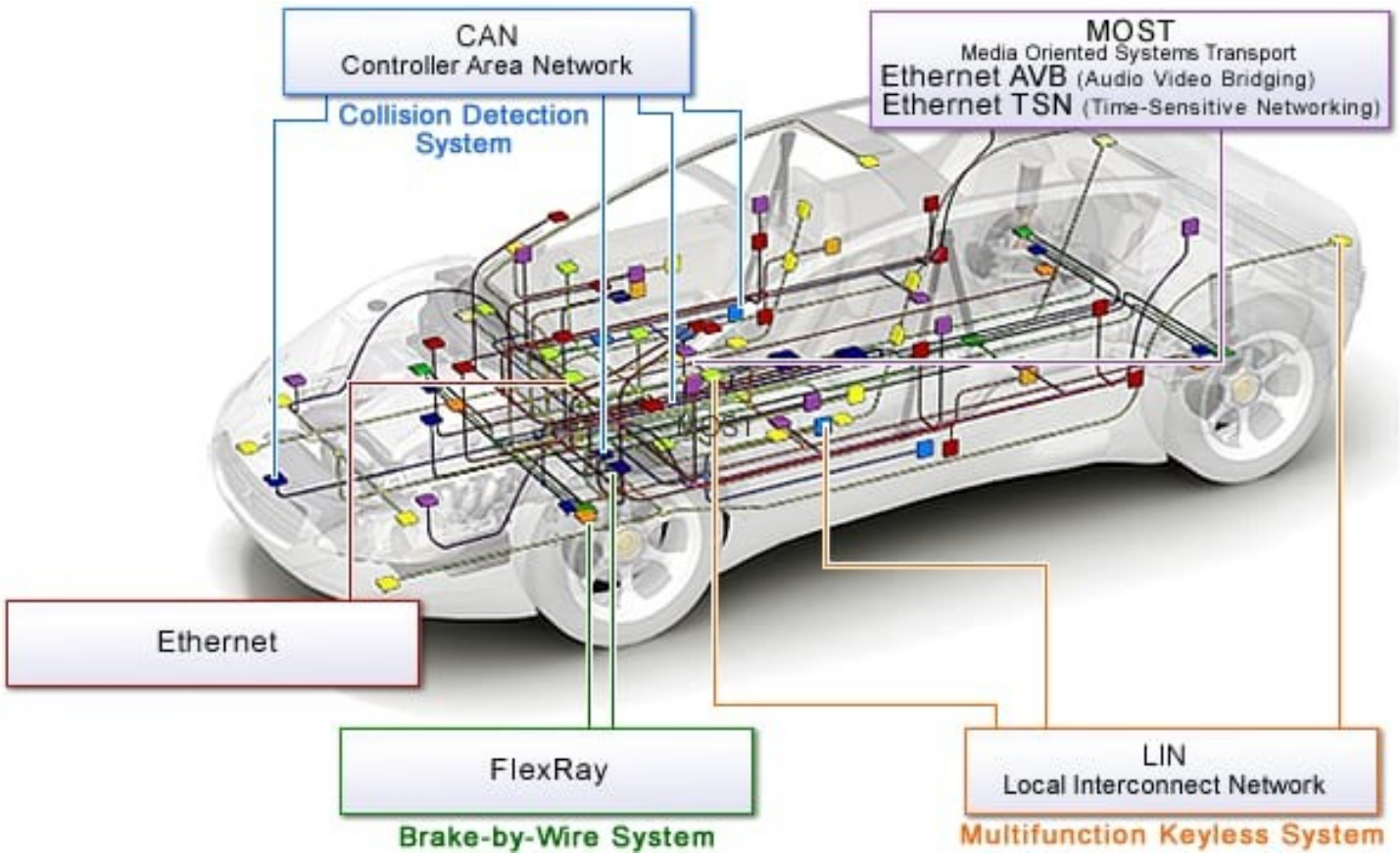
SPIA ESP



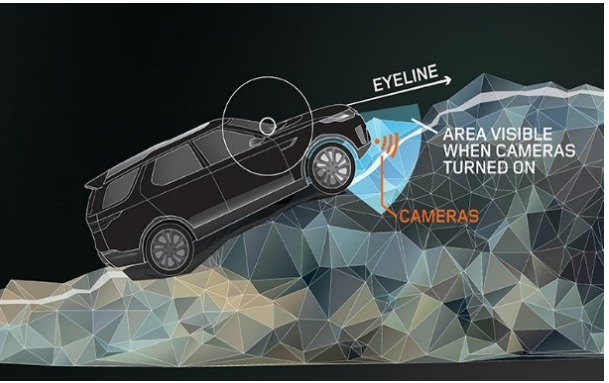
BlogMotori
www.blogmotori.com

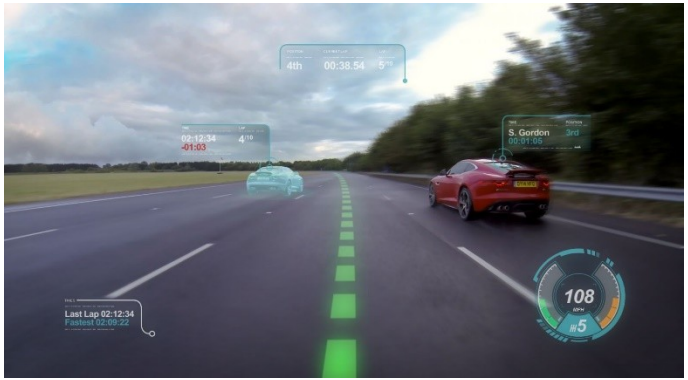
VOICE-CONTROLLED INTERFACES

IN-VEHICLE NETWORKING



MOTORSPORT E TELEMETRIA





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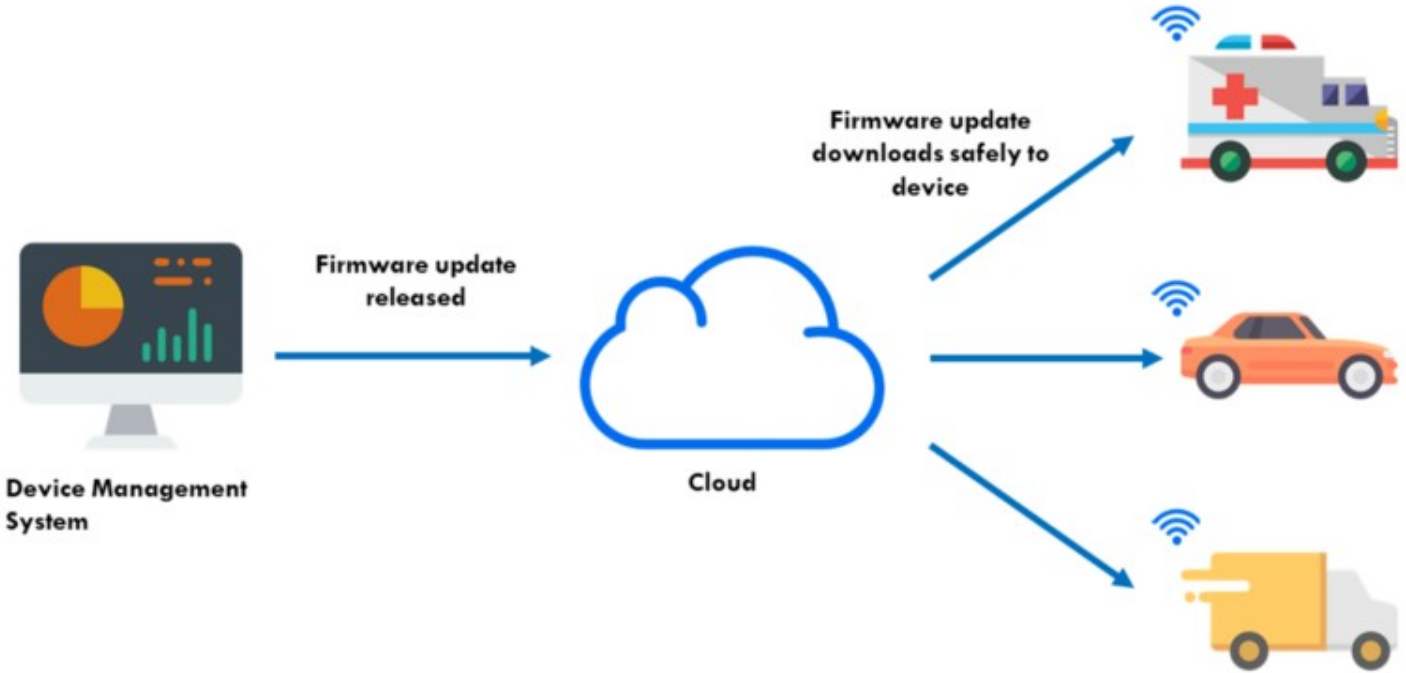
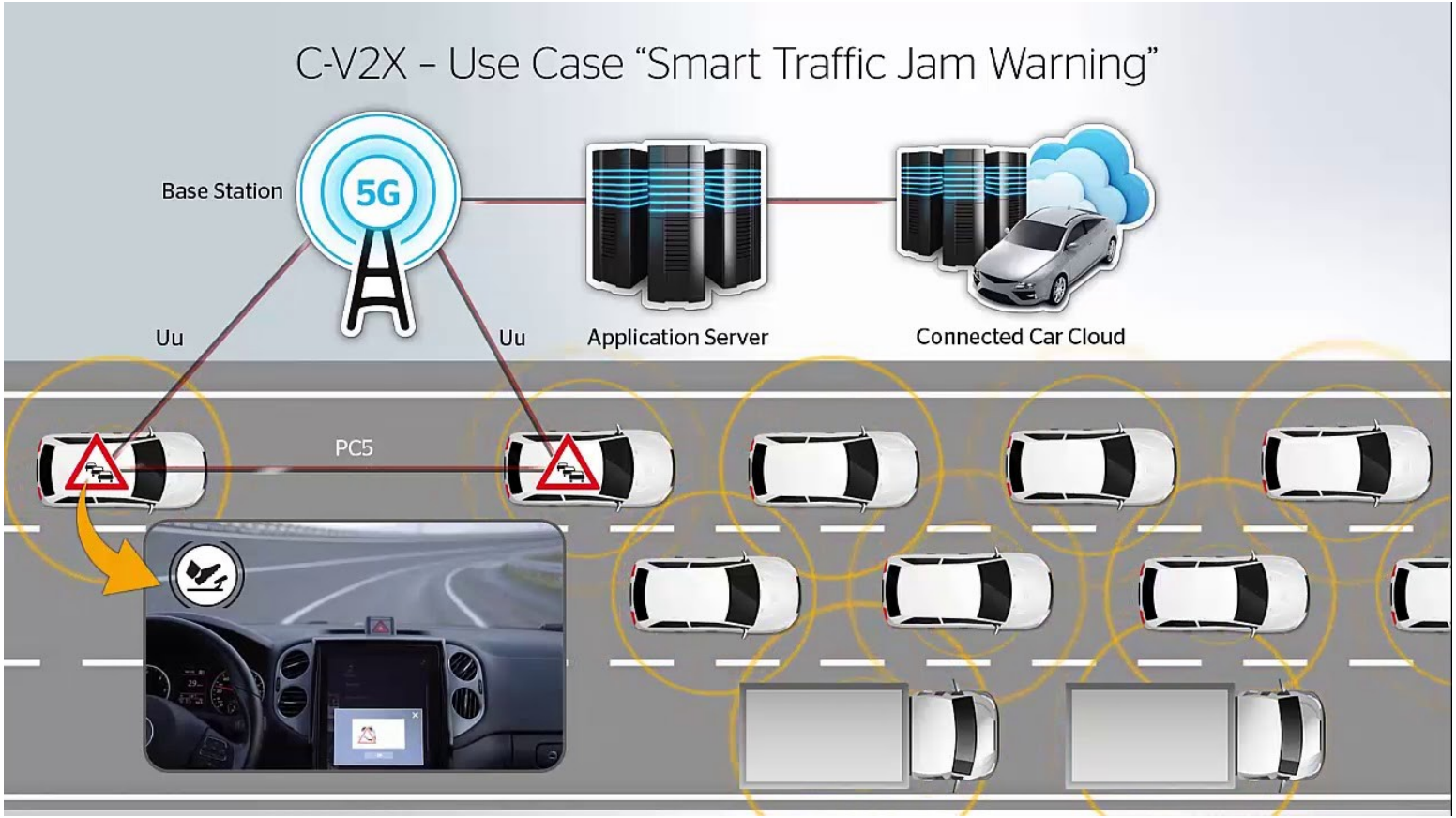
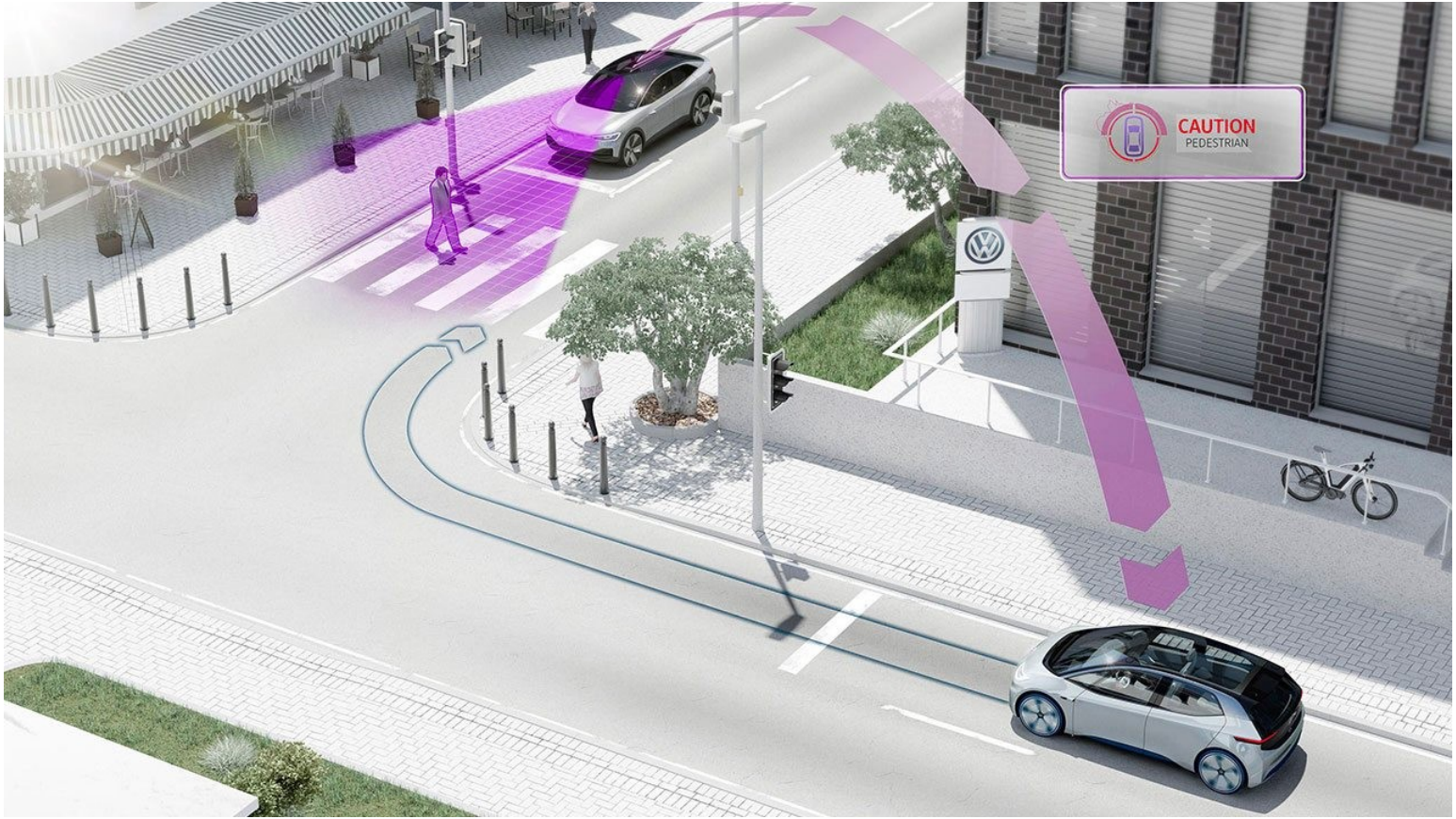
AGGIORNAMENTI SW OVER THE AIR (OTA)



SCENARI DELLA V2X



SCENARI DELLA V2X



DISEGNARE LA UX NELL'AUTOMOTIVE DI OGGI

DISEGNARE LA UX NELL'AUTOMOTIVE DI OGGI

1. Il valore sociale che un'automobile ricopre in una determinata cultura;
2. Il contesto sociale entro cui l'automobile svolge la sua funzione;
3. La variabilità dei paradigmi e delle prospettive del design nel tempo;
4. L'evoluzione tecnologica e dei modelli di business che hanno effetto diretto ed indiretto sul prodotto automobilistico e sul suo uso;
5. L'architettura su cui nascono gamme di modelli; più un'architettura è flessibile, maggiore sarà la gamma di prodotti che la popolerà;
6. Disegnare sulla persona con l'User Centered Design

DISEGNARE LA UX NELL'AUTOMOTIVE DI OGGI

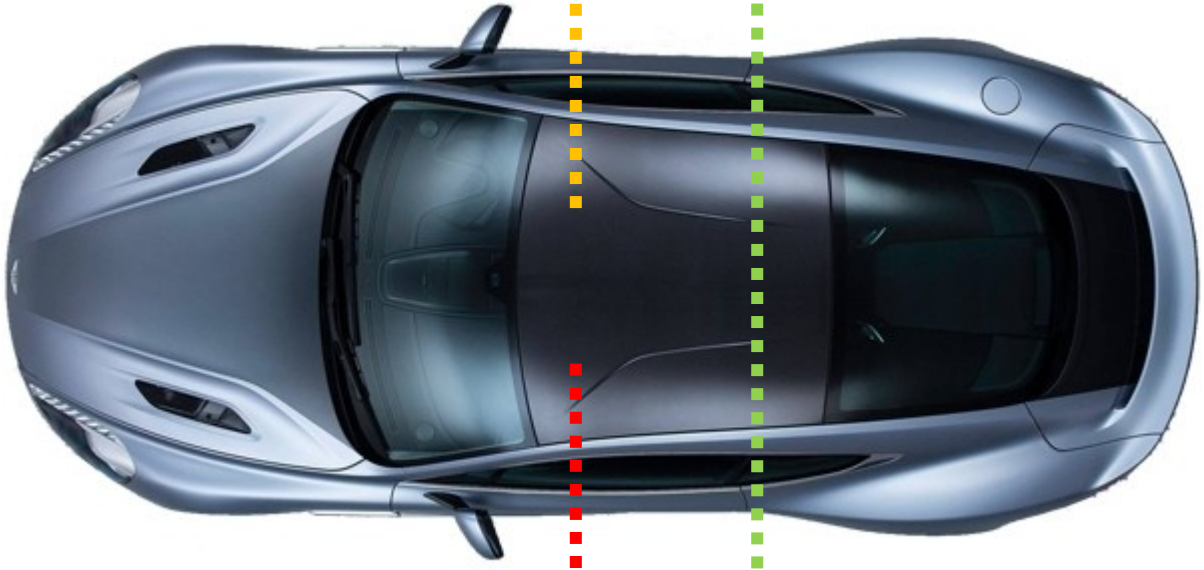
1. Il valore sociale che un'automobile ricopre in una determinata cultura;

2. Il contesto sociale entro cui l'automobile svolge la sua funzione;

DISEGNARE LA UX NELL'AUTOMOTIVE DI OGGI

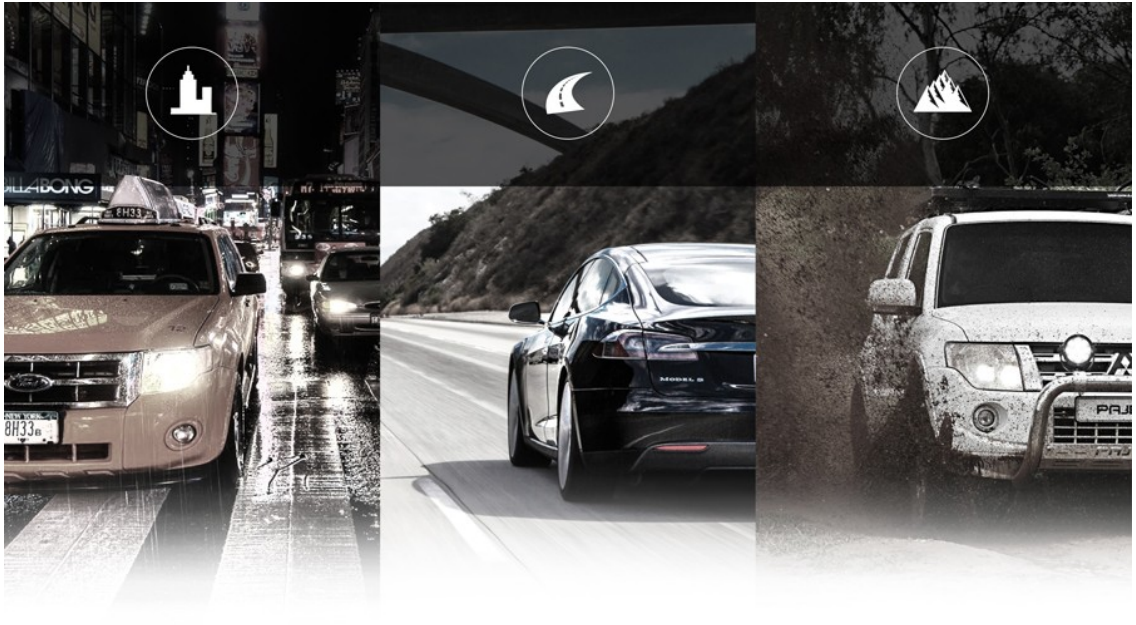
PASSEGGERO ANTERIORE
Sorgente di distrazione o di indicazioni

PASSEGGERO POSTERIORE
Visione onnicomprensiva dell'abitacolo



GUIDATORE
Area di interazioni critiche per la sicurezza

DISEGNARE LA UX NELL'AUTOMOTIVE DI OGGI



URBAN

High traffic volume
Low traffic speed
Chaotic traffic order
Bad road conditions

HIGHWAY

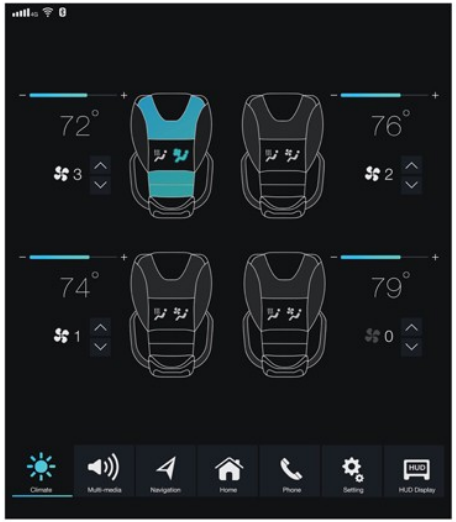
High traffic speeds
Orderly traffic order
Singular traffic type

COUNTRY

Multiple traffic types
Bad road conditions
Bad weather conditions

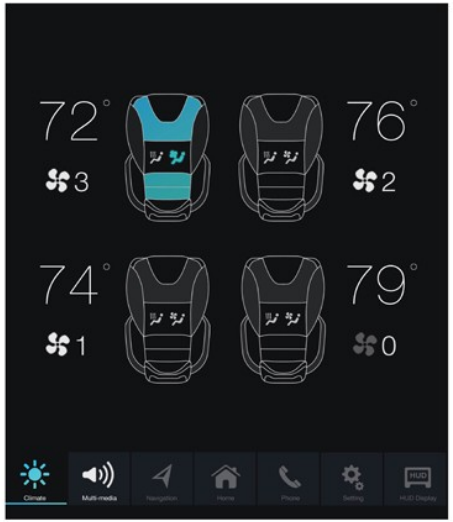
DISEGNARE LA UX NELL'AUTOMOTIVE DI OGGI

FULL ACCESS



VS

DRIVING MODE



More options for customization

20 Touch Buttons

Font Size: 72

Focused on information display

10 Touch Buttons (50% less)

Font Size: 72 72

(50% bigger)

DISEGNARE LA UX NELL'AUTOMOTIVE DI OGGI

3. La variabilità dei paradigmi e delle prospettive del design nel tempo;

DISEGNARE LA UX NELL'AUTOMOTIVE DI OGGI

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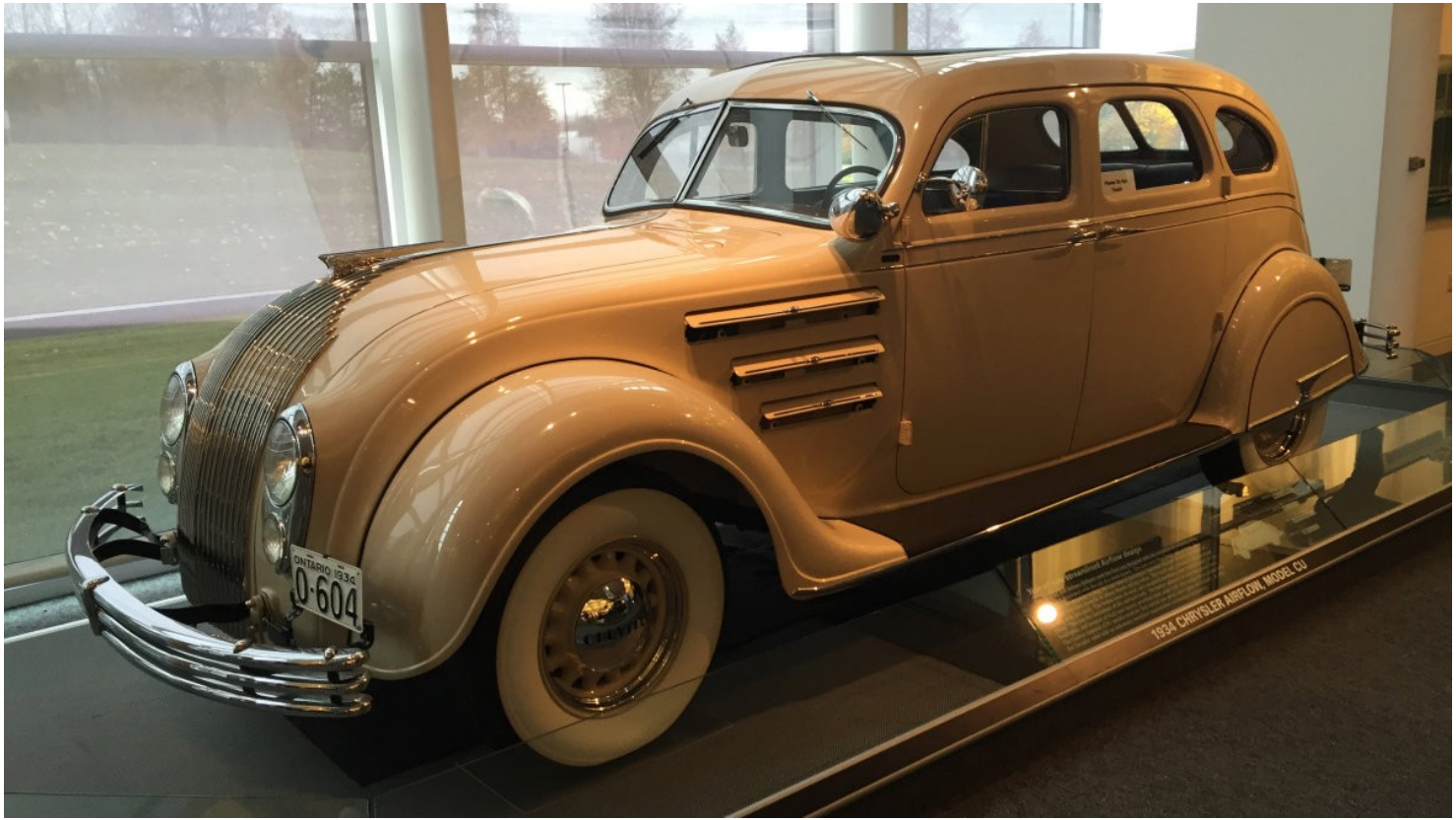
4. L'evoluzione tecnologica e dei modelli di business che hanno effetto diretto ed indiretto sul prodotto automobilistico e sul suo uso;

MERCEDES CLASSE E – AIRBAG CASE

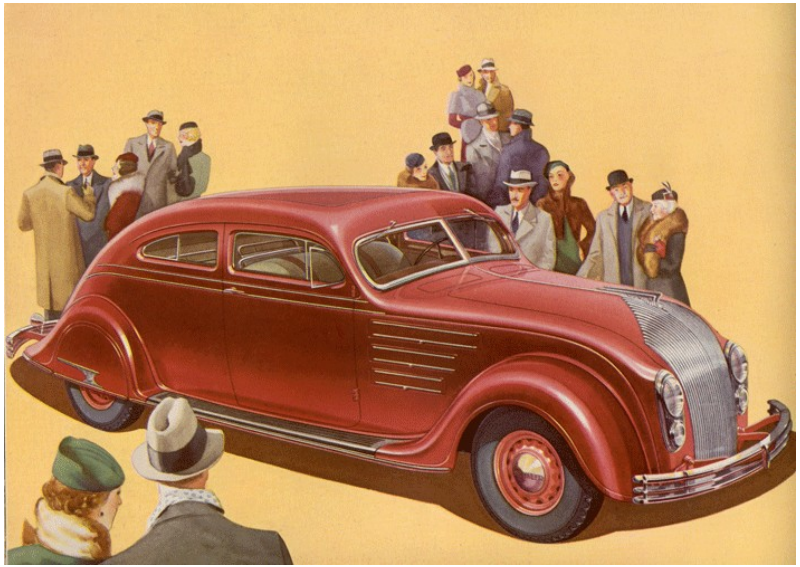
SMART VISION EQ FORTWO

SMART VISION EQ FORTWO

CHRYSLER AIRFLOW 1934

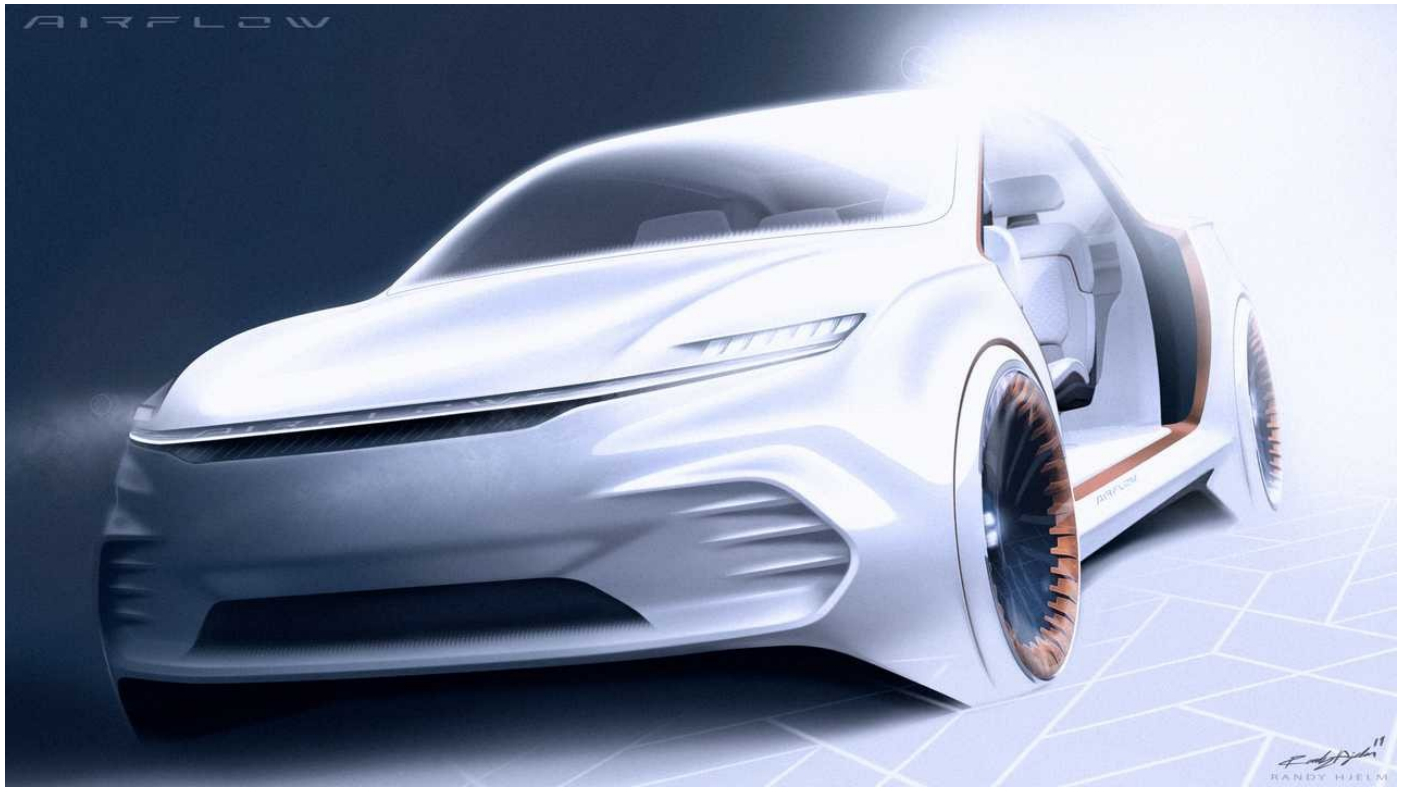


CHRYSLER AIRFLOW 1934



CHRYSLER AIRFLOW 1934

CHRYSLER AIRFLOW VISION 2020 – by FCA



CHRYSLER AIRFLOW VISION 2020 – by FCA

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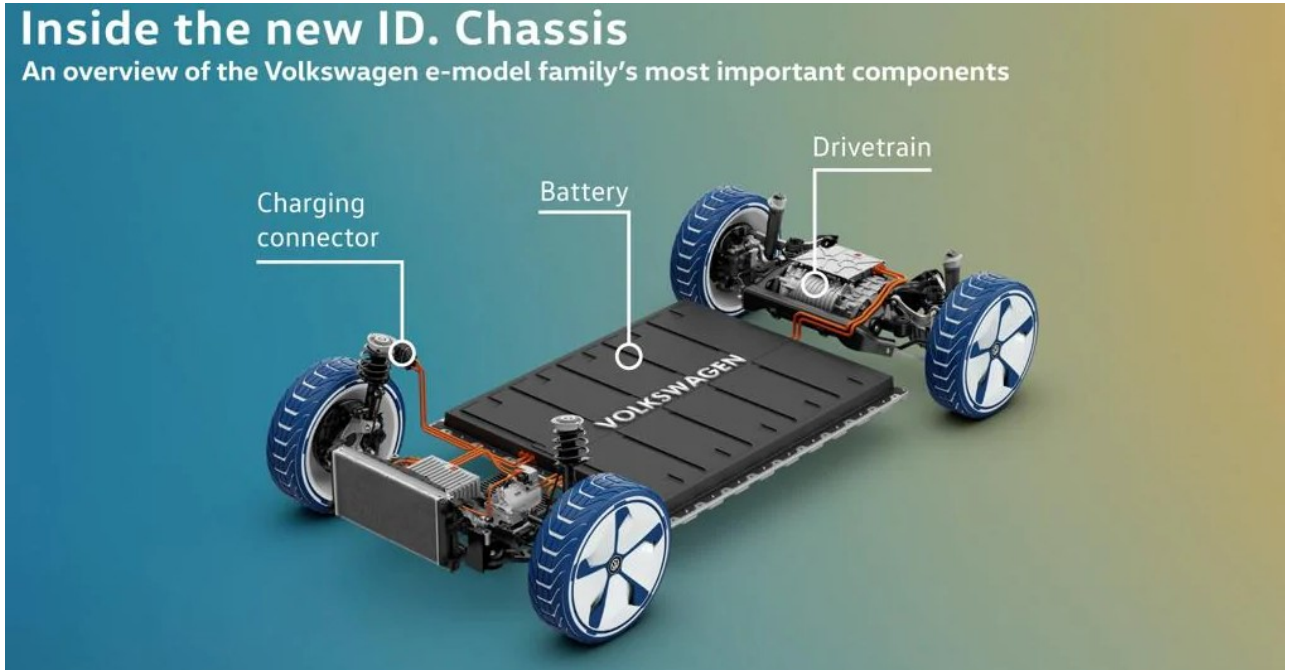
CHRYSLER AIRFLOW VISION 2020 – by FCA

5. L'architettura su cui nascono gamme di modelli; più un'architettura è flessibile, maggiore sarà la gamma di prodotti che la popolerà;



5. L'architettura su cui nascono gamme di modelli; più un'architettura è flessibile, maggiore sarà la gamma di prodotti che la popolerà;

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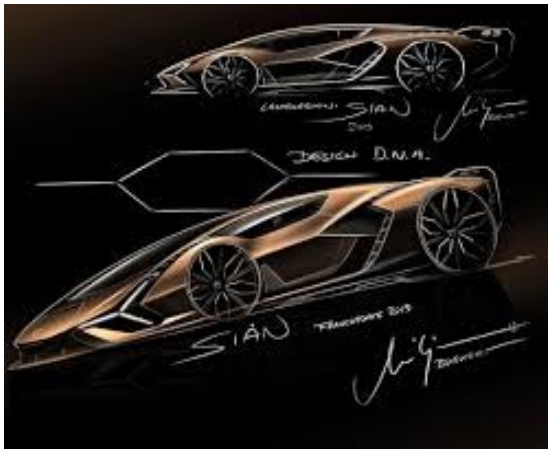
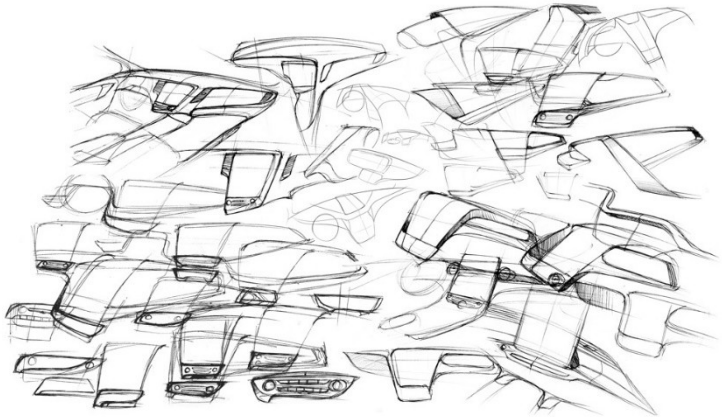
COME PROGETTIAMO LE ESPERIENZE FUTURE ?

COME PROGETTARE L'AUTOMOTIVE DEL FUTURO ?





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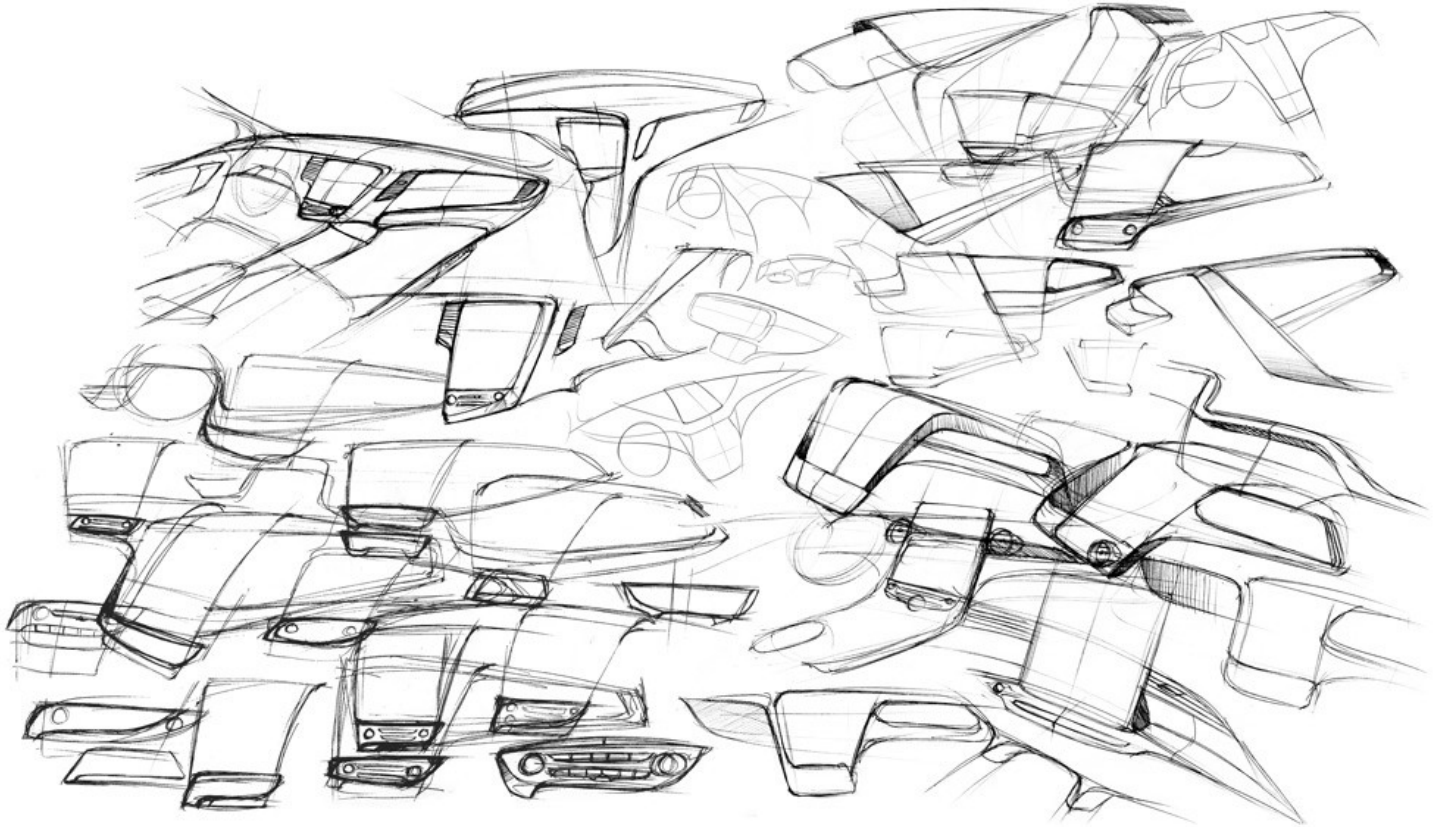
GRAZIE!

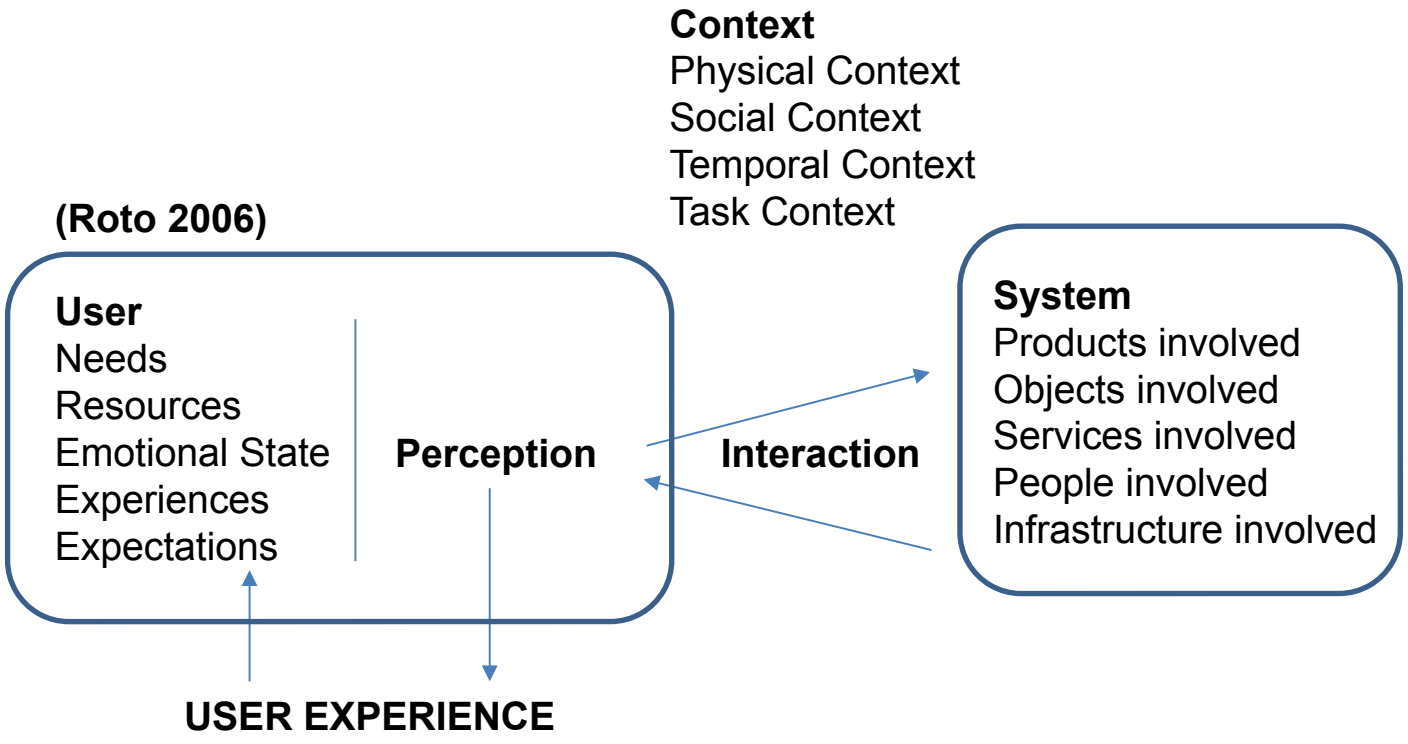


DEFINIRE L'ESPERIENZA UTENTE

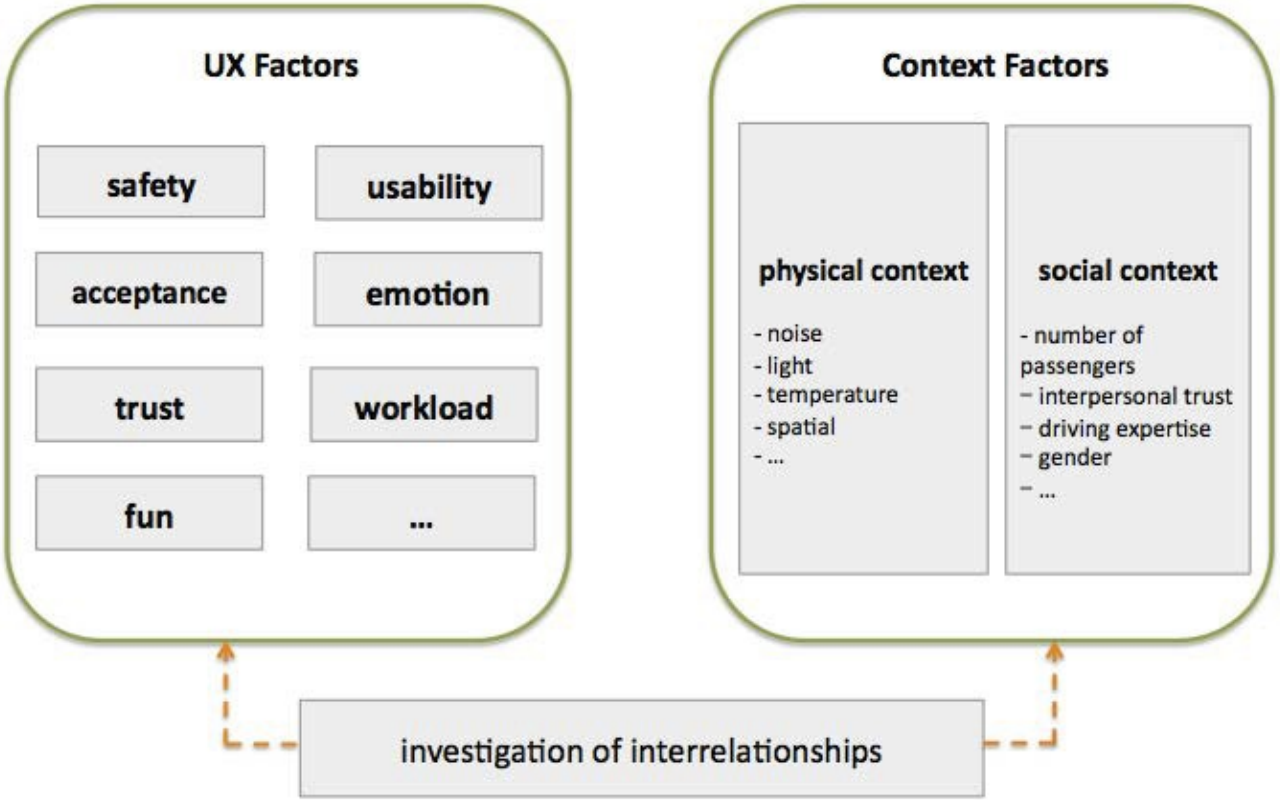
[Oppelaar 2008]:

- **Experience goes beyond the artefact**
- **Experience goes behind the actual use**
- **Experience is a momentum**
- **Analysis of experience requires multidisciplinary viewpoints**
- **Experience has a timeframe**

DEFINIRE L'ESPERIENZA UTENTE



USER EXPERIENCE CONTESTUALE



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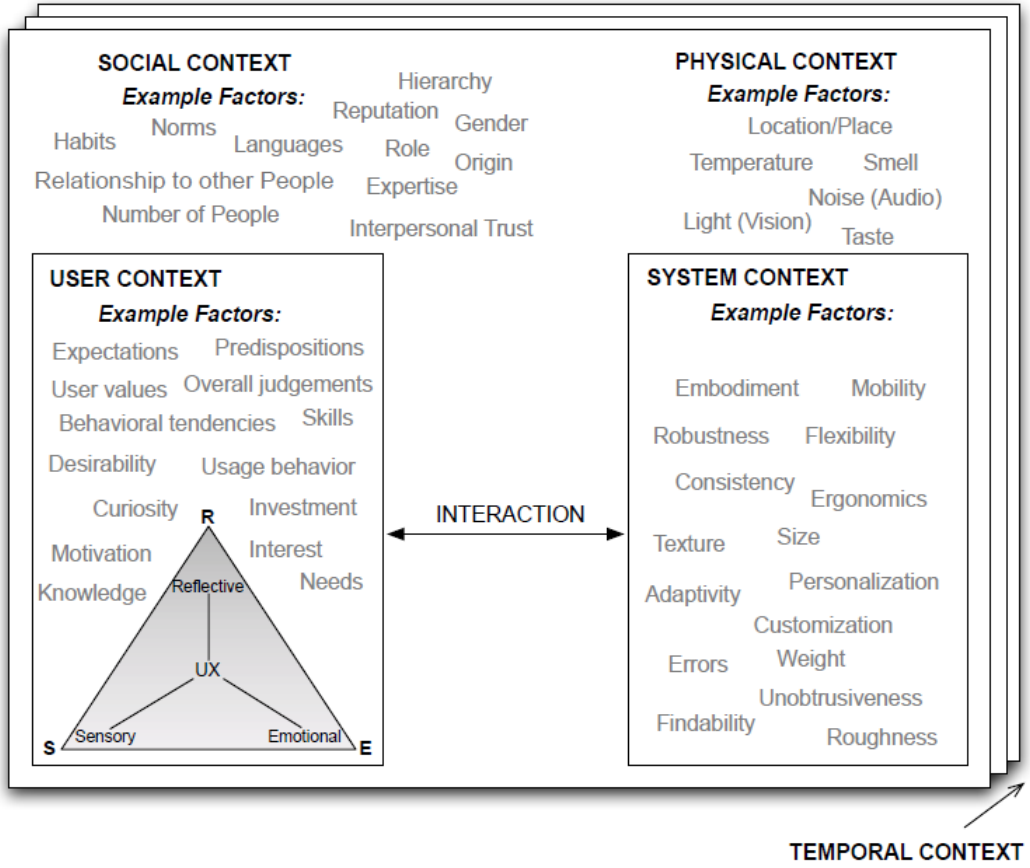

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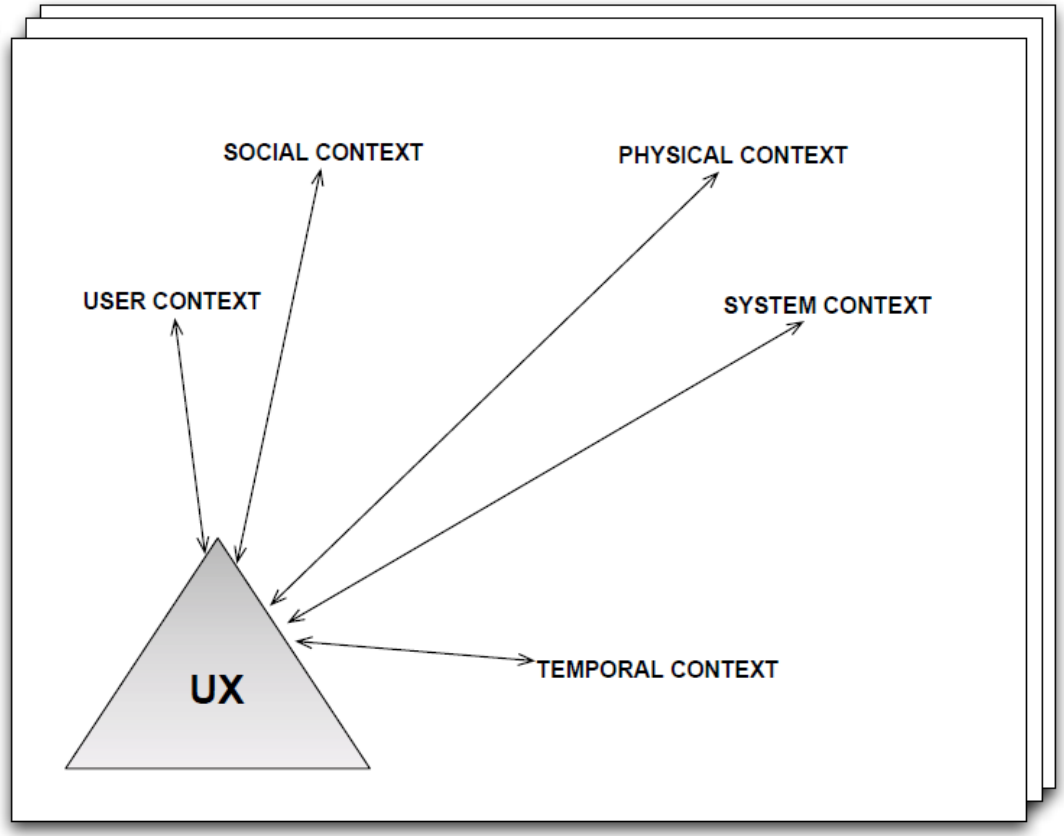
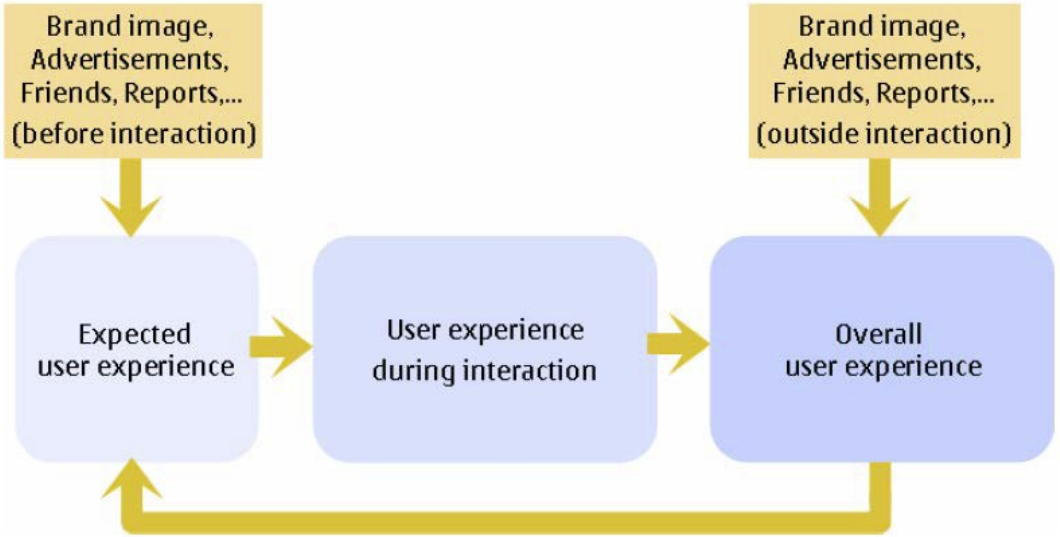


TEMPORALITA' DELL'ESPERIENZA UTENTE

"User experience is the complete experience of a user before, during or after the use of a product or service, directly caused or changed by this product or service. There are many aspects influencing the user experience, e.g. fulfillment of user needs and desires, usability aspects, emotional aspects of product usage." [Eggenkamp, 2006]



I FATTORI DELLA USER EXPERIENCE

Trust
Sensoric Attitudes / Aesthetics
Perceived Workload / Stress
Fun/Enjoyment
Usability
User Acceptance
Co-Experience
Perceived Safety
Emotion

LA FIDUCIA

Trust is a basic organizing principle of interpersonal exchange relations. It can be described as the problem of acting without knowing the reaction of the exchange partner in advance **[Leimeister et al (2005)]**

• ***Trust is one of the most important social concept that helps human agents to cope with their social environment and is present in all human interaction*** **[Gambetta, 1990]**

LA FIDUCIA

Trust exists between a trusting party (**trustor**) and a party to be trusted (**trustee**). The development of trust depends on the ability of the trustee to act in the best interest of the trustor and the degree of trust that the trustor places on the trustee.

SENSORIC ATTITUDES / AESTHETICS

• **Everything humans perceive must enter their minds through their senses. Designing for smell, taste, touch, sound and sight is combined in the term sensorial design [Shedroff, 2001]**

• **A deeper understanding of sensorial attitudes can result in more intuitive and easy to grasp interfaces by interacting with users in an innovative way**

• **Parts of the car as design material**

PERCEIVED WORKLOAD AND STRESS

The effort invested as a response to a demand placed on humans, physical and/or mental in nature

• Limited processing capacity theory: human mental resources are limited and that their deployment is under voluntary control. The higher the demand, the more resources have to be invested in order to keep the performance stable

• Cause is both external (task demand) and internal (person specific demand)

FUN AND ENJOYMENT

Things are fun when they attract, capture, and hold our attention by provoking new or unusual perceptions, arousing emotions in contexts that typically arouse none, or arousing emotions not typically aroused in a given context. Things are fun when they surprise us; when they don't feel like they look, when they don't sound like they feel. Things are fun when they present challenges or puzzles to us as we try to make sense and construct interpretations **[Carroll, 2004].**

[Brandtzæg et al. (2003)] present three main design implications for designing enjoyable technologies:

1. ***User control and participation, with appropriate challenge***

2. ***Variation and multiple opportunities***

3. ***Social opportunities in terms of co- activity and social cohesion***

USABILITY

ISO 9241-11 (1998) specifies usability as: *The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use.*

- **Therefore it is interesting to find out, for example:**
- **Is the system easy to use?**
- **Can users quickly learn to use this system?**
- **How confident does the user feel while using the system?**

USER ACCEPTANCE

User Acceptance can be defined as “the demonstrable willingness within a user group to employ technology for the tasks it is designed to support” [Dillion, 2001]

• Technology Acceptance Model (TAM) [Davis 1989]

• Perceived Usefulness: *the extent to which the individual believes that using a system will enhance his/her job performance*

• Perceived Ease of Use: *the extent to which an individual believes using a system will be free of effort*

• Behavioral Intention of Use: *The intent of the user to use the technology once it is made available*

CO-EXPERIENCE

- ***Co-experience is about user experience in social contexts***

- ***Co-experience takes place as experiences are created together, or shared with others***

- ***Co-experience reveals how the experiences an individual has and the interpretations that are made of them are influenced by the physical or virtual presence of others***

[Forlizzi & Battarbee, 2004]

PERCEIVED SAFETY

- **The perception of humans to what extent one is safe; the perceived level of danger while using an interactive system**

- **Design and behaviour of a system can positively influence the perceived safety**

- **A high level of perceived safety might be desirable in some areas but can also lead to negative effects such as users stop paying sufficient attention when handling dangerous tasks**

- **Make user aware of the difference of perceived safety and objective safety when designing interactive systems**

EMOTION

• **The driver's emotional state is an important issue for automotive safety.**
• **Since emotions affect perception and action, they are relevant for traffic participation. A number of driving behaviors are negatively affected by emotions, linking anger or aggression to accidents (see e.g. [Lajunen & Parker, 2001].**

• **Relevant emotional states during driving are e.g :**
  - **Aggressiveness & Anger**
  - **Stress**
  - **Anxiety**
  - **Sadness**
  - **Happiness**

USER EXPERIENCE IN THE CAR

• **Apart from Usability & Usefulness, the Drivers' Experience needs to get into the focus on a more comprehensive level**

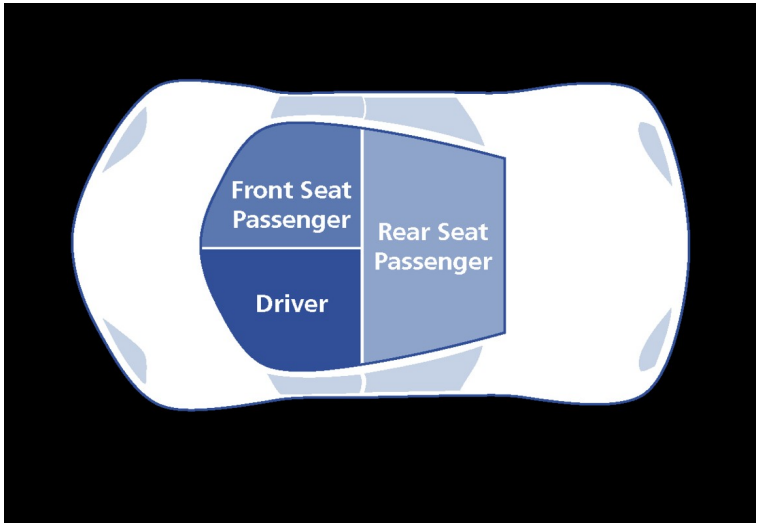
Focus: How to design cars & in-car systems that provide positive and desirable experiences to drivers and passengers?

CAR EXPERIENCE SPACES

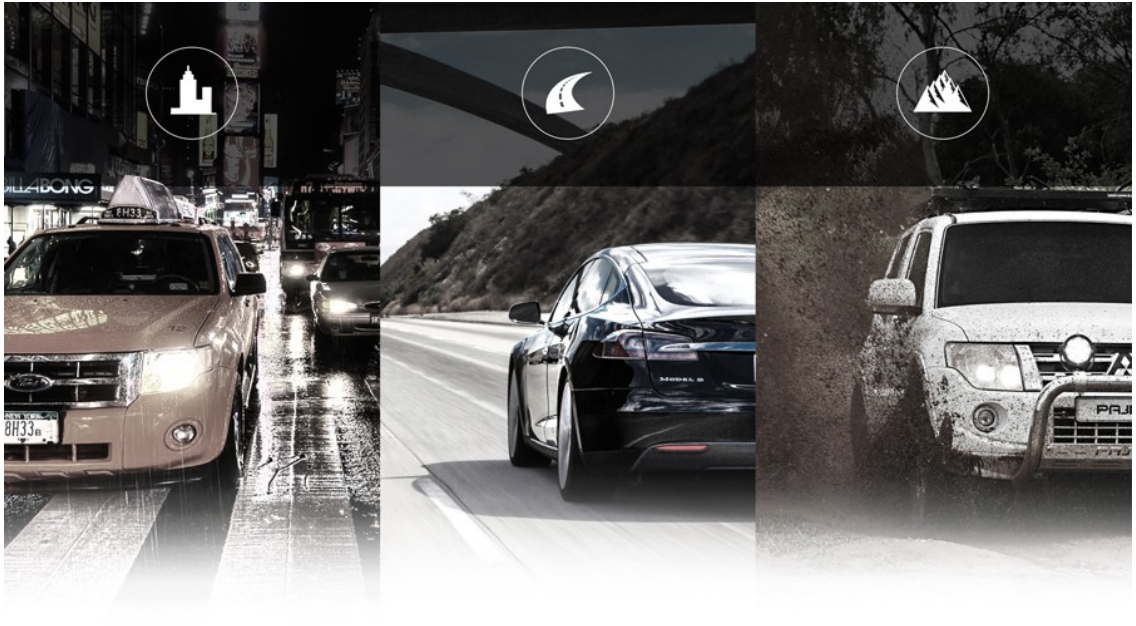
Front Seat Passenger Experience
„source of both assistance & distraction“

Driver Experience
„area of a variety of safety-critical interactions“

Rear Seat Passenger Experience
„included towards a holistic picture of the cabin“



DIFFERENT DRIVING SCENARIOS



URBAN

High traffic volume
Low traffic speed
Chaotic traffic order
Bad road conditions

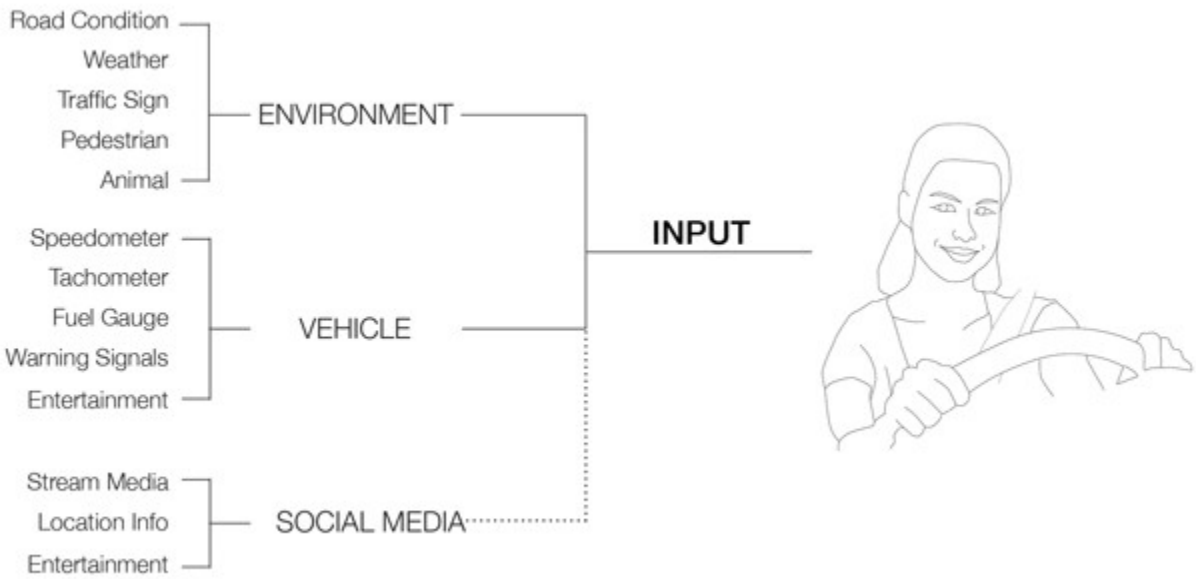
HIGHWAY

High traffic speeds
Orderly traffic order
Singular traffic type

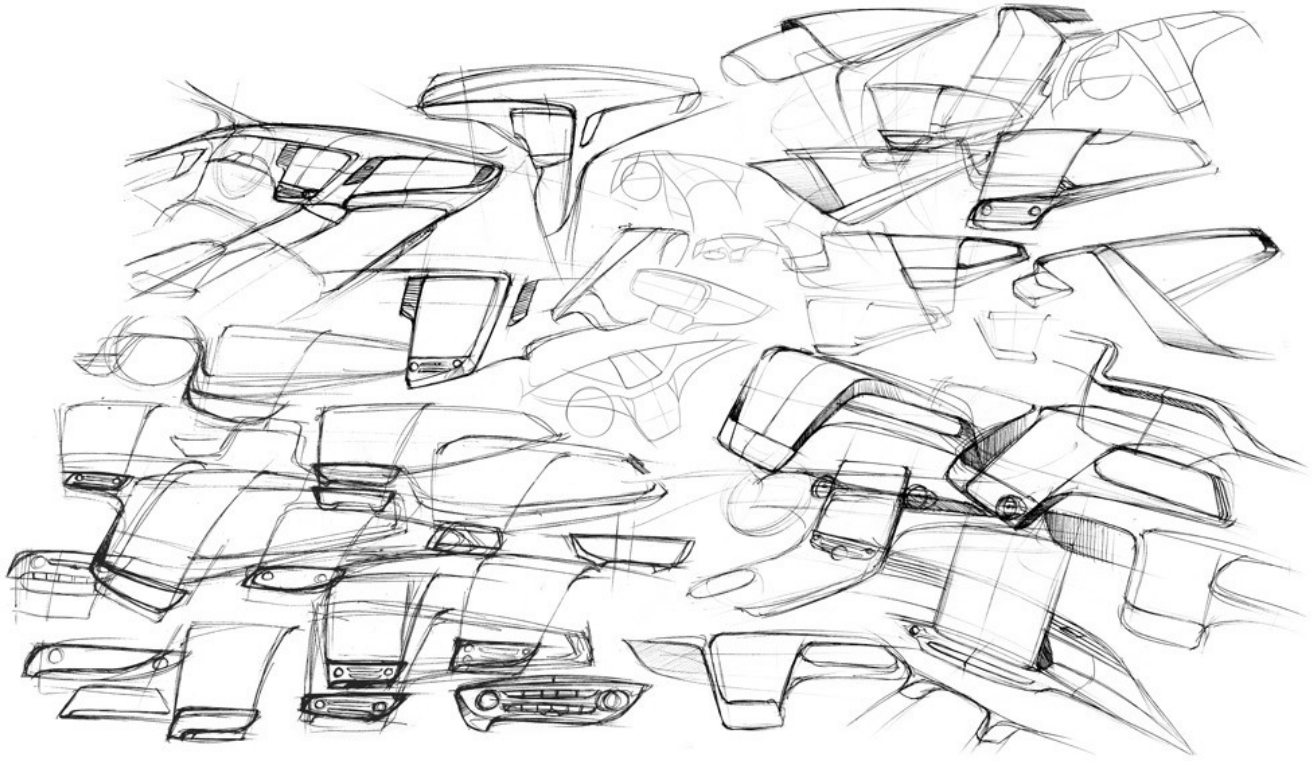
COUNTRY

Multiple traffic types
Bad road conditions
Bad weather conditions

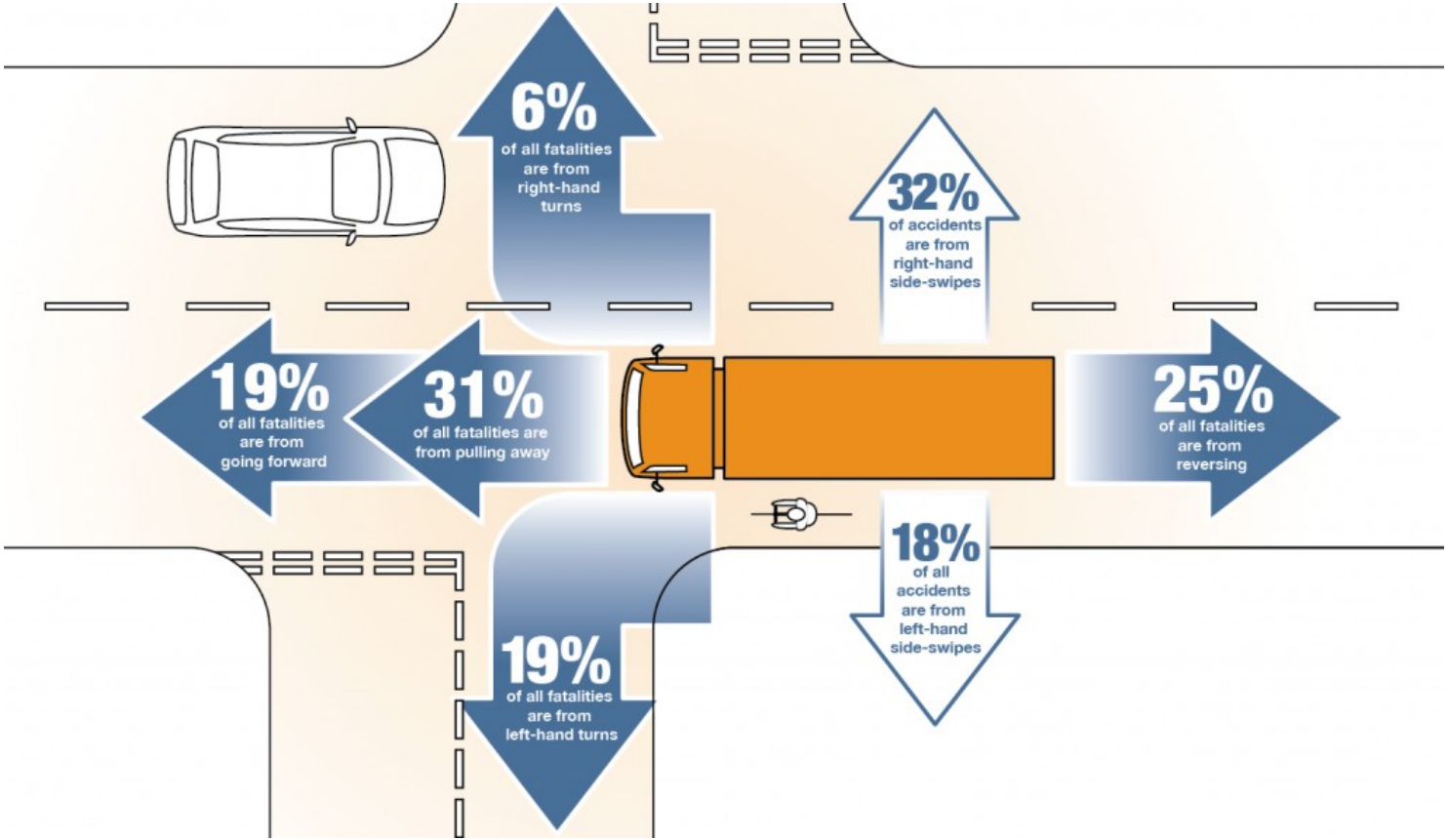
DIFFERENT DRIVING SCENARIOS



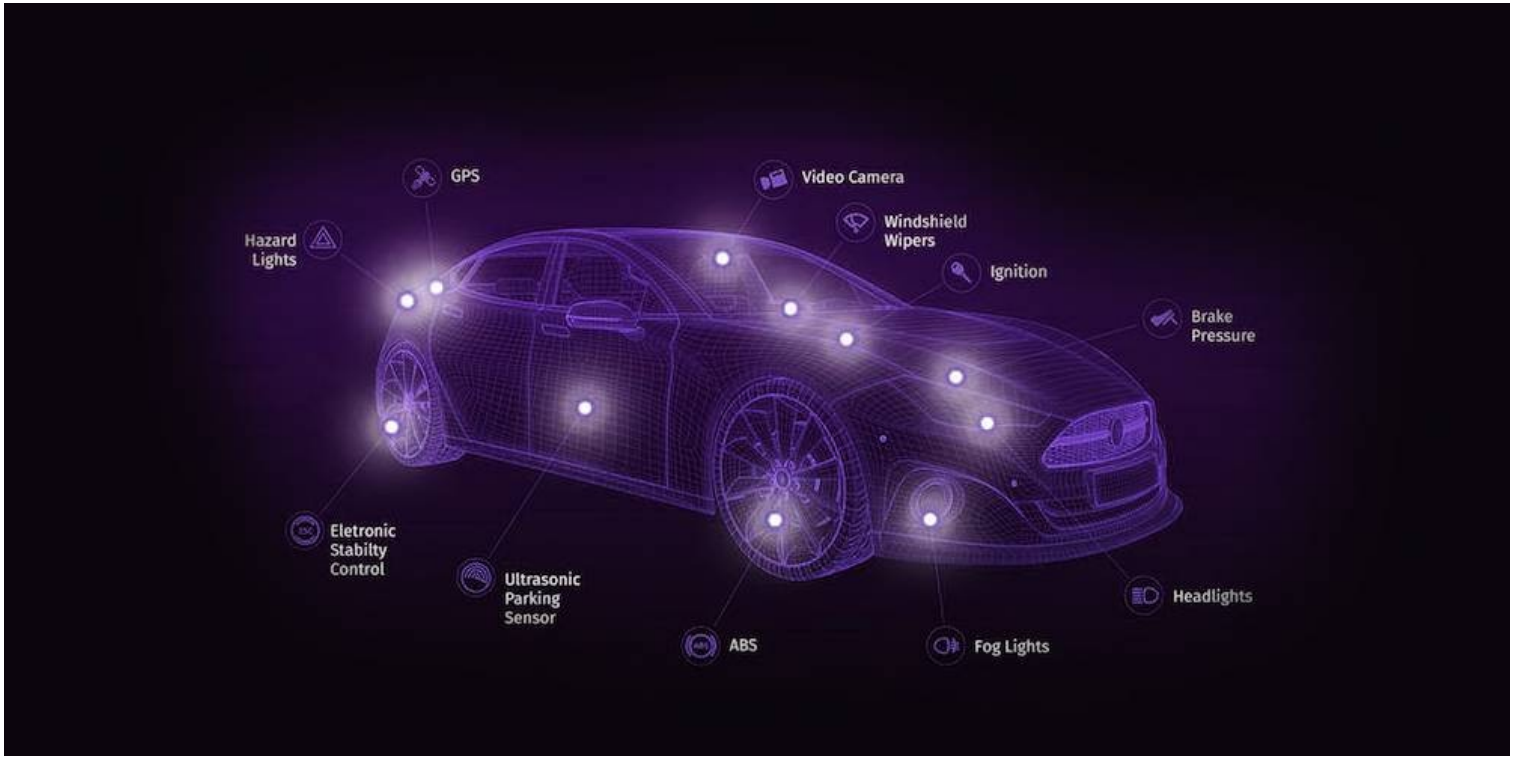
DIFFERENT DRIVING SCENARIOS



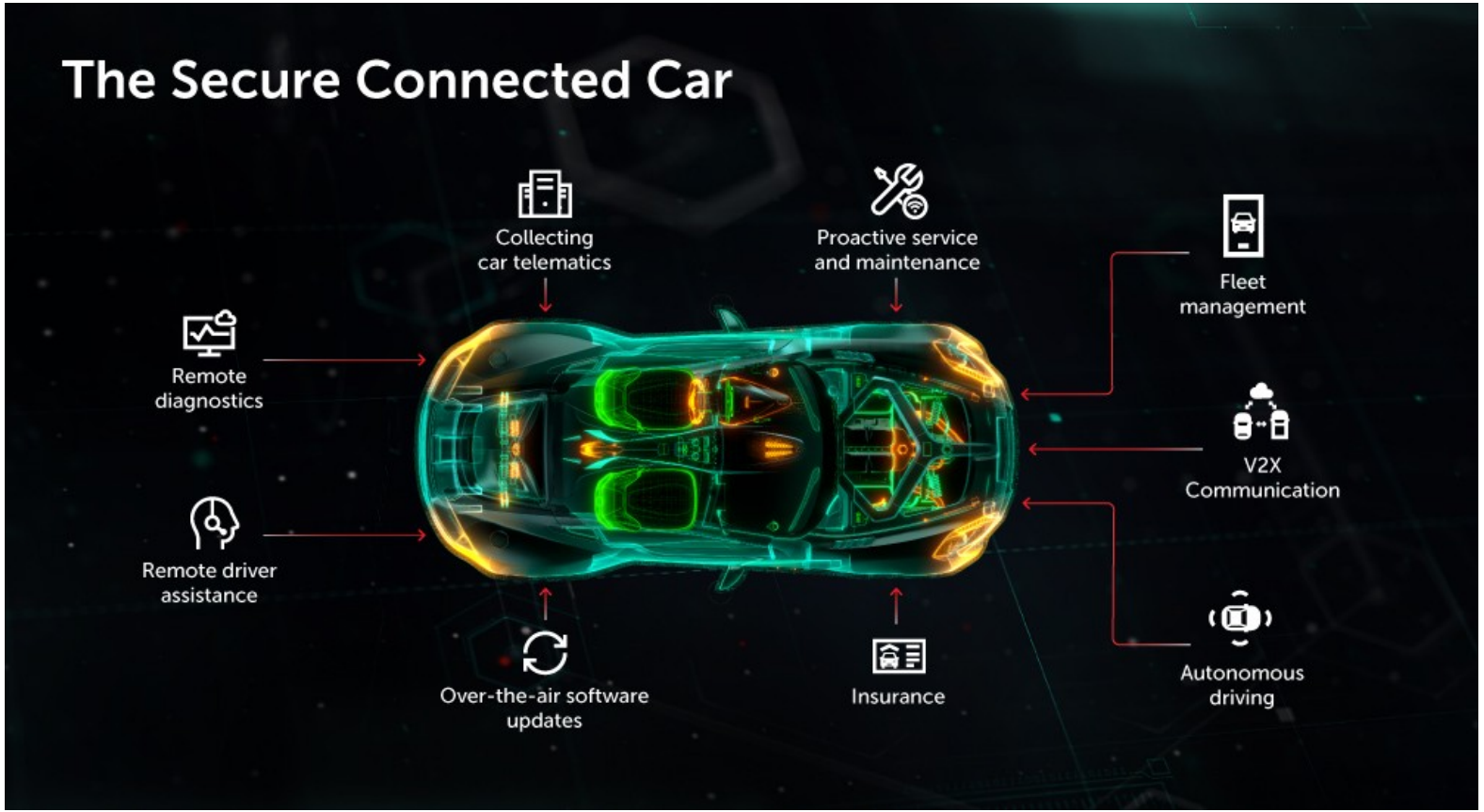
DIFFERENT DRIVING SCENARIOS



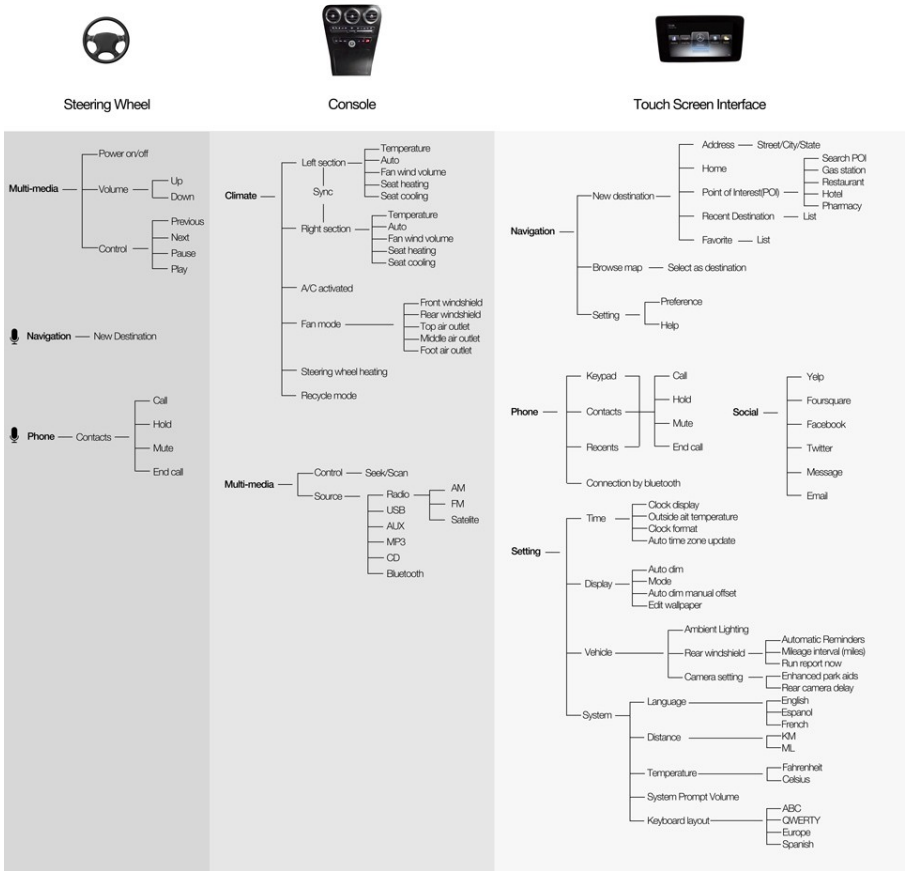
ARTIFICIAL INTELLIGENCE WILL AFFECT



ARTIFICIAL INTELLIGENCE WILL AFFECT

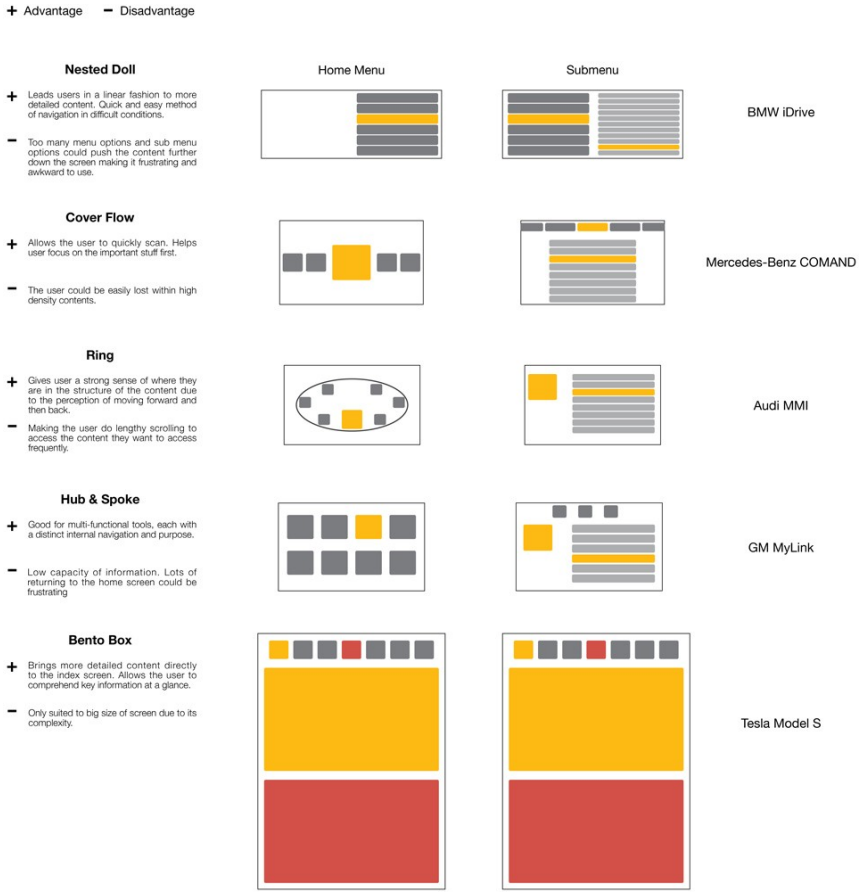


DIFFERENT DRIVING SCENARIOS



DIFFERENT DRIVING SCENARIOS

+ Advantage − Disadvantage



DIFFERENT DRIVING SCENARIOS

David Berti // AUTOMOTIVE USER EXPERIENCE

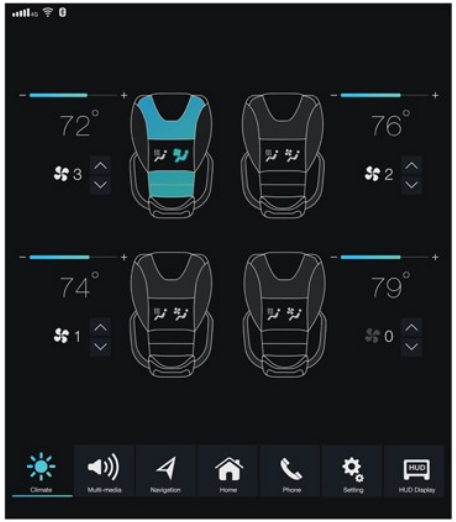
USER EXPERIENCE an emerging job opportunity

Mercoledì 10 Giugno 2020

DIPARTIMENTO DI MATEMATICA E INFORMATICA

DIFFERENT DRIVING SCENARIOS

FULL ACCESS



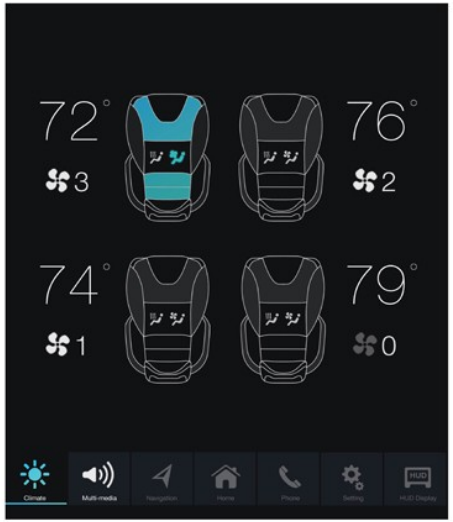
More options for customization

20 Touch Buttons

Font Size: 72

VS

DRIVING MODE



Focused on information display

10 Touch Buttons (50% less)

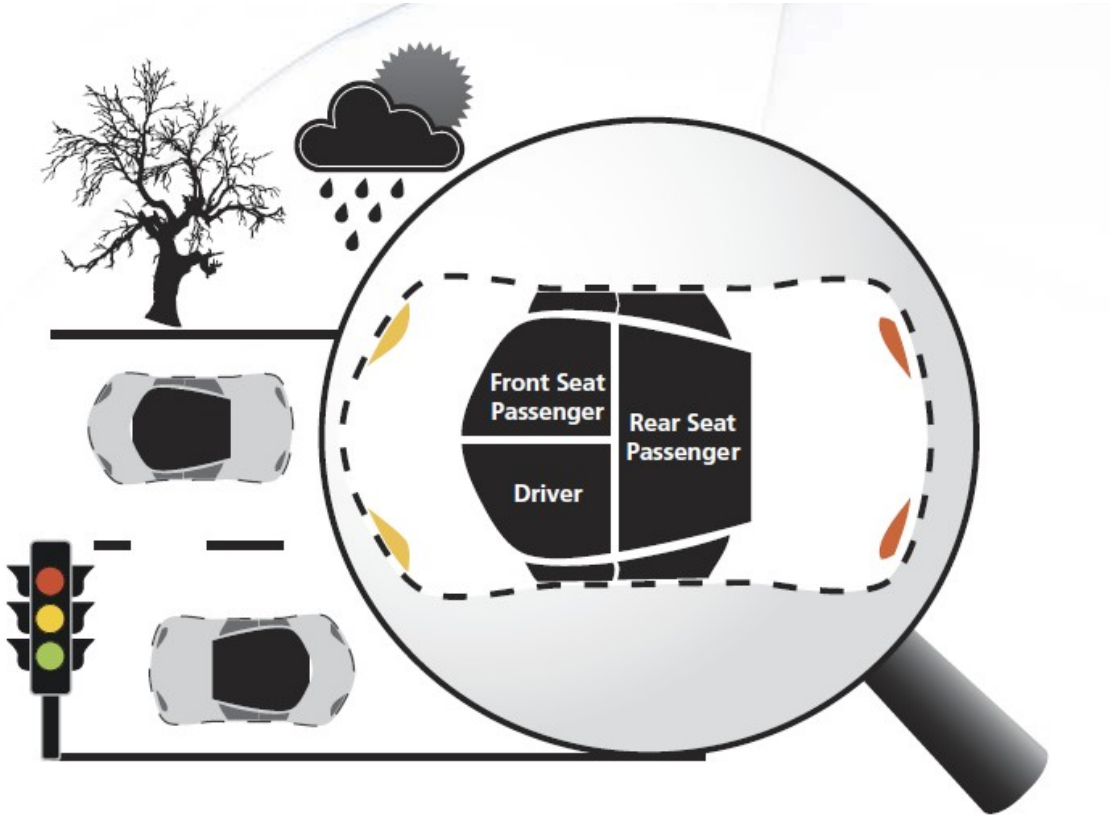
Font Size: 72 72

(50% bigger)

CAR EXPERIENCE SPACES

Context

Car is highly linked to context aroung it Understanding of context factors is important to understand experiences



INVESTIGATING CAR USER EXPERIENCE

- **Lab Studies**
  Highly controllable
  Reduced realism

- **In-Situ Studies**
  Researcher present (e.g., Ethnography, Contextual Inquiry)
  High effort, safety issues
  High realism, natural surrounding

- **Remote In-Situ Studies**
  Researcher not present (e.g., ESM, Video Ethnography)
  Mostly technology supported
  Danger of missing relevant "real" experiences

INVESTIGATING CAR USER EXPERIENCE

• The Dangerous Car
How can we avoid that somebody gets harmed during a study?
Safe integration of equipment, unobtrusive observation

• Limited Space
Limited space to include researcher and/or equipment
Intrusion into the social space

• The Moving Car
Changing environmental conditions (light, noise, ...)
High effort travelling for researcher

INVESTIGATING CAR USER EXPERIENCE

[Leshed et al (2008)]: In-car gps navigation: engagement with and disengagement from the environment

• Ethnographically-informed study with GPS users

• Found evidence for practices of disengagement of users with their environment.

You no longer need to know where you are and where your destination is, attend to physical landmarks along the way, or get assistance from other people in the car and outside of it.

• Also found opportunities

Discovering invisible landmarks, exploring previously unknown areas thanks to a new sense of security

[Meschtscherjakov et al (2009)]:

Acceptance of future persuasive in-car interfaces towards a more economic driving behavior.

• Evaluate future eco-friendly interfaces towards their user acceptance

• Online Survey based on TAM (+added questions towards disturbance, security risks, suitability)

• Results: Augmentation of existing interfaces was most accepted (e.g. eco speedometer)

INVESTIGATING CAR USER EXPERIENCE

[Knobel et al. (2012)]: *Clique Trip*: feeling related in different cars

• Stress the importance of creating relatedness experiences when travelling in different cars to the same destination

• Conducted a case study:
Addressed analysis, design, and evaluation of the experience regarding the Clique Trip prototpye

Insights were derived from experience reports, implemented in the car and evaluated on the road.
• Demonstrated how they designed for a positive social experience in the automotive context to evoke a feeling of relatedness and closeness while driving

INVESTIGATING CAR USER EXPERIENCE

[Harris & Nass (2011)]: *Emotion regulation for frustrating driving contexts*
• Negative emotional states – e.g., through frustrating events – are dangerous during driving
• Examined effects of cognitively reframing frustrating events
Task: navigate a challenging driving course that included frustrating events such as long lights and being cut-off (N=36)

3 conditions:
• *Reappraisal-down: voice prompts that should deflate negative reactions*
• *Reappraisal-up: voice prompts that brought attention to the negative actions of vehicles and pedestrians*
• *Silent: no voice prompts*
• ***Result: Participants in the reappraisal-down condition* had better driving behavior and reported less negative emotions**

Lowering frustration on the road could be done by changing cognitions immediately after frustrating events

INVESTIGATING CAR USER EXPERIENCE

[Inbar & Tractinsky (2011)]: ***Make a Trip an Experience: Sharing In-Car Information with Passengers***

• Suggest to involve passengers in the handling of invehicle information systems (IVIS)

also consider needs of passengers and their potential contribution as additional information handlers who buffer the driver from information overload

Benefits:
For passengers: reduced boredom, increased trust, a sense of inclusion
For drivers: less distraction and reduced information load

INVESTIGATING CAR USER EXPERIENCE

[Eckoldt et al. (2012)]: ***An Experiential Perspective on Advanced Driver Assistance Systems.***

• Stresses the experiential perspective in the automotive domain

• Study on advanced driver assistance systems (ADAS)

How do ADAS impact people's driving experience?

Results show that there is a difference in the usage of ADAS with regard to "joy of driving" and "joy while driving":

• ADAS are perceived rather negatively when „joy of driving" is in the fore, as this is related to a feeling of mastery and control over the car.

• ADAS are perceived rather positively when „joy while driving" is in the fore, as this stems from aspects beyond driving, e.g., through a stimulating landscape or through feeling related to others inside or outside the car.

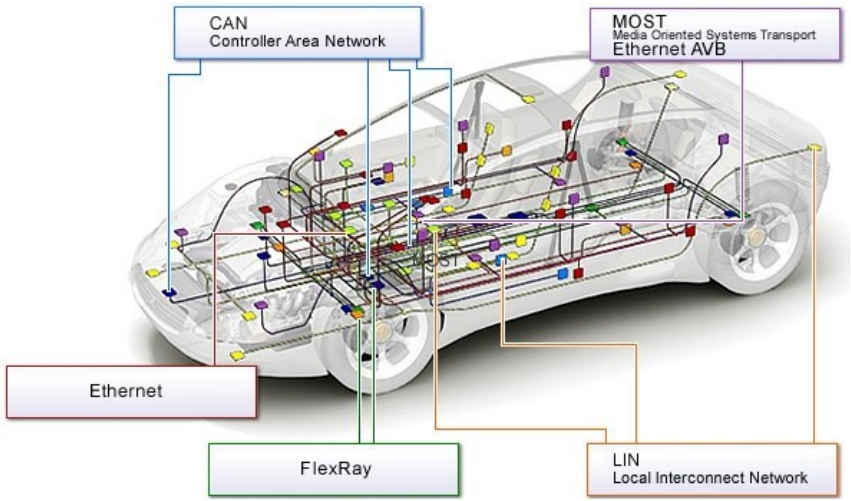
INVESTIGATING CAR USER EXPERIENCE

User Experience is a comprehensive concept which needs comprehensive consideration

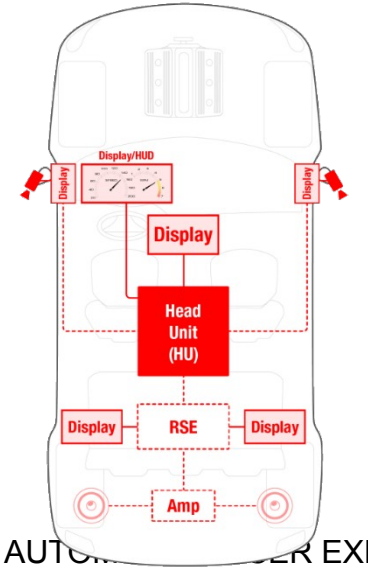
- **There are relations between factors**
- **There is a temporal dimension**
- **There is a contextual dimension**
- **UX insights in some domains not necessarily hold also in the car context**
- **More studies are needed to get a bigger picture (still fragmented)**

Reti interne alla vettura

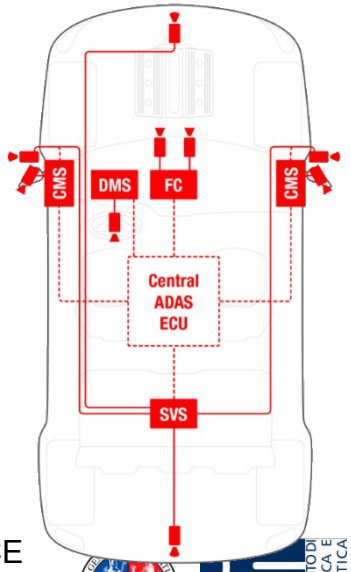
Reti dati in vettura



Infotainment - Distribuzione audio/video



ADAS - Distribuzione video



Informazioni prodotte dalla vettura

Anni 90: i PC si connettono ad Internet

Dot-com revolution

Anni 00: i telefoni si connettono ad Internet

Smartphone revolution

Oggi: le automobili si connettono ad Internet

Connected Car revolution

Cosa posso fare con le informazioni della vettura?

Come accedo alle informazioni della vettura?