

ADVANCED DRIVER ASSISTANCE SYSTEMS (ADAS) IN AUTONOMOUS TRANSPORTATION

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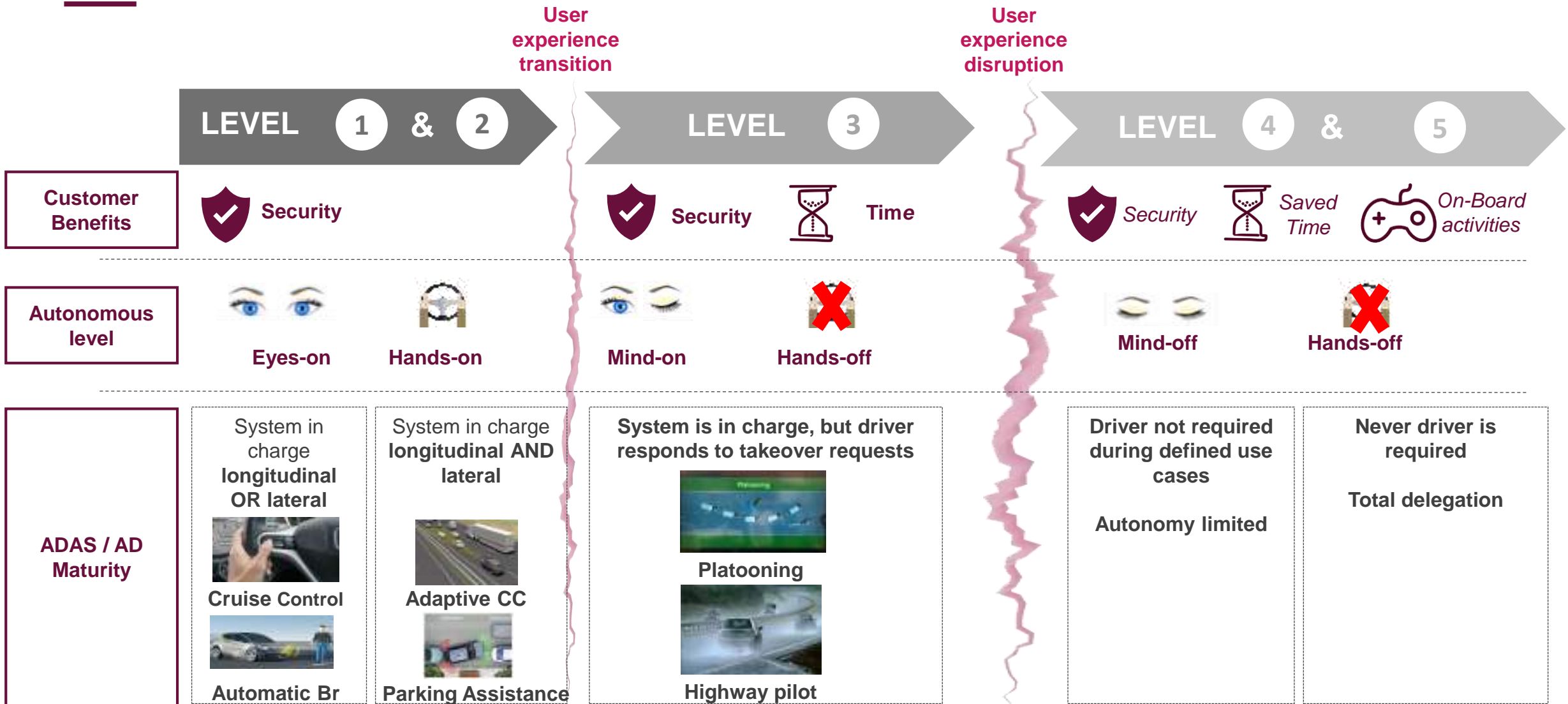
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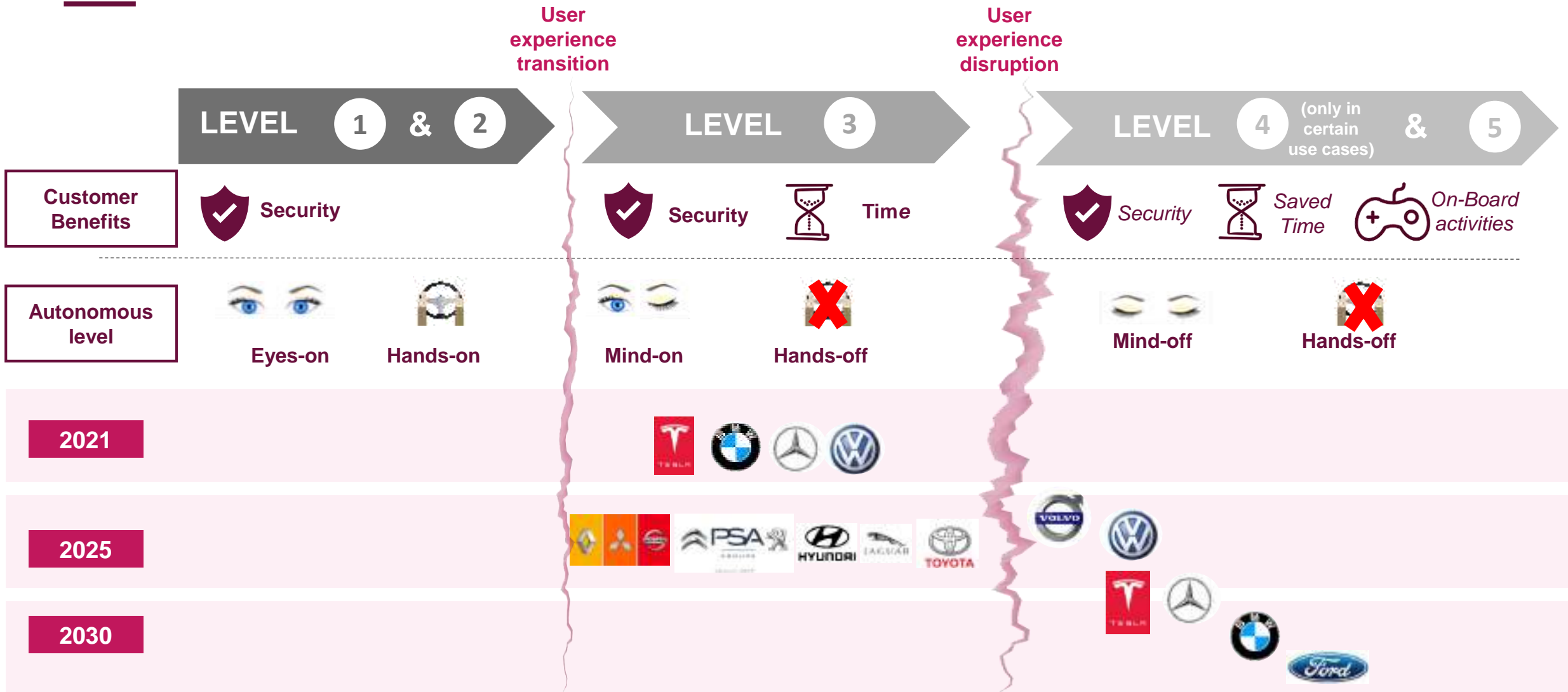
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Until Level 2, the driver is in charge of monitoring the environment, after that disruptions on the user's experience occur

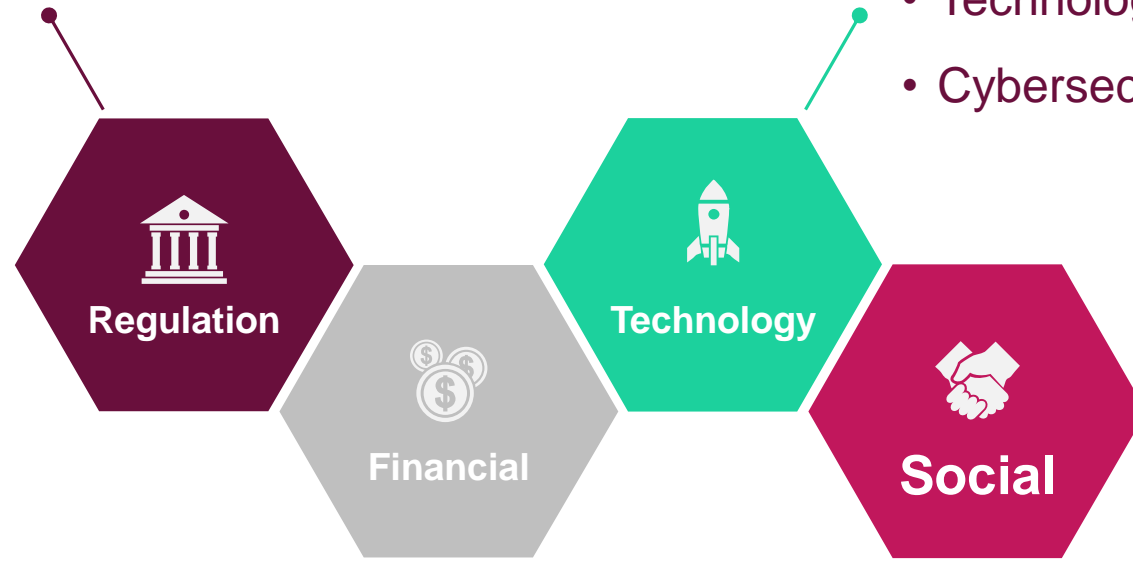


Car manufacturers are gradually moving towards fully autonomous vehicles



However, there are several challenges that need to be addressed, including social and behavioral aspects

- New regulations design & implementation



- Technology maturity
- Cybersecurity

- Price of autonomy

- **Driver acceptance**
- **People acceptance**

The fear to the unknown can limit rational decision making...as well as adoption of technology



I don't trust this to not harm me

I know it's irrational, but I'm scared of....

I'm wary of things I don't / I can't understand

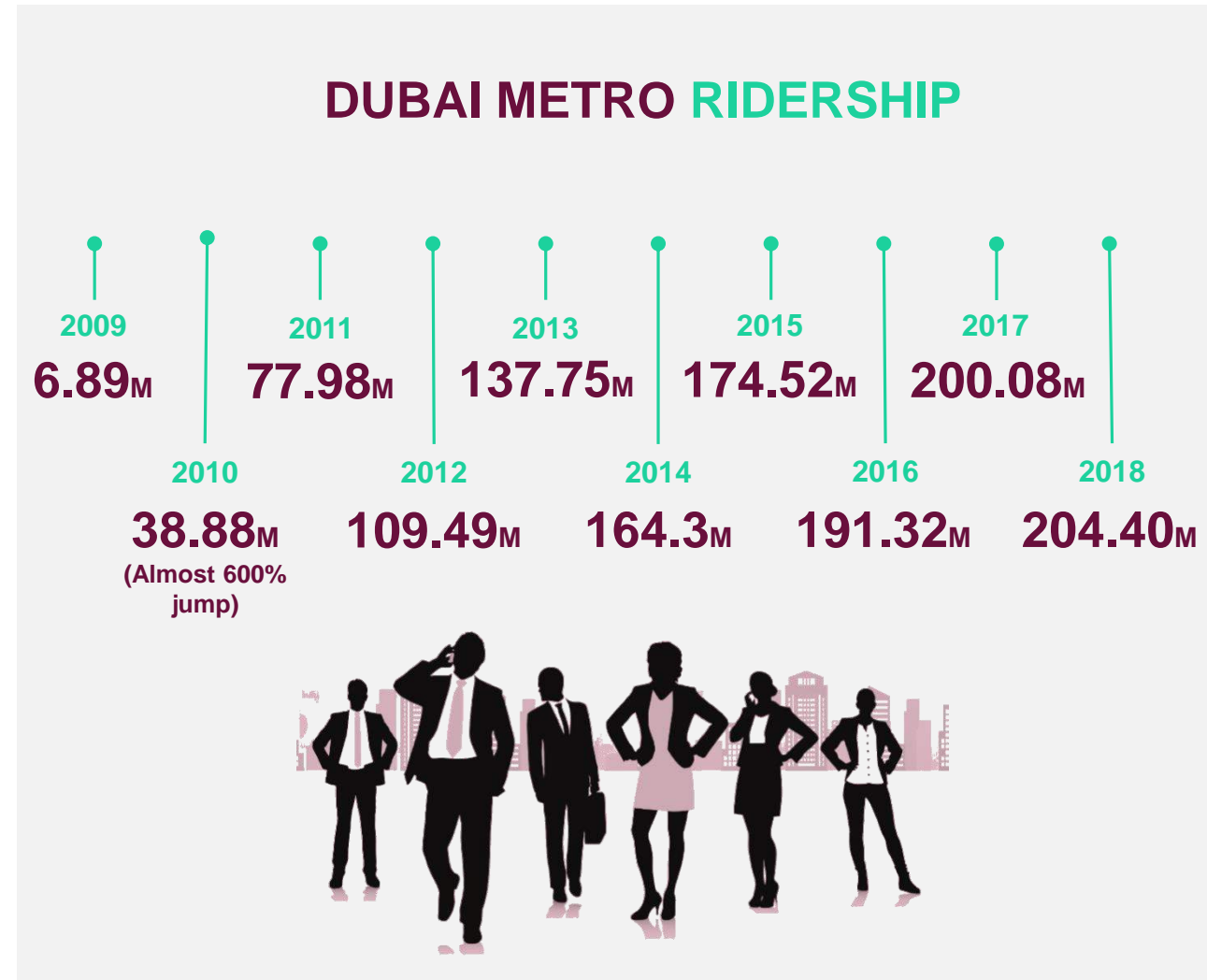
Riding a driverless metro in Dubai seemed scary at first to most people

- Commuters in Dubai were **initially afraid to ride** the Metro when it launched back in September 2009 **due to the lack of a driver**.
- So, RTA placed a **supervisor (i.e. pretend driver)** in front of the Metro head train.



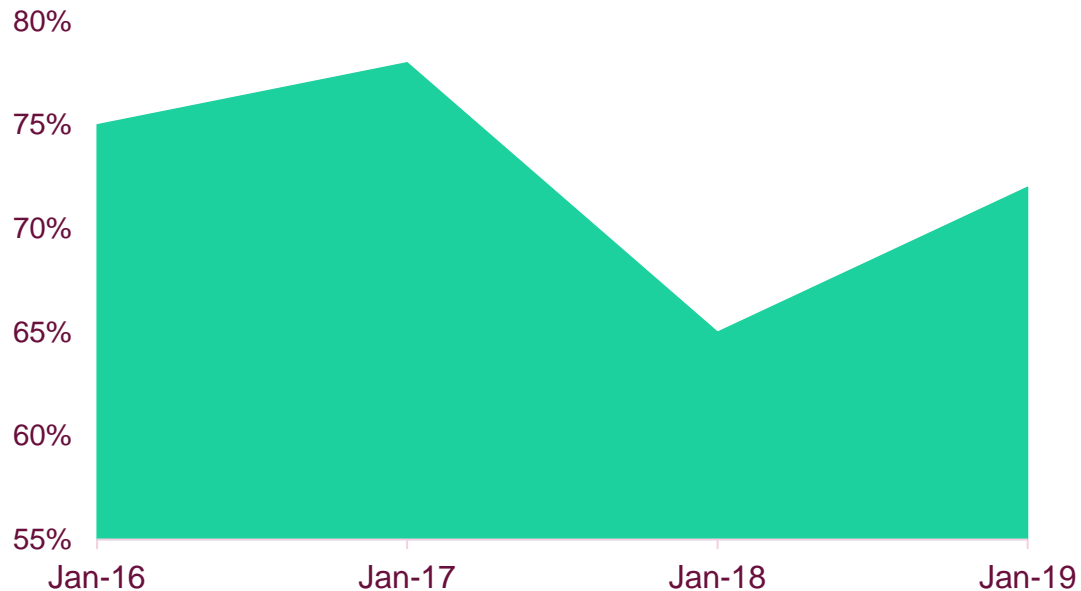
Key takeaways

- An initial push is required to reaffirm the safety of new technologies.
- Implementation of new technologies can be slow at start but gain traction through experimentation “& “socialization”

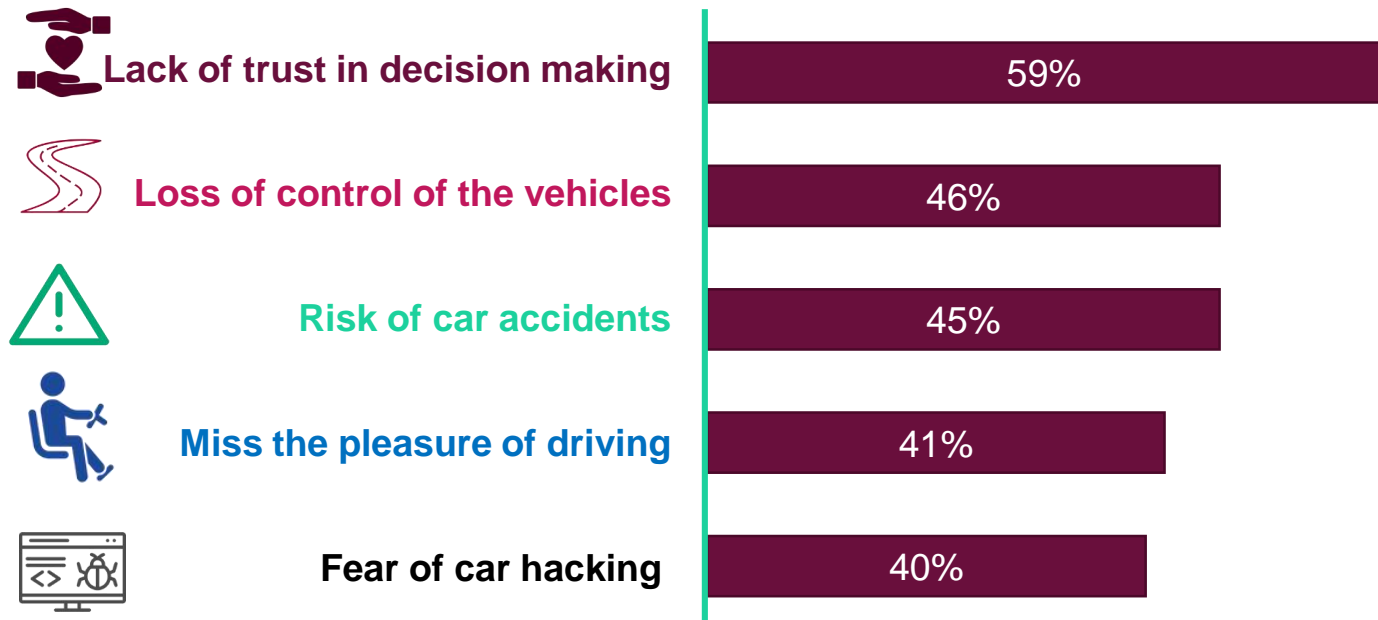


There are several reasons why people are afraid of autonomous vehicles

% of drivers afraid to ride in a fully autonomous vehicle



What are the three main reasons why you are afraid from using a self driving car ?



Therefore the acceptance for AVs is low... Experimentation through the use of ADAS could pave the way to accelerate AV development

Trust in system



- Educate people on the technologies behind autonomous vehicles
- Introduce free test rides in pilot environments for people

Loss of control on the vehicle



Risk of car accident



- Reassure people on safety
- Increase transparency on test results

Driving pleasure



- New activities in the car for people
- Highly personalized and curated User experience
- Introduce the possibility to drive

Fear of car hacking



- Increase awareness of security protocols used and complexity of hacking multi-layer complex systems

Adoption of autonomous cars can be increased through experimentation

There are two ways of experimentation that could increase autonomous vehicle adoption:

Pilot rides



Organize pilot rides for people in a test environment to make them comfortable with the concept.

Daily use of ADAS



Usage of ADAS amongst current drivers will get them more comfortable with car automation.

Pilot rides (1/2): Lyft and Aptiv logged 50,000 tips in Las Vegas



50,000 self driving rides since March 2018

Largest open-to-the-public, self-driving autonomous vehicle service in the world

80% accept self driving and 96% would do it again

Still carries a **safety driver** at the wheel

Pilot rides (2/2): Waymo limited self driving test in Phoenix



10,500 self-driving rides

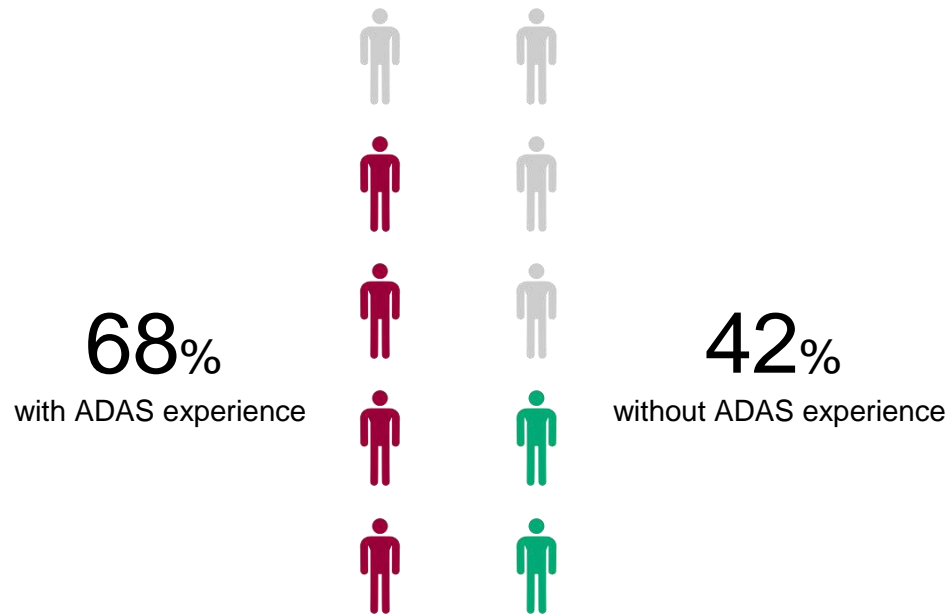
Shuttling Phoenix residents in a geofenced area that covers several suburbs

70% trips with 5*

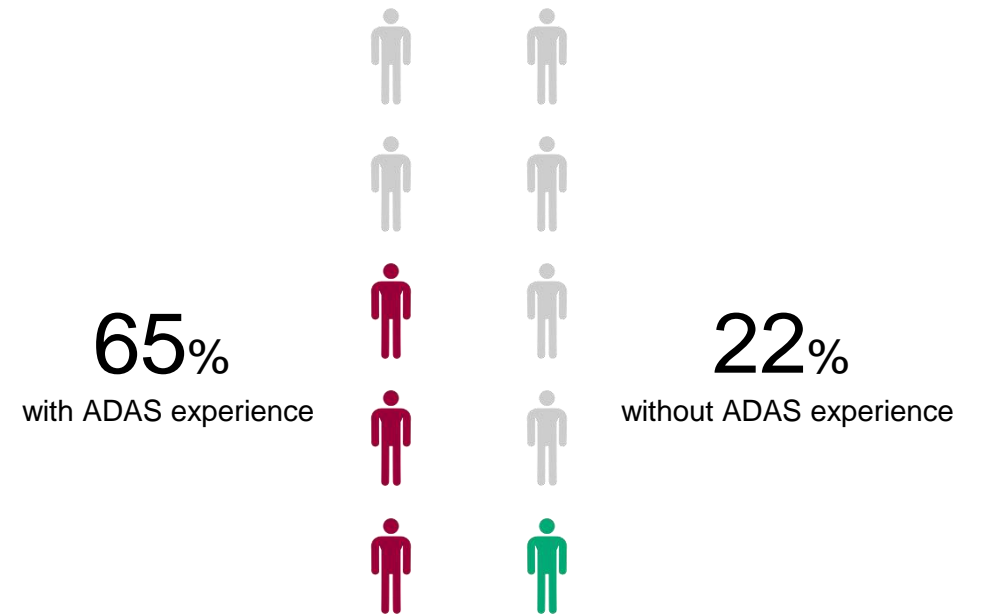
Waymo sent an email to its test users saying that “**Completely driverless** (*no safety driver*) Waymo cars are on the way”

Drivers who use ADAS and technology are more likely to use autonomous cars

Intention to use Autonomous Car-as-a-Product (CaaP):













Intention to use Autonomous Car-as-a-Service (CaaS):



Tech savvy drivers are **more** likely to use autonomous vehicles compared to average drivers

Most leading OEMs offer L1 and some L2 functions on their current models

Level 0	Level 1	Level 2.1	Level 2.2	Level 2.3
<ul style="list-style-type: none"> • Forward Collision Warning • Traffic Sign Recognition • Lane Departure Warning • Blind Spot Monitoring • Basic Cruise Control • Rear Cross Traffic Alert 	<ul style="list-style-type: none"> • Collision Avoidance – by Braking • Collision Avoidance – by Steering • Lane Keeping Assist • Blind Sport Intervention • Rear Cross Traffic Alert with Active Brake Assist • Traffic Sign Recognition with Active Speed Adaptation • Lane Centering • Adaptive Cruise Control (speed) • Adaptive Cruise Control (stop & go) 	<ul style="list-style-type: none"> • Semi-Automatic Parking Assist <p>1st </p> <p>2nd </p> <p>3rd </p>	<ul style="list-style-type: none"> • Auto Lane Change (Driver Initiated) • Fully Automatic Parking Assist • Remote Parking(outside vehicle control but within vehicle's vicinity) <p>1st </p> <p>2nd </p> <p>3rd </p>	<ul style="list-style-type: none"> • Piloted Driving (PD) <p>1st </p> <p>2nd </p> <p>3rd  </p>
<p>Leading Car OEMs in Level 2</p>				

The usage of ADAS is limited and the demand for advanced functionalities is quite limited

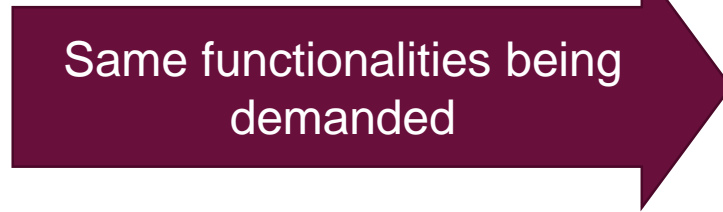
Current

Main used functions

- Cruise control
- Collision warning
- Blind spot warning
- Adaptive cruise control

Less popular functions

- Automatic lane changing
- Active parking assistance
- Lane keeping assistance
- Speed sign recognition



Future

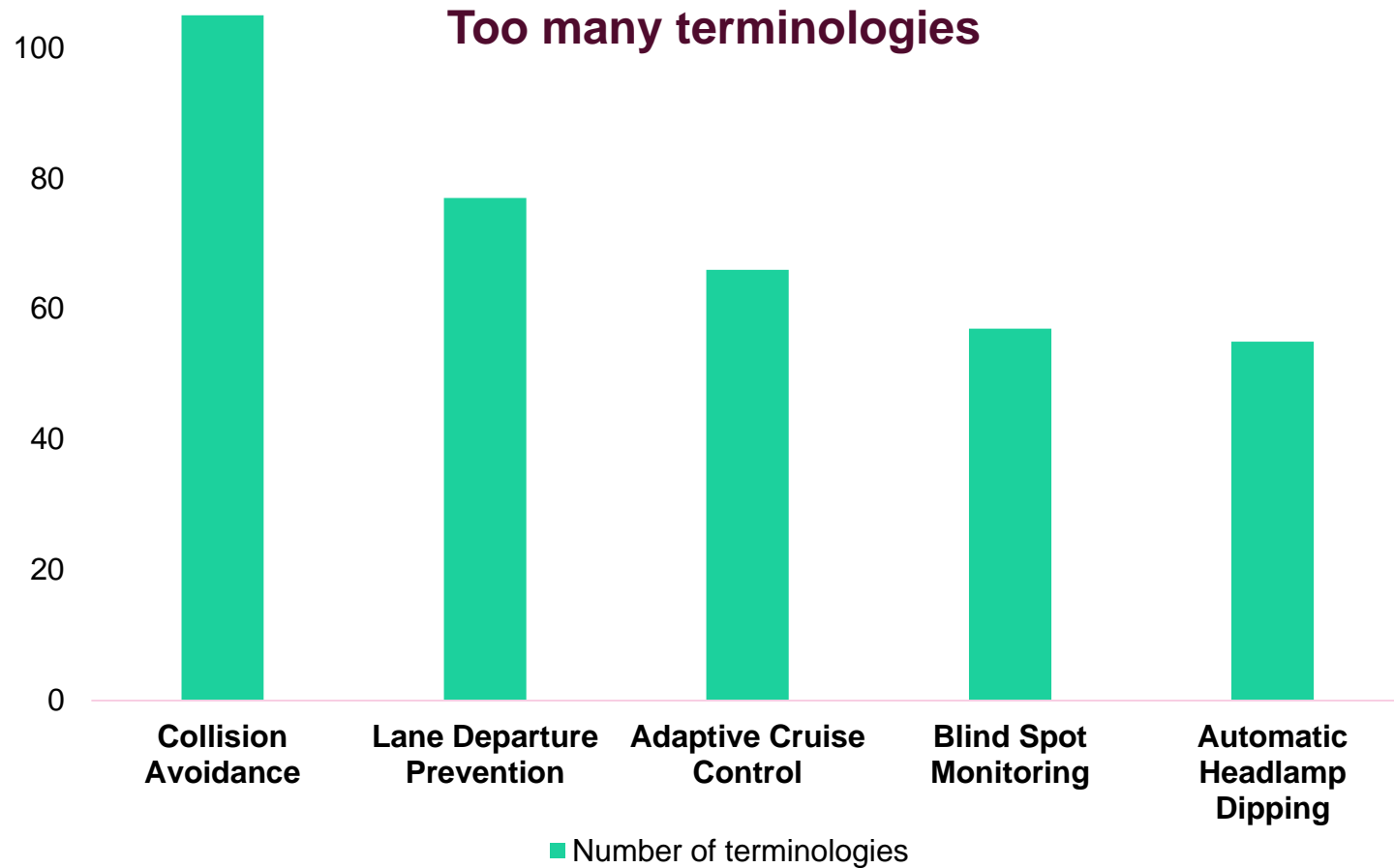
Requested functions

- Cruise control
- Collision warning
- Blind spot warning
- Adaptive Cruise control
- NEW** Automatic emergency breaking

What are the main challenges for a larger adoption of ADAS?

Confusion and cost are the main barriers for an increase on ADAS adoption (1/3)

OEMs use non standardized terminologies, which makes user adoption even more difficult



Top 5 OEMs with over 25 different names for their ADAS



Confusion and cost are the main barriers for an increase on ADAS adoption (2/3)

In most of the cases ADAS are sold as premium “add-ons” to standard configurations

LAND ROVER

NEW DISCOVERY SPORT
DISCOVERY SPORT | DISCOVERY SPORT S | DISCOVERY SPORT SE

01 MODELS

DISCOVERY SPORT	DISCOVERY SPORT S	DISCOVERY SPORT SE
<ul style="list-style-type: none"> Emergency Braking Rear Camera 	<ul style="list-style-type: none"> Emergency Braking Rear Camera Traffic Sign Recognition and Adaptive Speed Limiter 	<ul style="list-style-type: none"> Rear Camera Traffic Sign Recognition and Adaptive Speed Limiter Park Assist Clear Exit Monitor 360° Parking Aid Rear Traffic Monitor Emergency Braking Blind Spot Assist
<p>Emergency Braking</p> <p>Emergency Braking can help to prevent collisions with other vehicles or pedestrians. If a potential front collision is detected, a warning is displayed giving you time to take action. A forward looking camera monitors vehicles ahead at speeds from 5-30km/h for frontal collisions and 5-60km/h for pedestrians and cyclists. If a vehicle is still unoccupied and you have taken no action, the system will apply the brakes to help reduce the severity of the possible impact.</p> <p>Rear Camera</p> <p>Rear Camera provides improved visibility when reversing. Static lines representing the vehicle's outer perimeter and predicted path are superimposed on the rear view image displayed on your Touchscreen.</p>	<p>Emergency Braking</p> <p>Emergency Braking can help to prevent collisions with other vehicles or pedestrians. If a potential front collision is detected, a warning is displayed giving you time to take action. A forward looking camera monitors vehicles ahead at speeds from 5-30km/h for frontal collisions and 5-60km/h for pedestrians and cyclists. If a vehicle is still unoccupied and you have taken no action, the system will apply the brakes to help reduce the severity of the possible impact.</p> <p>Rear Camera</p> <p>Rear Camera provides improved visibility when reversing. Static lines representing the vehicle's outer perimeter and predicted path are superimposed on the rear view image displayed on your Touchscreen.</p>	<p>Rear Camera</p> <p>Rear Camera provides improved visibility when reversing. Static lines representing the vehicle's outer perimeter and predicted path are superimposed on the rear view image displayed on your Touchscreen.</p> <p>Traffic Sign Recognition and Adaptive Speed Limiter</p> <p>Our Traffic Sign Recognition system keeps you fully informed and aware on the road, by displaying speed limits and/or overtaking signs on the instrument cluster where they can easily be seen.</p> <p>When activated, our Adaptive Speed Limiter and Traffic Sign Recognition information to adjust your vehicle's speed accordingly.</p>

02 ENGINES

03 SPECIFICATION PACKS

C 200

Midtrunk | Special paint | **Packages** | Colors | Wheels | Upstately | 360° | Equipment | Your configuration

<input checked="" type="checkbox"/> Active Parking Assist with PARKTRONIC ultrasonic sensors (front and rear) (included in base price)	<input type="checkbox"/> COMAND Package Driving Assistance Package Plus including Active Lane Change Assist and Enhanced Automatic restarting. Driving Assistance Package PLUS also require the selection of the Premium Package. COMAND Online Infotainment system able to connect to the internet, high-resolution media screen, fast hard-disk navigation with 3D map display and dynamic route guidance & LINDA/ATRONIC Traffic Sign Assist. Burmester® surround sound system with 13 speakers, 9-channel DSP amplifier & 590watt output.	<input type="checkbox"/> AMG Line Exterior

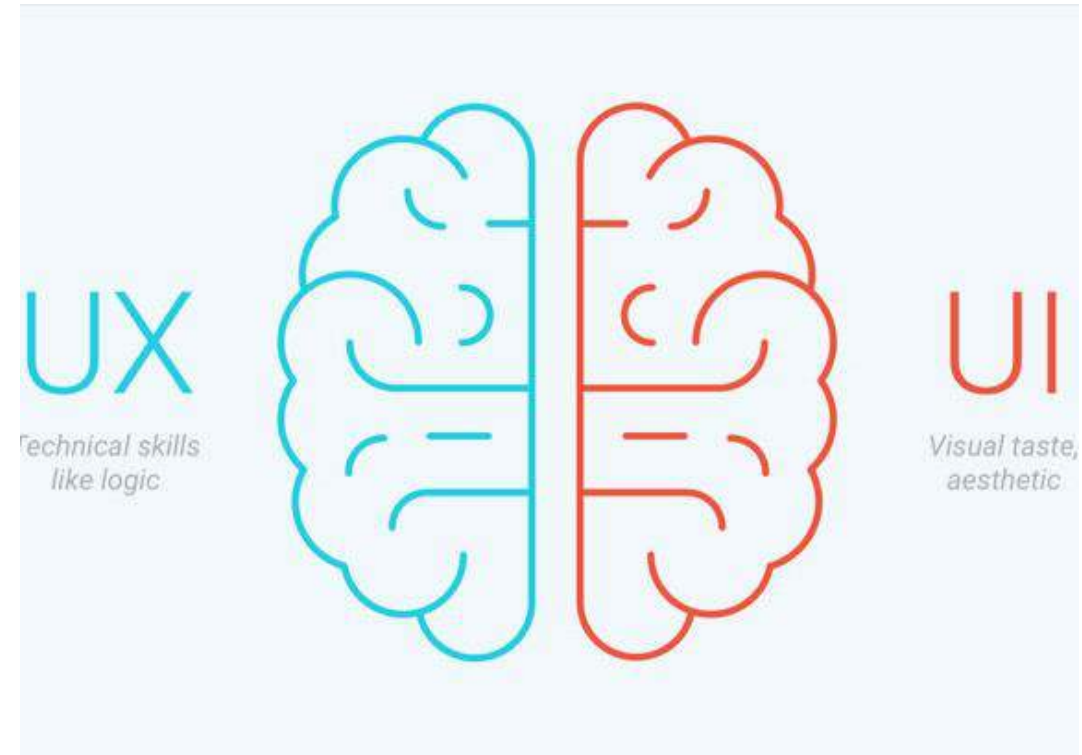
Confusion and cost are the main barriers for an increase on ADAS adoption (3/3)

Complex dashboard configurations and difficult to find / learn and operate ADAS difficult adoption. An average car owner uses only 5 functions* non-essential configurations on car dashboard design



What are potential solutions for increasing ADAS' mass adoption?

Placing UX and UI at the center of car cockpit design is key



Interactive technology in cars could play a key role in increasing ADAS adoption

In-car Education



Vehicles could be equipped with on-board and interactive courses on various functions of ADAS and prompt drivers on using some relevant functions.



1

Mike is currently driving at a constant speed.



2

An audio message is prompted asking Mike if he would like to use “Adaptive cruise control” and “Lane centering” functions.



3

Mike decides to use the recommended ADAS functions.

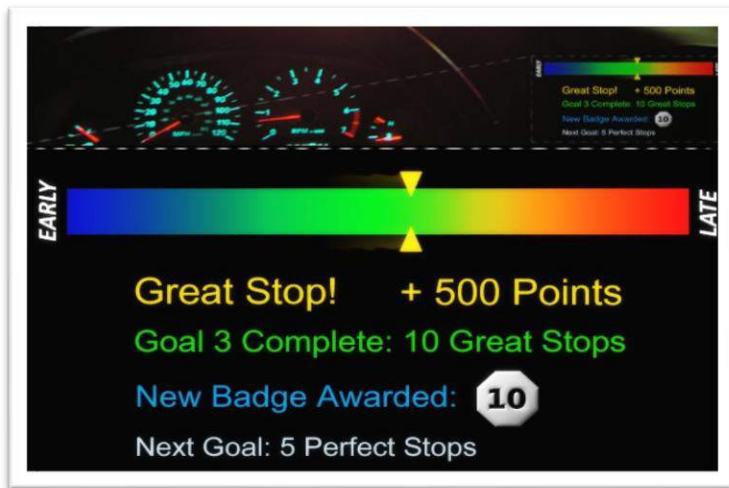


4

When Mike arrives, an audio message is prompted asking Mike if he would like to use the “fully automated parking assist” function with the option to learn more about it.

Interactive technology in cars could play a key role in increasing ADAS adoption

ADAS Gamification



Gamification could be a key enabler to increase ADAS adoption. Points could be handled out for completing challenges, which can be redeemed for insurance discounts & other rewards.



1

Fatima is currently driving her car while listening to music.



2

She is promoted several messages & tips with challenges to enable her to have the safest way to drive.



3

She decides to collect several points on the feature and is rewarded with points. Fatima then shares her score with her insurance to get discounts.



4

Fatima is rewarded with a discount on her insurance based on the number of points she has earned.

ADAS adoption can be increased through 4 key enablers

**Monitor
ADAS usage
rate**



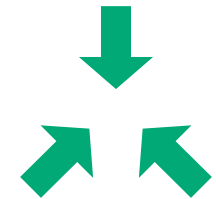
**Simplify ADAS
user interface**



**“Socialize”
ADAS with
users**



**Harmonize
ADAS
terminologies**



The future of ADAS goes to the conversion with connectivity

53% of automotive and transportation companies believe better connectivity is the top driver for technology innovation*

Potential Future Areas for ADAS

1

Sensors Development

Combination of sensors (Lidar, Radar, Cameras, etc)

Sensor fusion

Redundancy and reliability

Drastically price reduction

2

Connectivity

Vehicle-to-vehicle (V2V) technology: Interconnected cars among each other (e.g. platooning, bee colonies algorithms)

Vehicle-to-Everything (V2X) (e.g. signals, gas pumps, etc)

Vehicle-to-humans (V2H) (e.g. sensors measuring vitals connected to the car)

All time connected to cloud

3

Collaboration

Infotainment centralization Vs. OEM inhouse developments

ADAS outsourcing and centralization

ADAS terminology standardization



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