TechTalk: Psychology of Mobility

March 30, 2023

Driving with Psychology

Dr. Christoph Bernhard

Vita

Dr. Christoph Bernhard

- PhD in Psychology
- Deputy Head of Operations / Senior User Experience Researcher at **Custom Interactions GmbH**
- 6 years experience in applied psychology in automotive industry
- Focus on human-machine interaction, assistance systems & applied human perception

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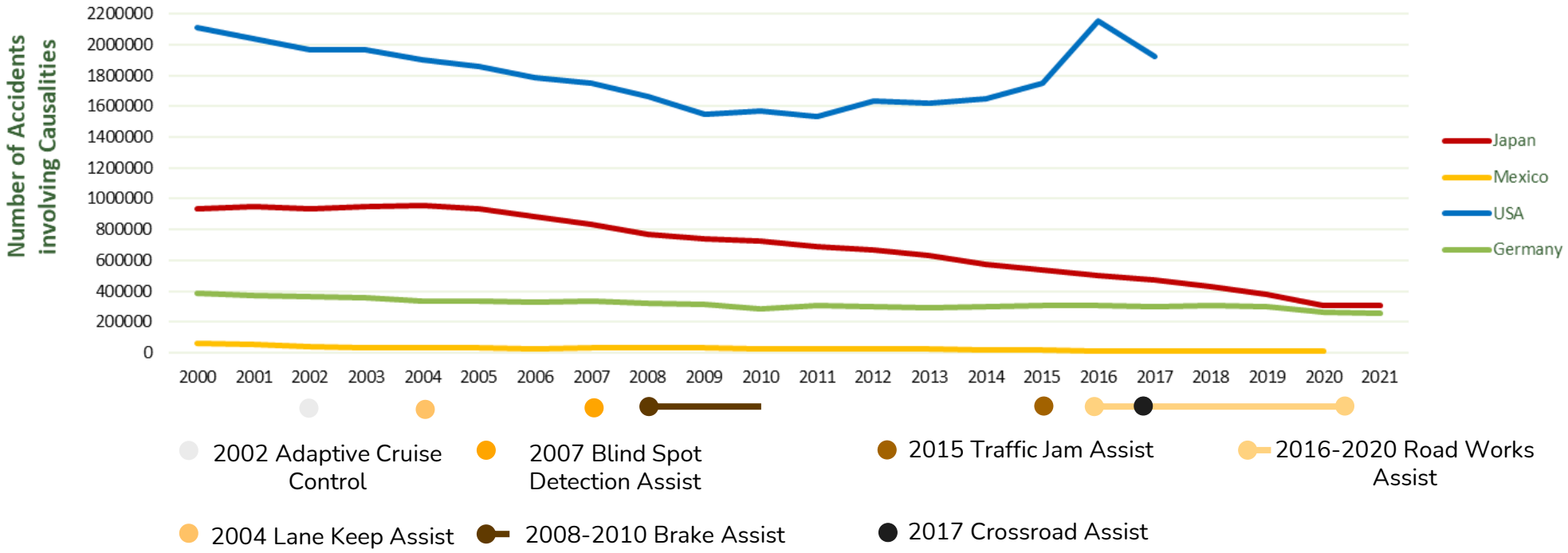
How users trick systems that do give them a positive experience

https://www.youtube.com/watch?t=60&v=ovc2axLmzIw&feature=emb_imp_woyt

„Users will find ways to improve their experience”

How industry works towards reduction of accidents and increases safety



„Innovations will not succeed to increase road safety if they do not have a positive user experience“

Source:
Organisation for Economic Co-operation and Development (https://data.oecd.org/transport/road-accidents.htm)

Example 1: Partially Automated Driving

Requirements:

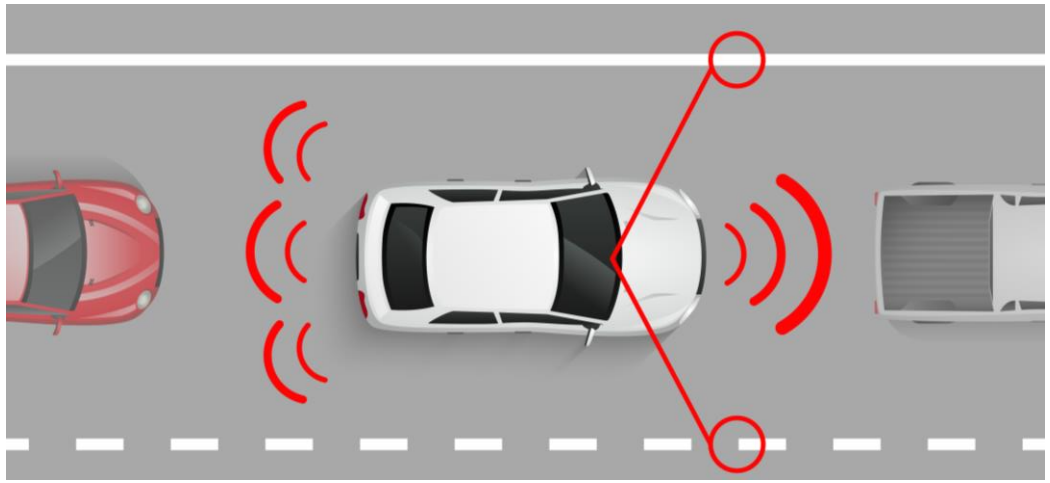
Focus attention and monitor

Hold the wheel and be ready to react

„Human drivers are bad in monotonous tasks – they will focus on other tasks, even if this leads to risks.“

Sources:
Youtube (https://www.youtube.com/watch?t=60&v=ovc2axLmzIw&feature=emb_imp_woyt)
Freepick
Hand icons created by Freepik – Flaticon (https://www.flaticon.com/free-icons/hand)
Eye icons created by Freepik – Flaticon (https://www.flaticon.com/)

Example 2: Lane keep assistant



Lane maintenance systems still a turnoff for many drivers

June 22, 2017

Requirements:

- Focus attention and monitor
- Indicate your lane change with a turn indicator

„If a system delivers a negative experience, drivers will not use it.“

Sources:
Freepick
Insurance Institute for Highway Safety (https://www.iihs.org/news/detail/lane-maintenance-systems-still-a-turnoff-for-many-drivers)
Hand icons created by Freepik – Flaticon (https://www.flaticon.com/free-icons/hand)
Eye icons created by Freepik – Flaticon (https://www.flaticon.com/)

Why are drivers not using systems that increase safety? Because the systems do not provide a good experience.

Pragmatic Quality

Describes how **easy** or **efficient** a system supports the user in what he wants to **do** („do-goals“)

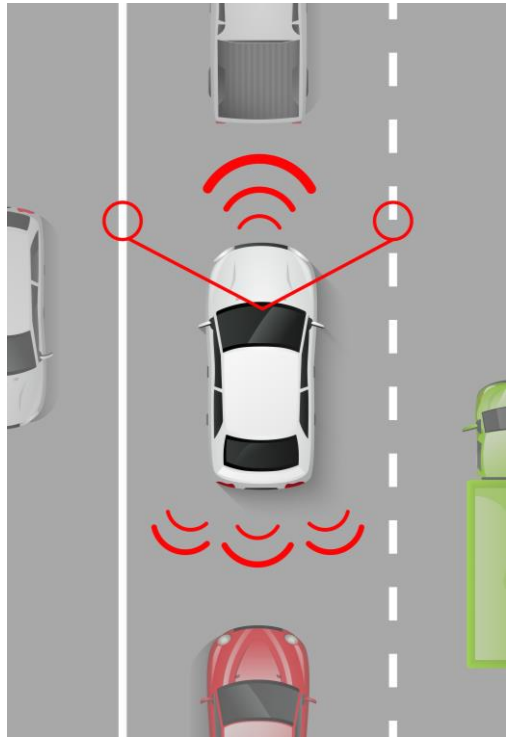
Hedonic Quality

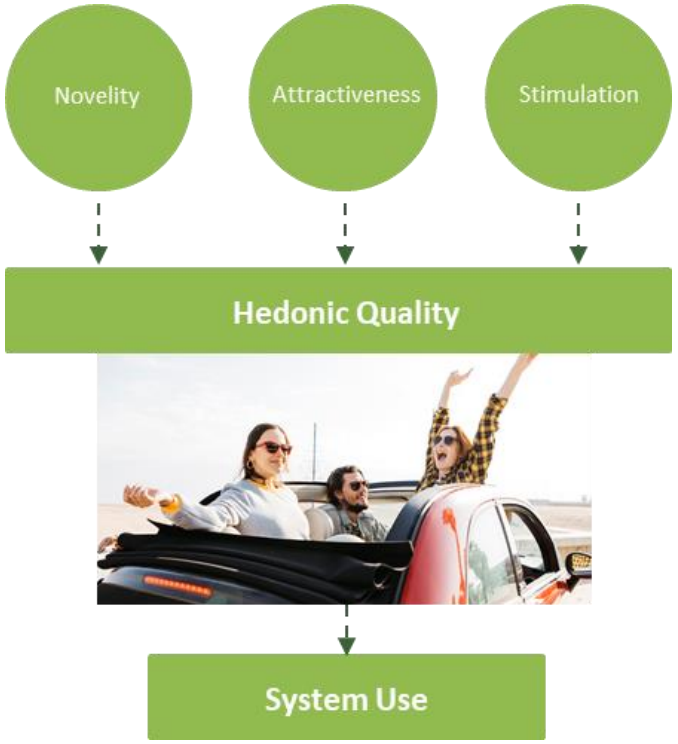
Describes to what degree system use evokes **positive experiences**, such as **joy** or **pleasure** in use („be-goals“)

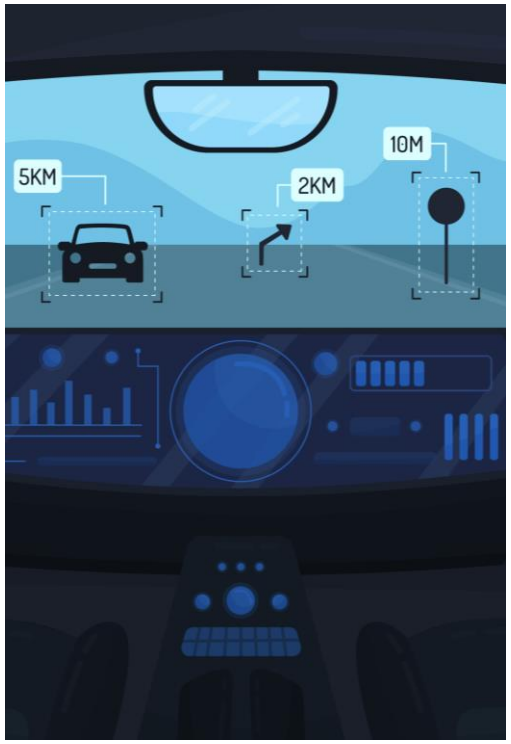
„Being safe and easy to use is not enough.
A system needs to evoke a positive mobility experience.“

Source:
Freepik

Psychology & Mobility – What promotes positive experience?





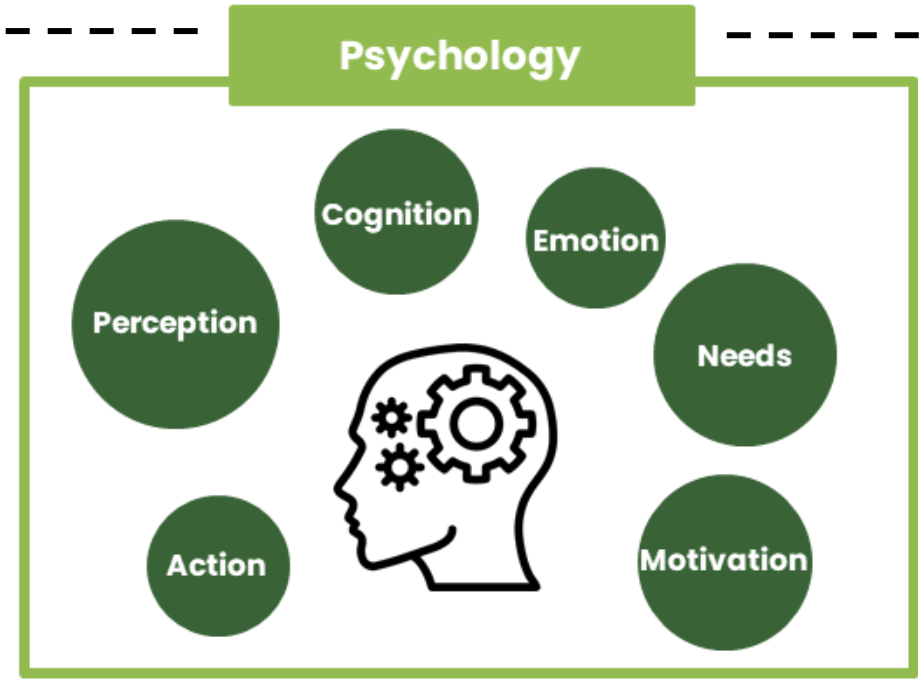


„Systems can evoke a positive mobility experience by addressing the needs of human drivers.“

Source:
Freepik

Psychology & Mobility – What is the role of Psychology?

Driving

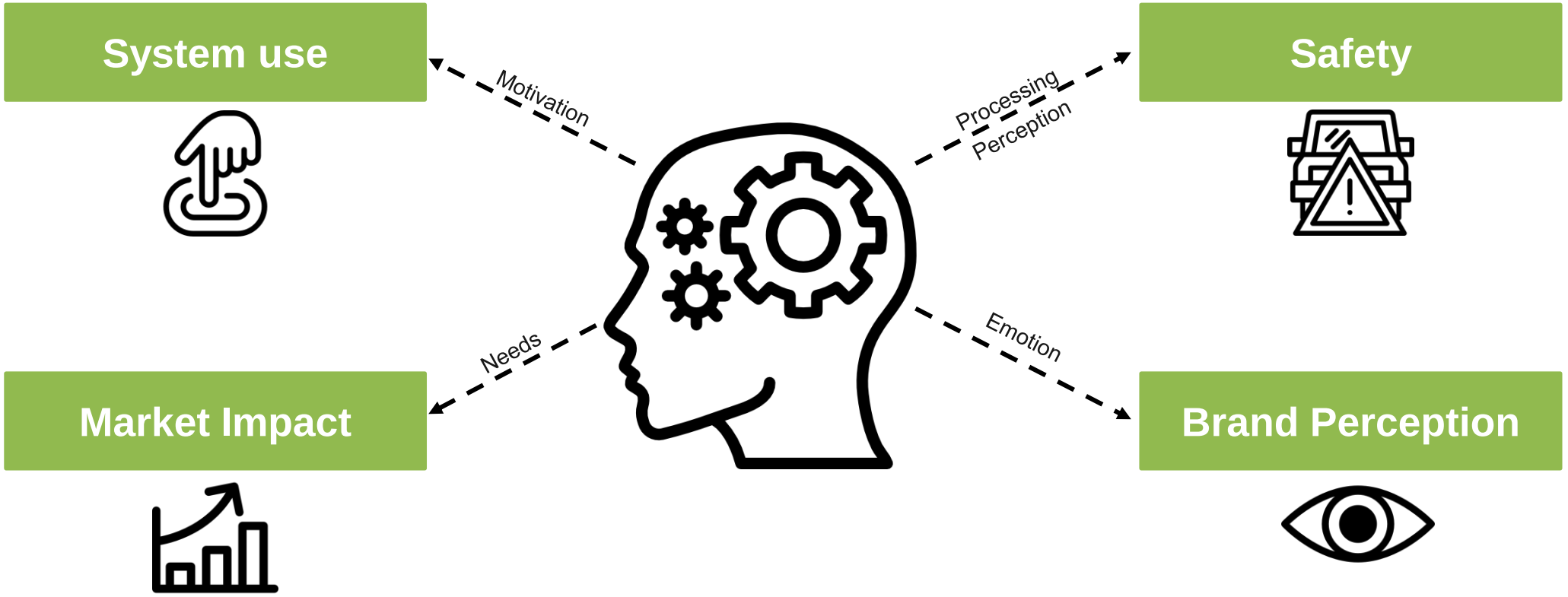


Positive Experience

Psychology provides knowledge, methods and tools to analyse and understands needs, wishes and demands of drivers.

Sources:
Freepik
Think icons created by Smashicons – Flaticon (https://www.flaticon.com/free-icons/think" title="think icons)

Psychology & Mobility – What is the role of Psychology?



Sources:
Eye icons created by Freepik – Flaticon (https://www.flaticon.com/)
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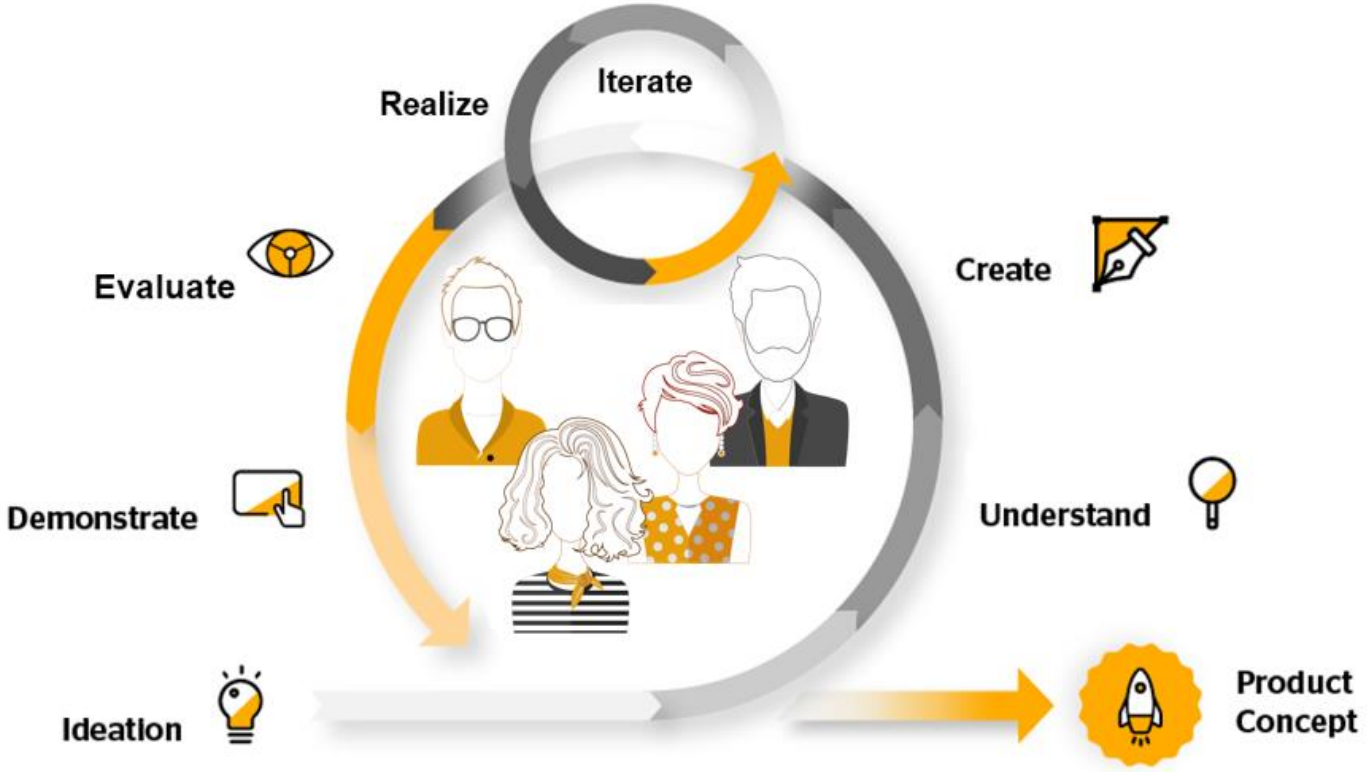
Graphic icons created by Kiranshastry – Flaticon (https://www.flaticon.com/free-icons/graphic)
Think icons created by Smashicons – Flaticon (https://www.flaticon.com/free-icons/think" title="think icons)

Psychology & Mobility Experience – Why is it important?

https://www.youtube.com/watch?v=BIAHOm_SACM&feature=emb_logo

„Driving will be a positive experience if the system fulfils needs of users”

Psychology & positive experience is important – but how do we get there?



„User Centered Design is a way to bring knowledge about the user into the development of new systems.“

Conclusion: Importance of Psychology & Mobility Experience

- New innovations will not succeed to increase road safety if they do not have a positive user experience.
- Being safe and easy to use is not enough to create a positive user experience.
- A positive mobility experience can be created by fulfilling user needs for Novelty, Attractiveness and Stimulation.
- Psychology provides knowledge, methods and tools to analyse and understand needs, wishes and demands of users
- User Centered Design is a way to bring this knowledge into the development of new systems.

Thank you!

Your contact

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Transformation in mobility experiences

Guido Meier-Arendt

Experiences

Link to preferences and context









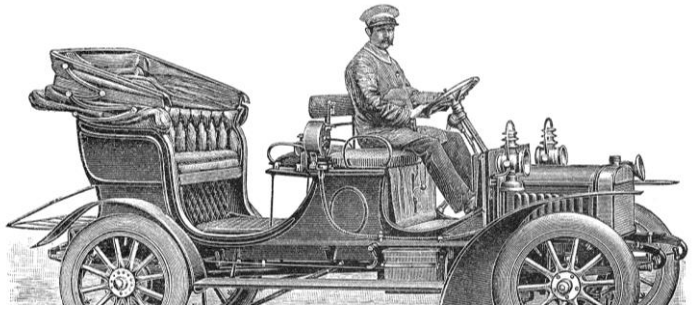



Transformation in mobility experiences

The change in time

Means of transportation

Human Machine Interface (HMI)



User needs

Augmented Reality Head-up Display - Vision 2025

A natural enhancement of the Human Machine Interface

Transformation in mobility experiences

The user is human

It´s not the **BRAIN** which drives a car, it´s the **HUMAN BEING** …

Transformation in mobility experiences

User experience dimensions

User experience (UX)

Safety Usability Joy of Use

User experience (**UX**) refers to a person's **total experience** using a particular product, system or service

Pragmatic Dimensions

Efficiency Dependability Perspicuity

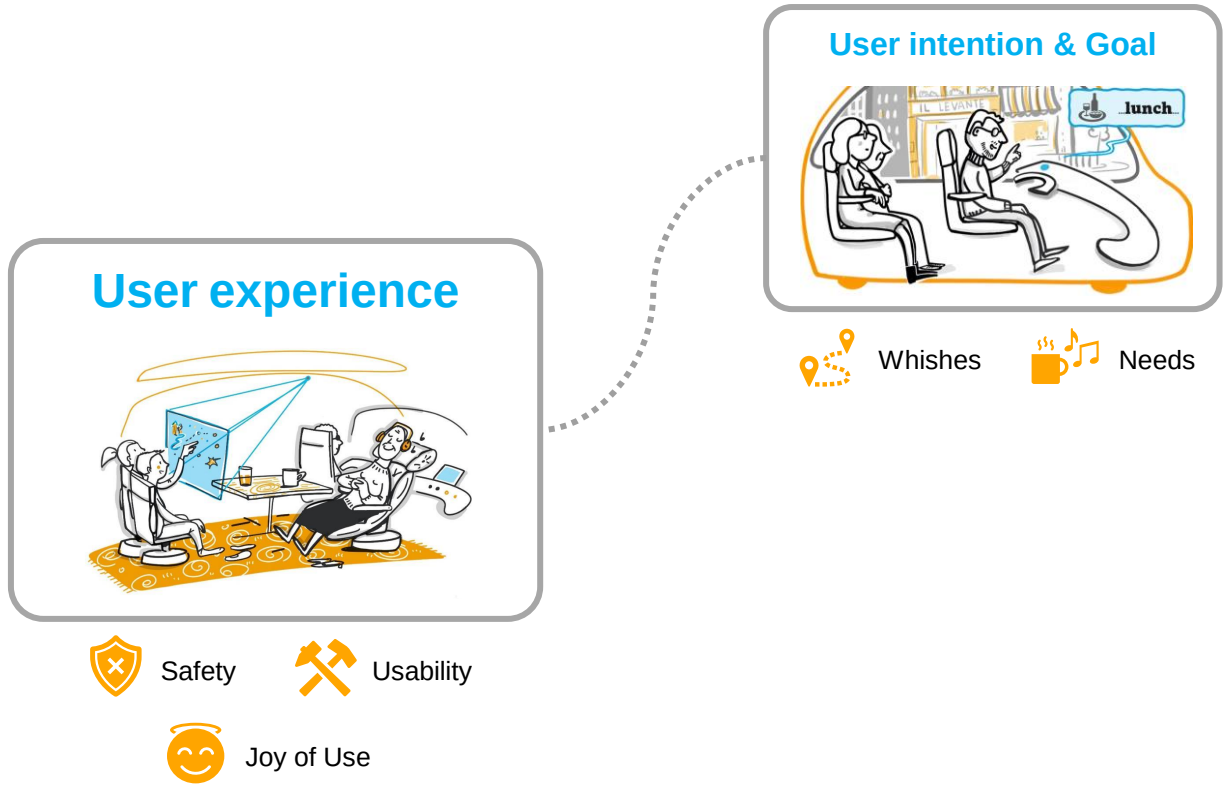
Hedonic Dimensions

Novelty Attractiveness Stimulation

- Perceptions
- Beliefs
- Emotions
- Preferences
- Behavior

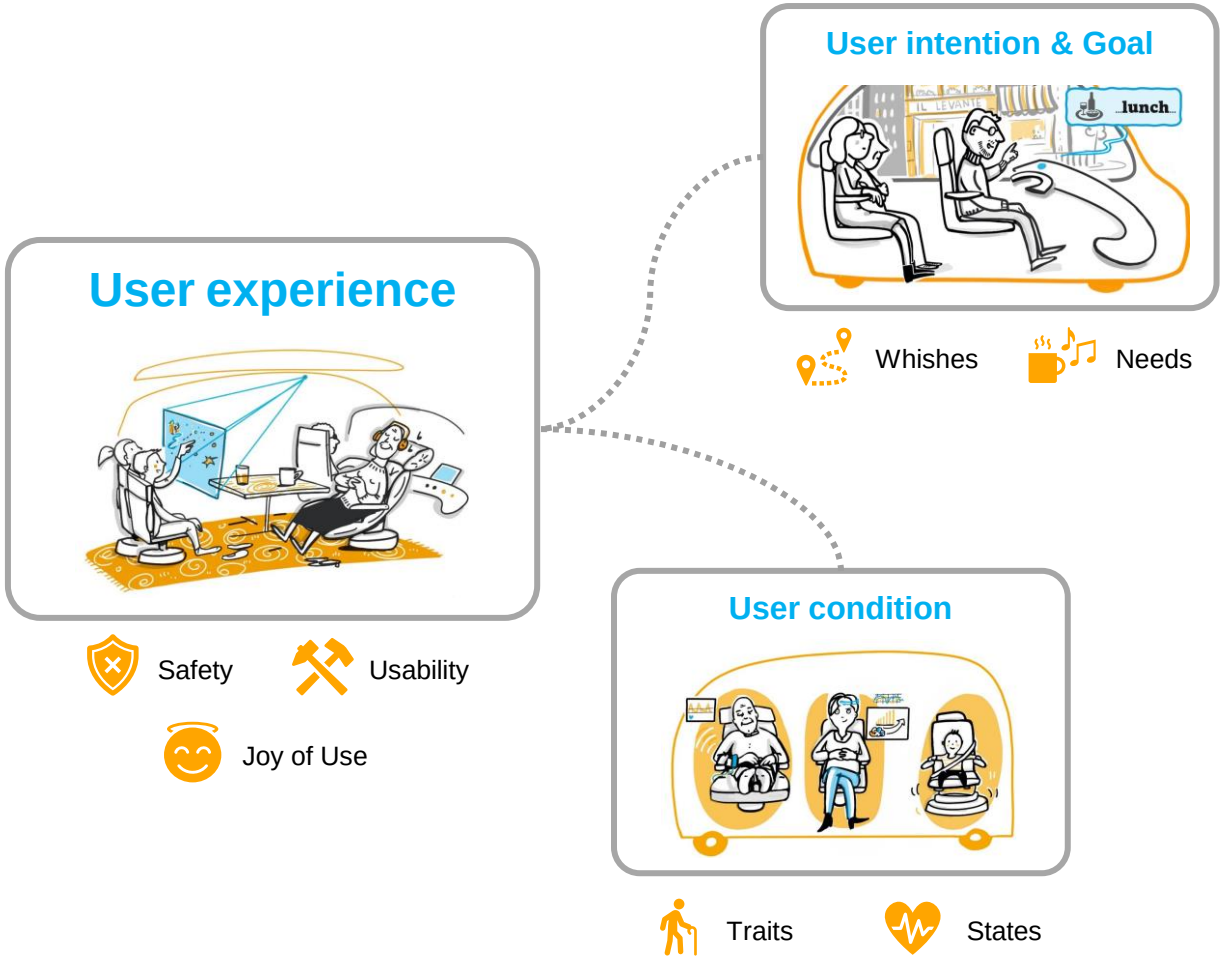
Understanding the user and his context

Basic dimensions of mobility experiences



Understanding the user and his context

Basic dimensions of mobility experiences



Understanding the user and his context

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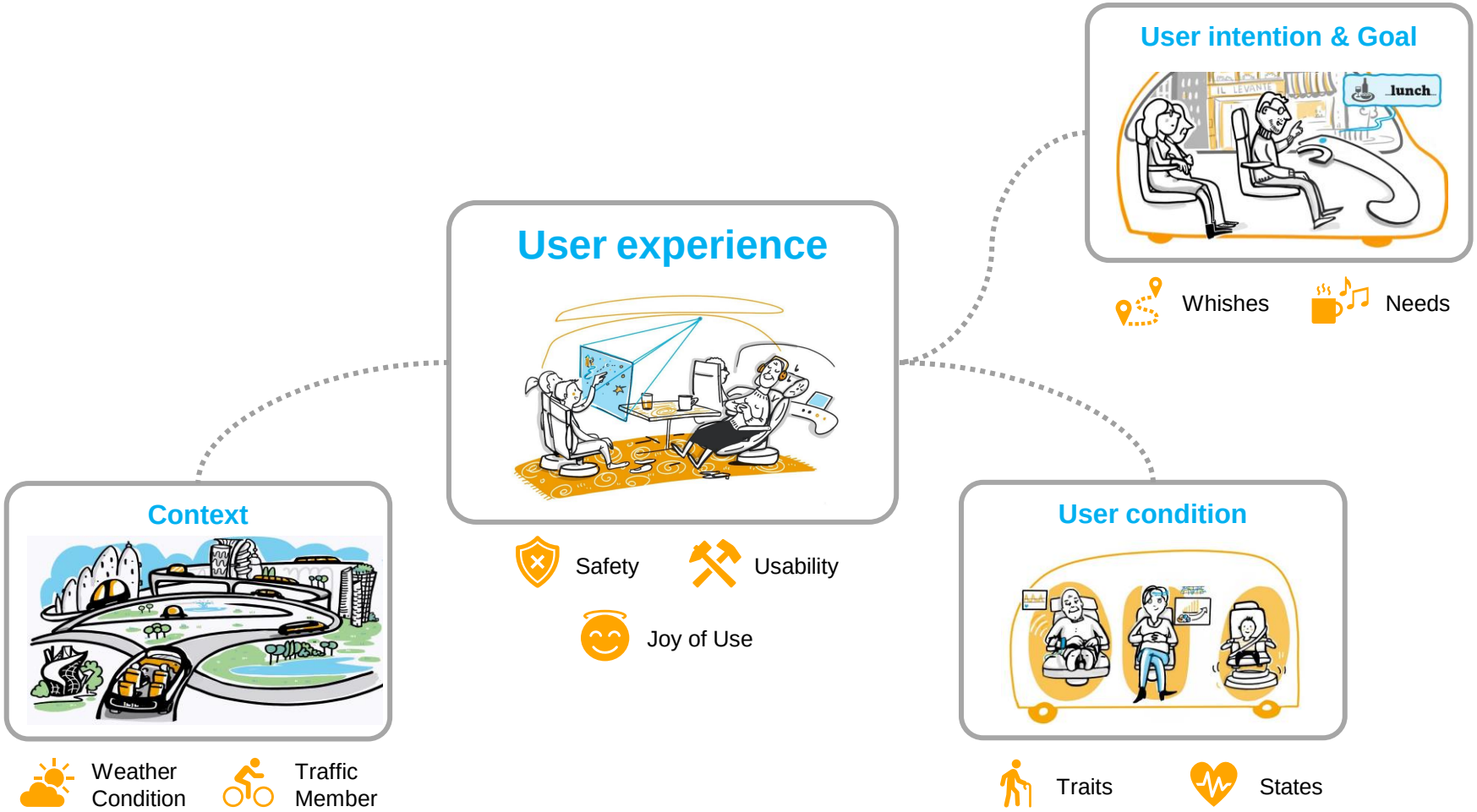

Understanding the user and his context

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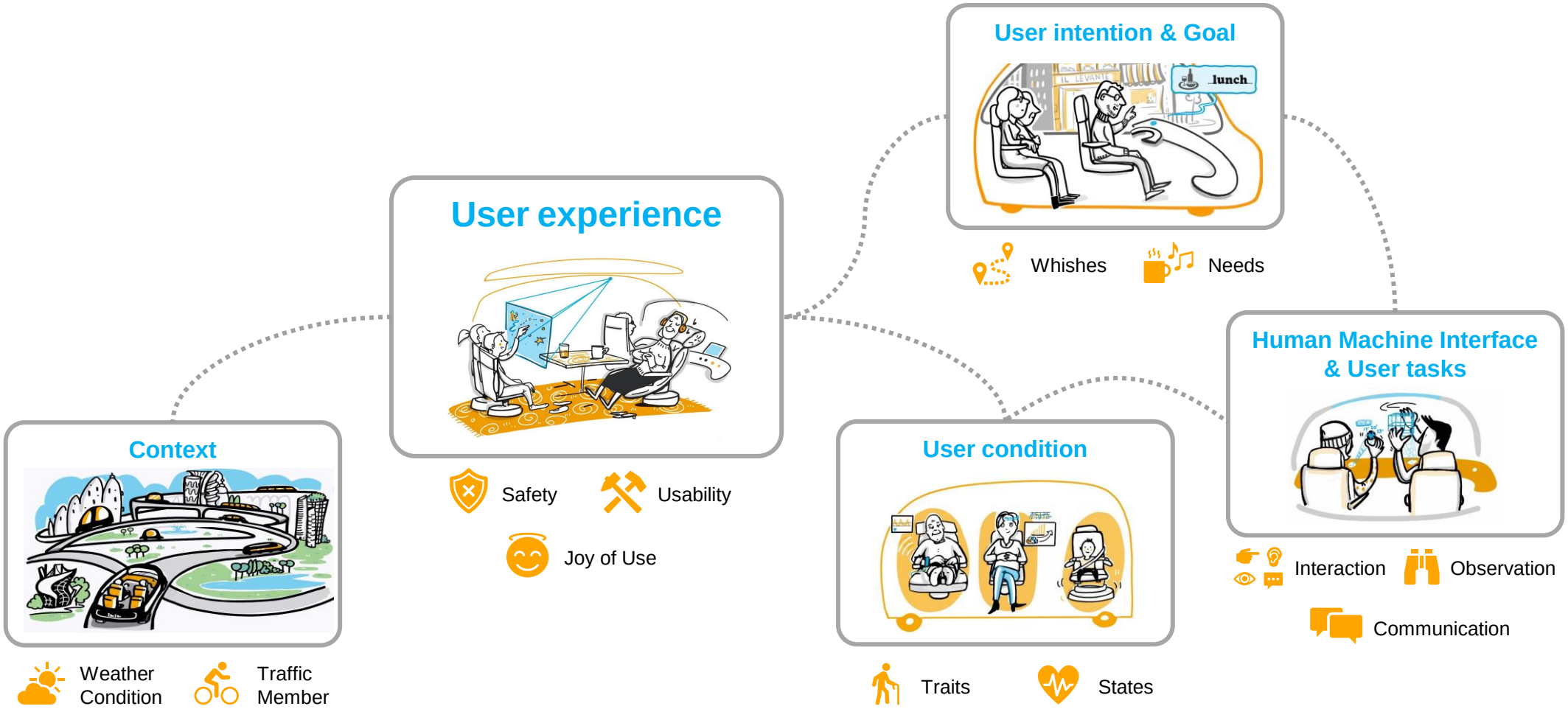


Understanding the user and his context

Basic dimensions of mobility experiences

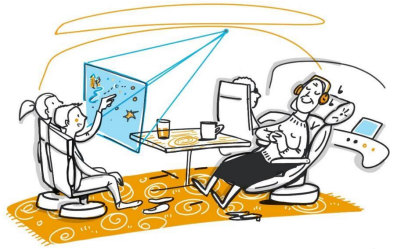
Psychology

- Perception
- Cognition
- Social Psychology
- Differential Psychology
- Emotion & Motivation

User intention & Goal

- Whishes
- Needs

User experience



- Safety
- Usability
- Joy of Use

Human Machine Interface & User tasks

- Interaction
- Observation
- Communication

Context

- Weather Condition
- Traffic Member

User condition

- Traits
- States

Understanding the user and his context

Basic dimensions of mobility experiences

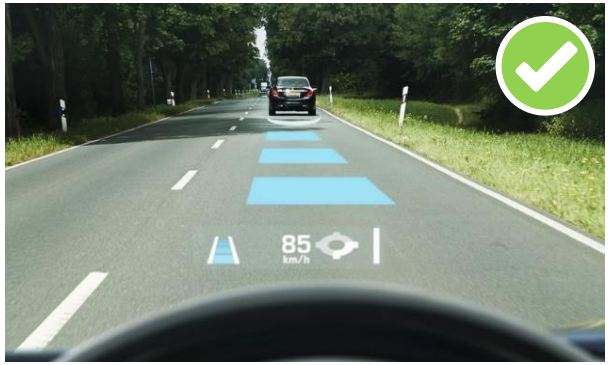
Psychology

- **Perception**
- Cognition
- Social Psychology
- Differential Psychology
- Emotion & Motivation

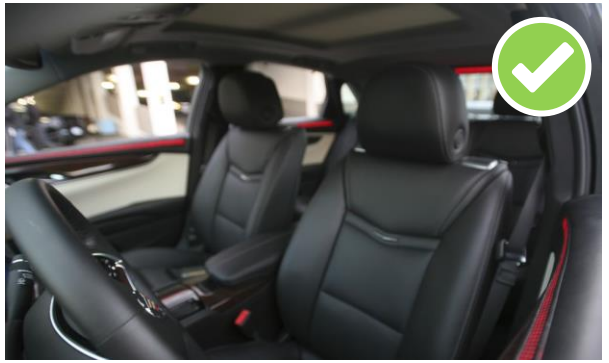
Perception

- Thresholds
- Channel capacity

→ Reading time
→Visual distraction



- HUD / AR HUD to lower perception times



- Peripherical information to guide information perception

Understanding the user and his context

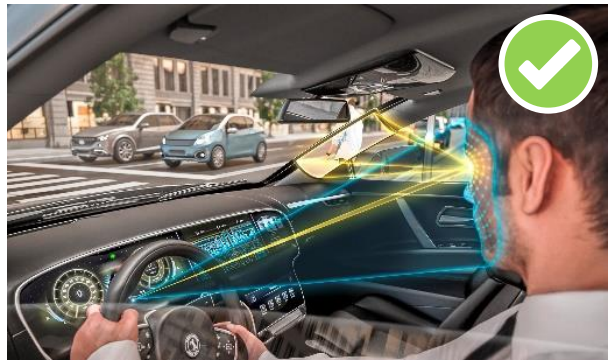
Basic dimensions of mobility experiences

Psychology

- Perception
- **Cognition**
- Social Psychology
- Differential Psychology
- Emotion & Motivation

Cognition

- Cognitive overload
- Situation awareness
- Mode awareness
- Vigilance



› Cabin Sensing

› Intersection Assistant

Psychology

Basis for user´s goals and technology solutions

Psychology

- Perception
- Cognition
- Social Psychology
- Differential Psychology
- **Emotion & Motivation**

Emotions

› Strong emotions are affecting traffic safety 1)

1) Source: https://vtnews.vt.edu/articles/2016/02/022316-vtti-researchdistraction.html last access March 29th, 2023

Psychology

Basis for user´s goals and technology solutions

Psychology

- Perception
- Cognition
- Social Psychology
- Differential Psychology
- Emotion & Motivation

- Fear of missing out
- Texting while driving 1)

- Highly Automated driving
- Efficient HMI solutions

1) Schroeder, P., Wilbur, M., & Peña, R. (2018, March). National survey on distracted driving attitudes and behaviors - 2015 (Report No. DOT HS 812 461). Washington, DC: National Highway Traffic Safety Administration. https://rosap.ntl.bts.gov/view/dot/35960 ; last access March 29th, 2023

Understanding the user and his context

Basic dimensions of mobility experiences

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- Needs

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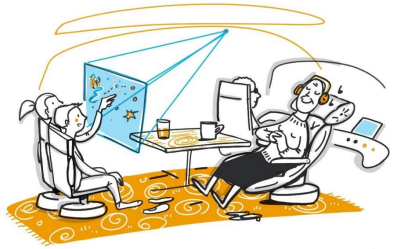

- Safety
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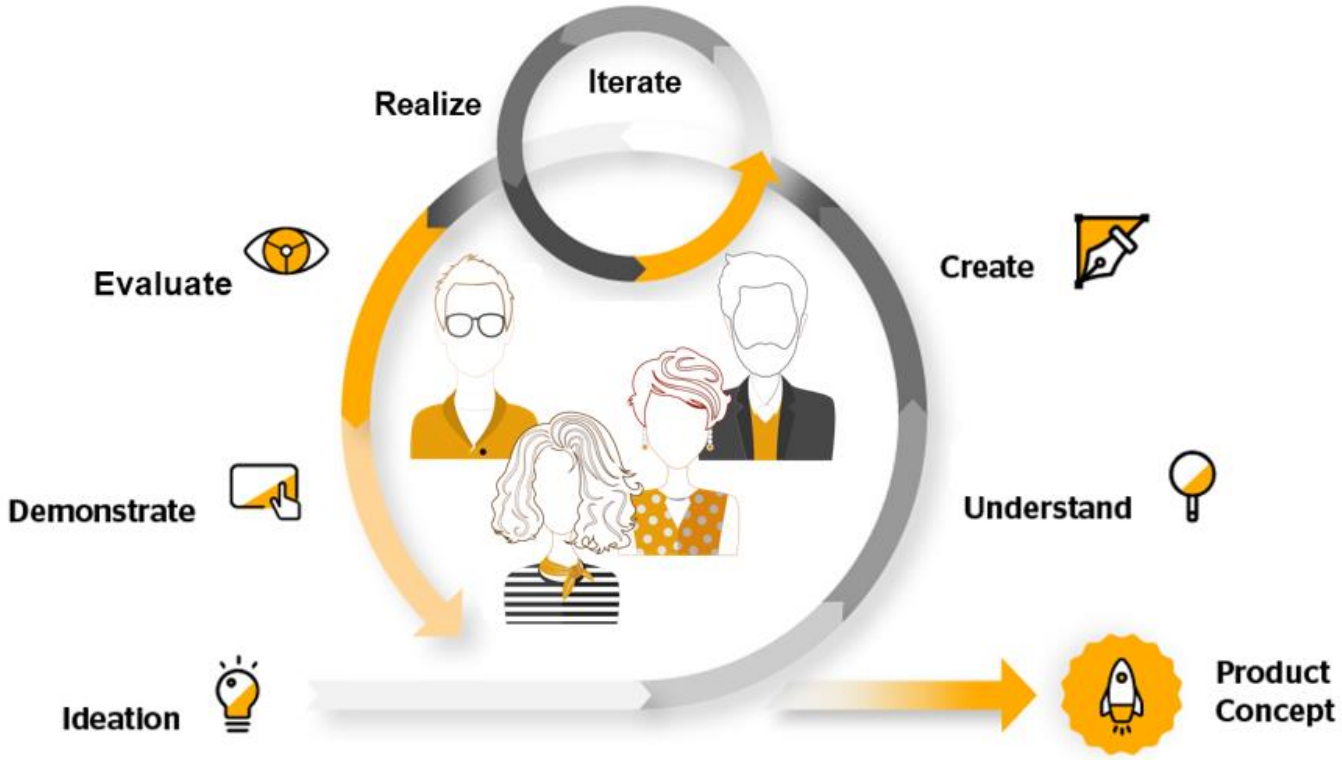
Transformation in mobility experiences

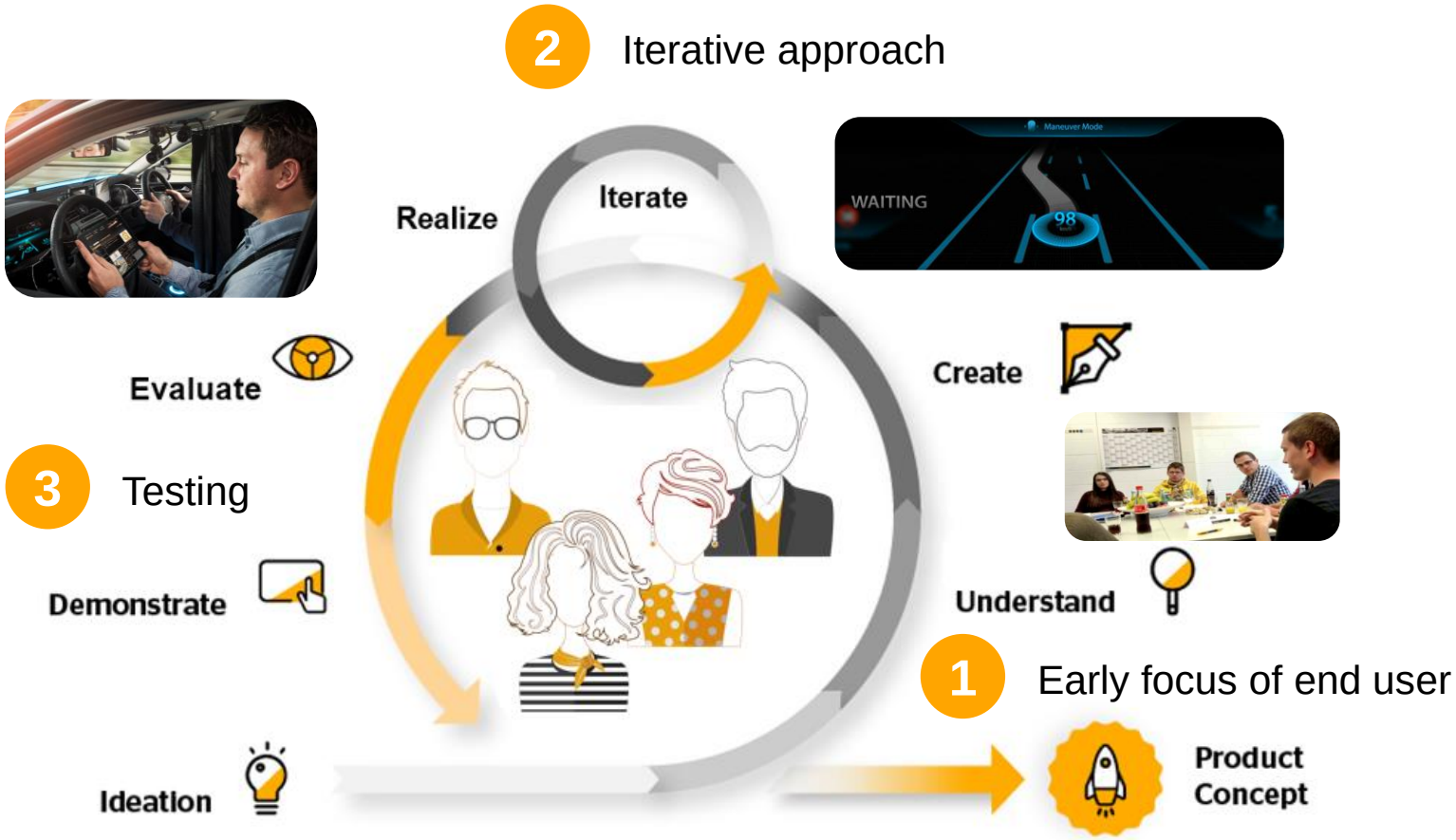
User centered design



Key Principles

Transformation in mobility experiences

User centered design

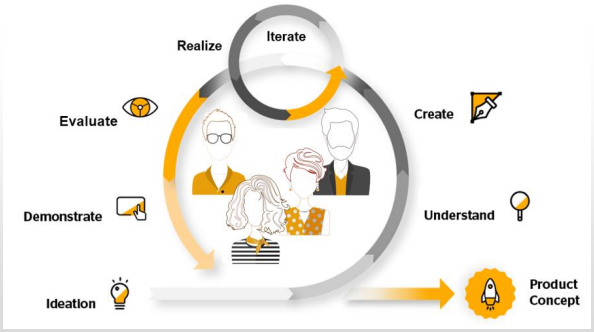


Key Principles

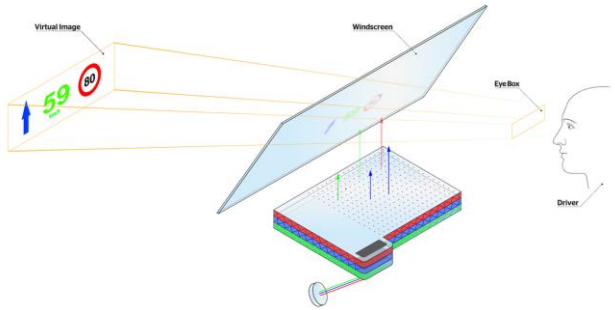
Transformation in mobility experiences

User centered design

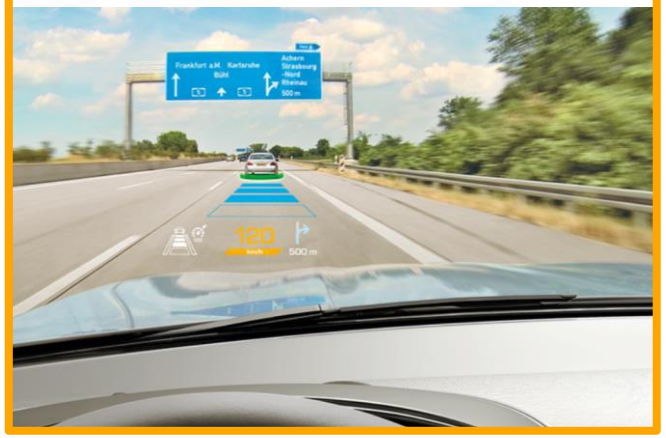
User Centered Design



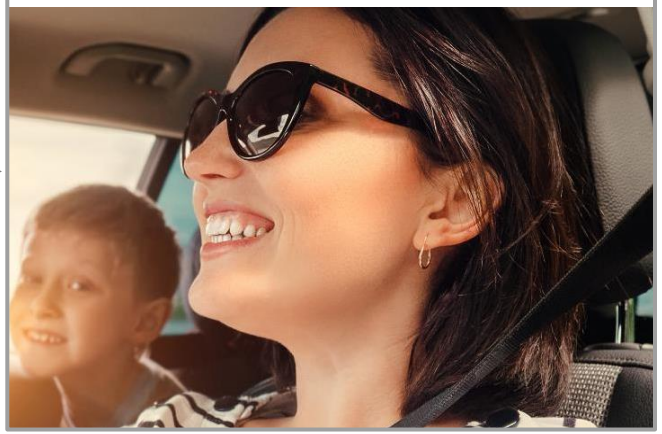
Technology & Services



HMI | Holistic approach

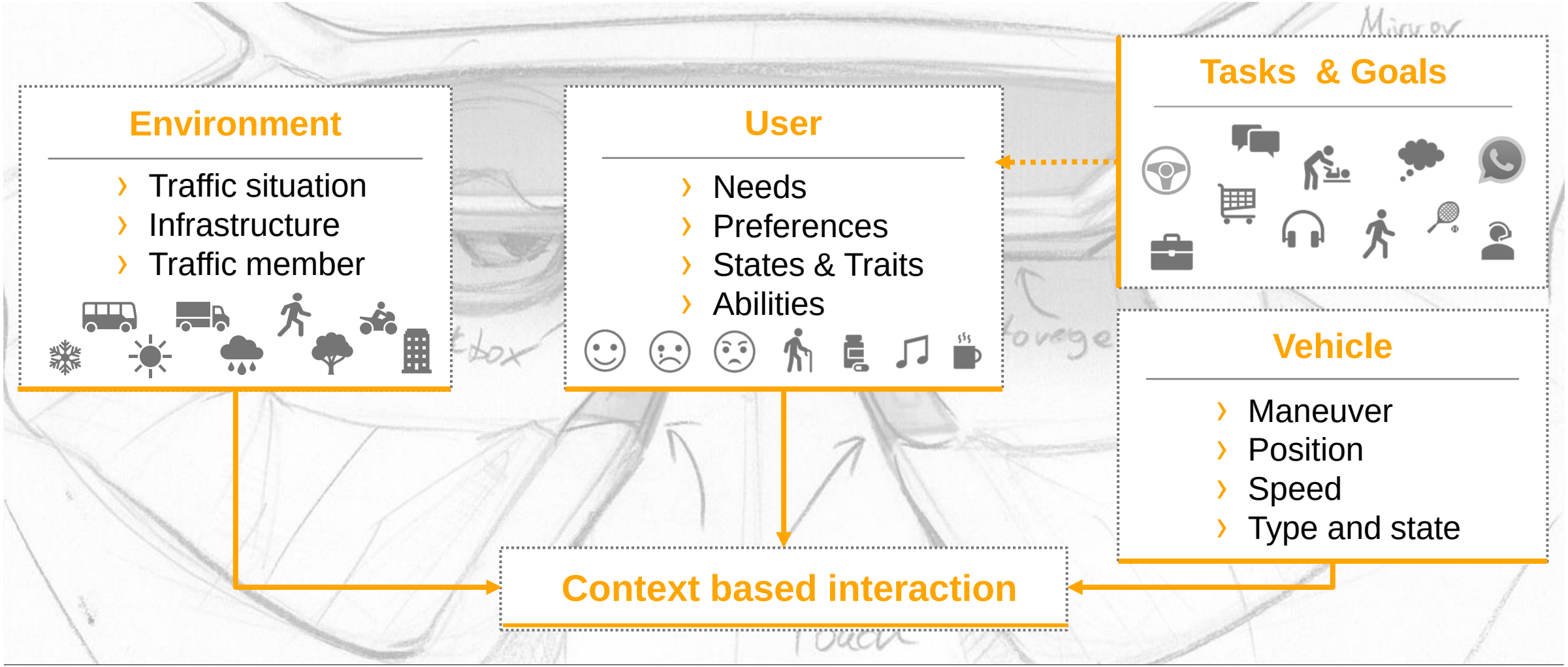


Positive UX



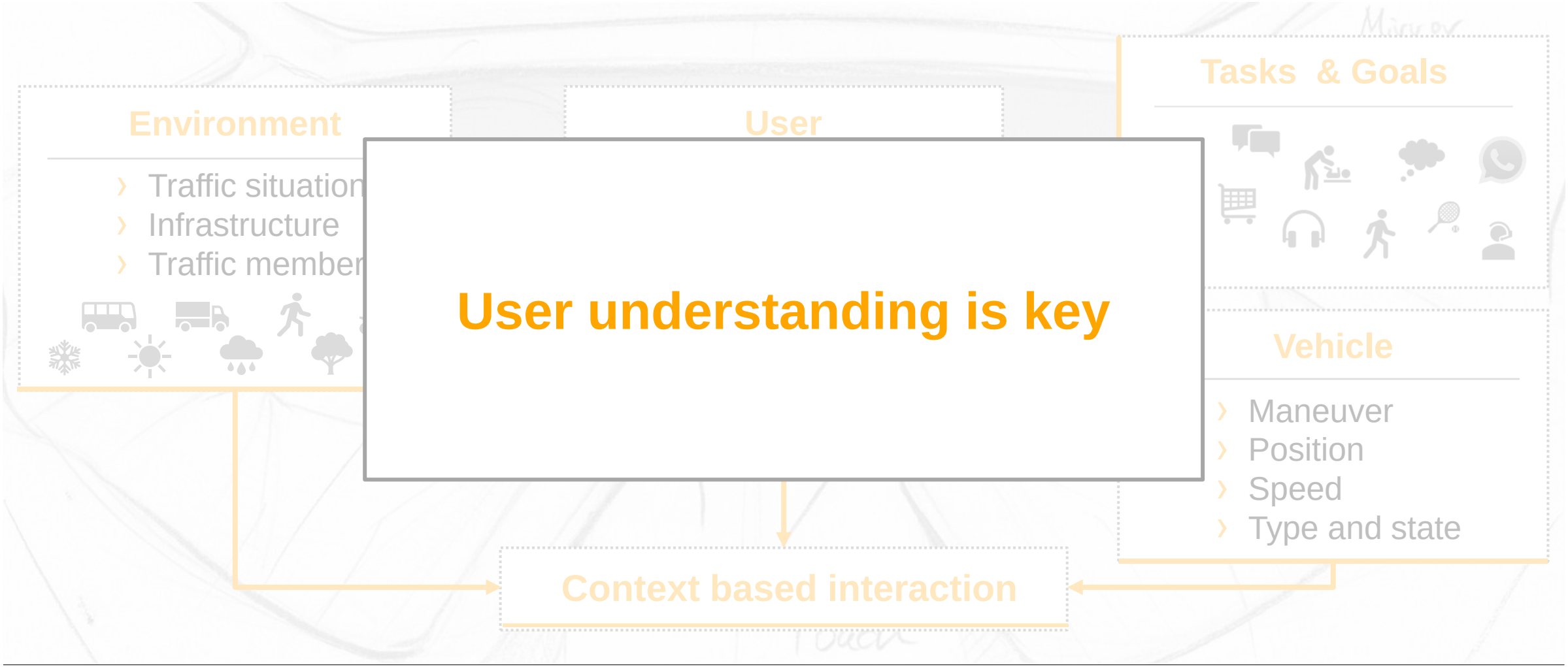
Human Machine Interface development

Holistic approach is essential



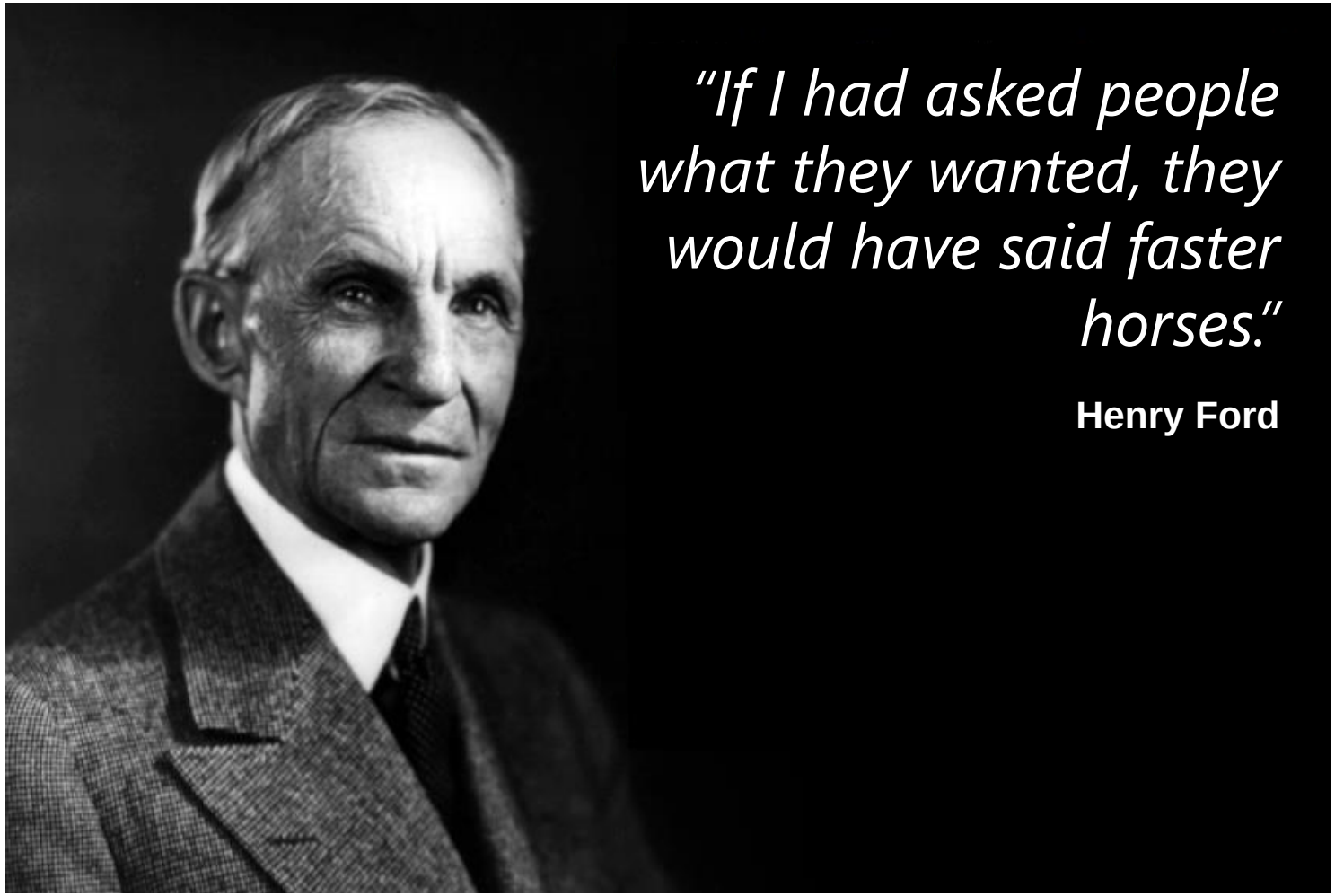
Human Machine Interface development

Holistic approach is essential



Transformation in mobility experiences

User understanding

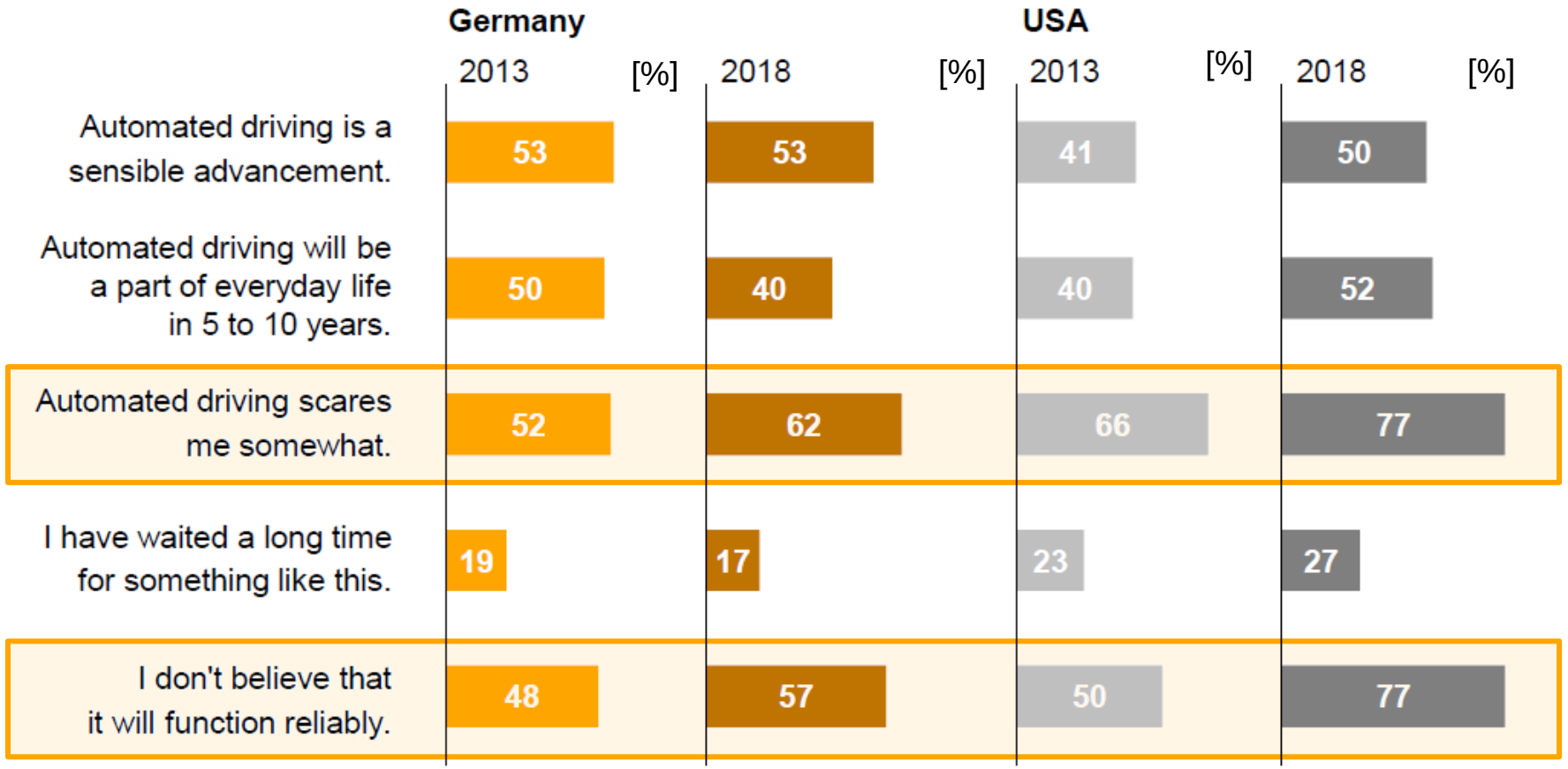


Understanding the user is about …

- … asking the "right" questions
- … selecting a suitable method
- …figuring out his needs
- …analyzing his context

Attitudes towards Automated Driving

Challenge: Trust



time comparison

Driver

Representative

Question: Within the next five to ten years there will be cars which can drive themselves so that the driver can spend some of the journey time doing other things. People can have different opinions about automated driving.
For each statement, please tell me to what extent you agree or disagree.

figures in percent,
share of "yes, I tend to agree" displayed

Continental mobility study 2013 Participants: 1000 per country; 200 online interviews per country; Continental mobility study 2018 Participants: 1015 per country; 1050 online interviews per country

Increase trust level…

…through enhanced system transparency

- Show what the vehicle in automated mode recognizes
- Clear assignment of system and user tasks
- Multimodal information management
- Providing route related information

Increase trust level…

…through enhanced system transparency

HAPTIC SEAT

SPEECH OUTPUT
EARCONS

Inspiring mobility experiences
Conclusion

- Transformation in mobility experiences took place
- None driving related tasks will become most important
- HMI creation according end users' needs is the enabler for positive mobility experiences
- Understanding the end user in regards of psychology dimensions is important
- Considering the context is key
- Result: Human machine interface innovations which perfectly fits to user´s expectations

Inspiring mobility experiences
Conclusion

User Centered Design with it´s focus on a deep user understanding is THE enabler for HMI technologies which leads to **inspiring mobility experiences**

We are the advocate of the end user

Blind Trust? Calibrating Trust in Technology

Sebastian Weiss

“**TRUST** is the attitude that **an agent will help achieve an individual’s goals** in a situation characterized by **uncertainty and vulnerability**.”

Lee & See (2004)

"**TRUST** is the attitude that **an agent will help achieve an individual's goals** in a situation characterized by **uncertainty and vulnerability**."

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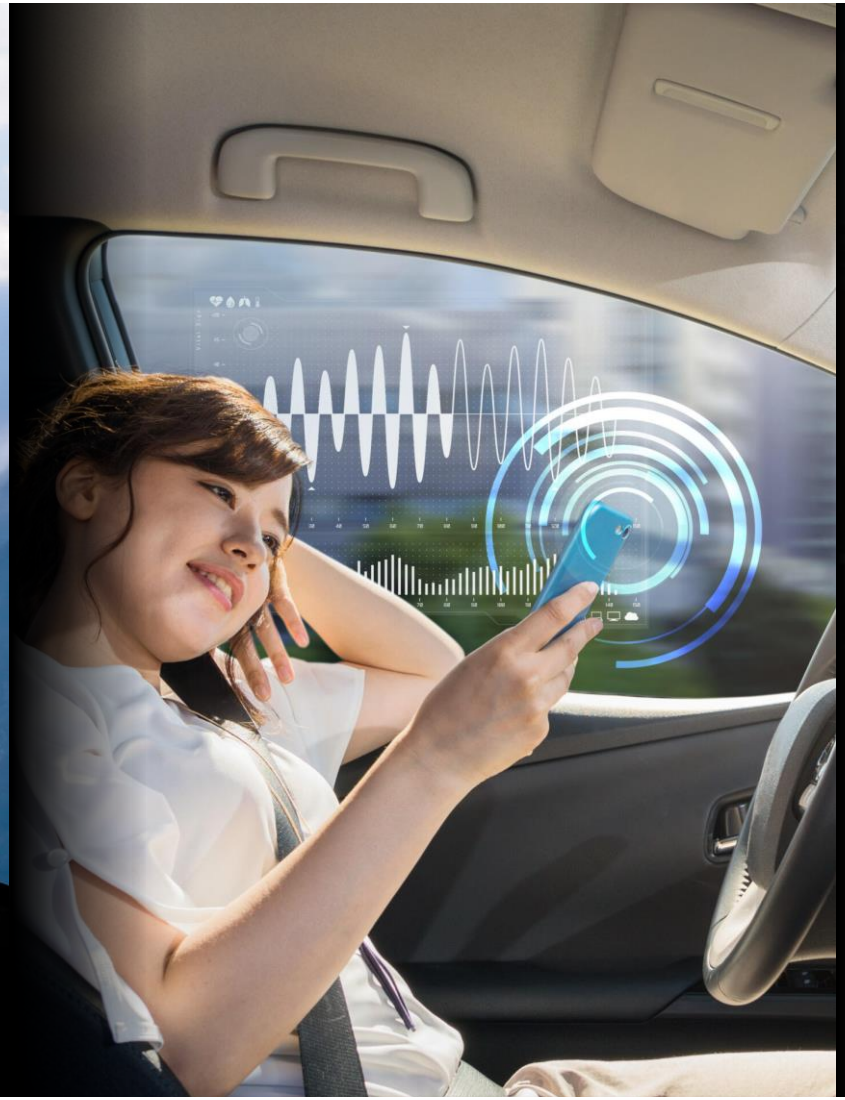
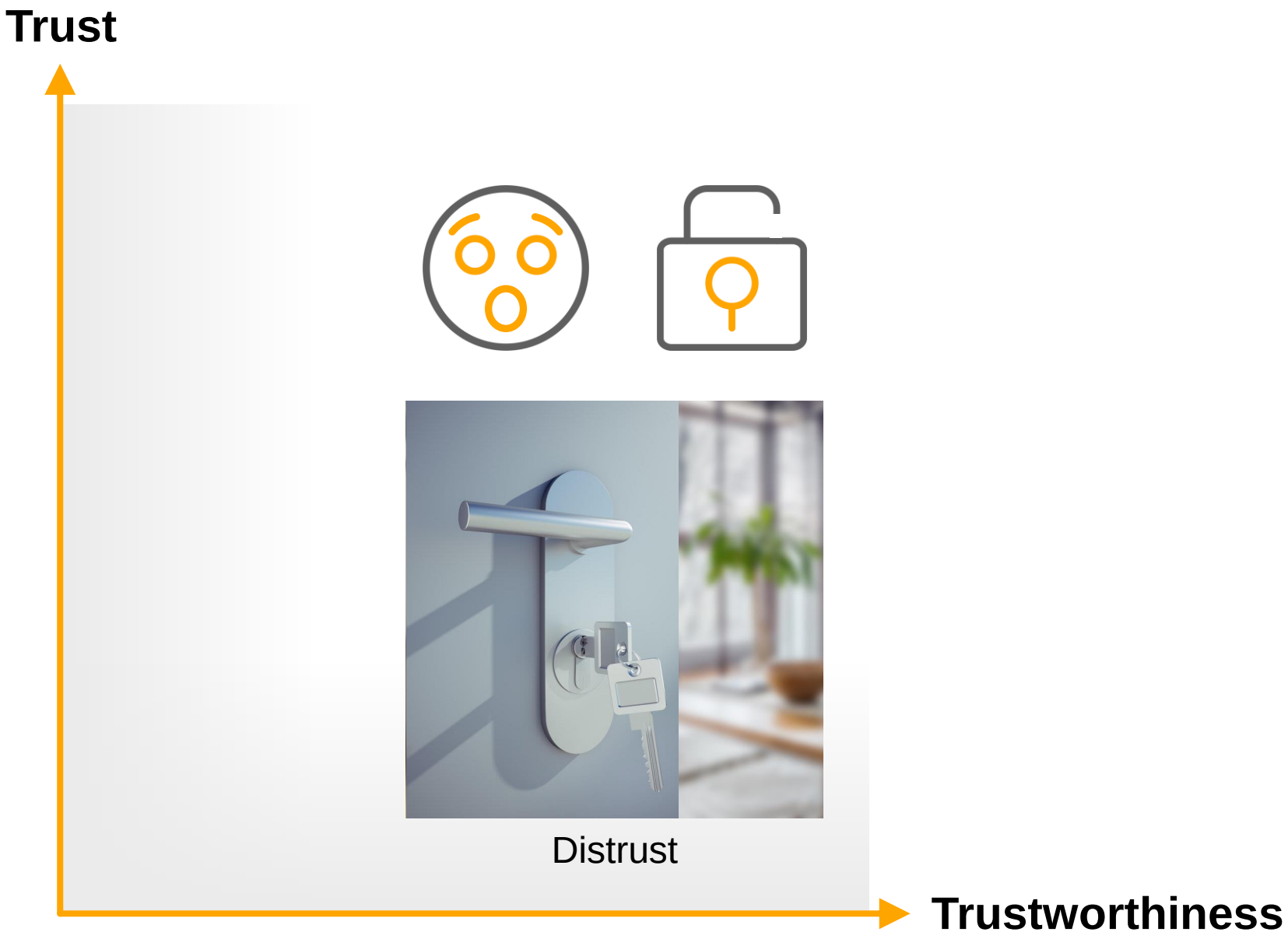
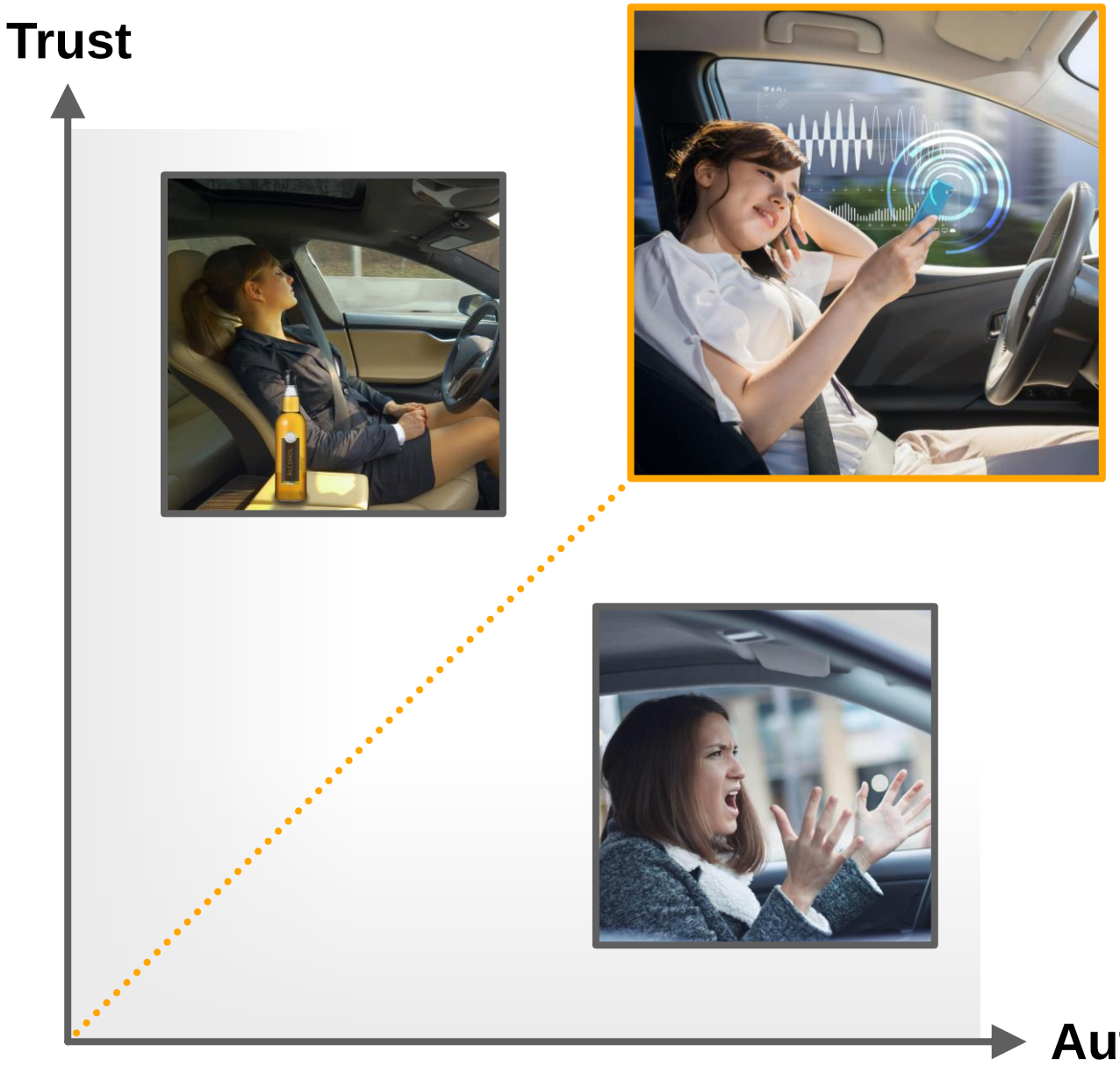


Should you trust blindly?



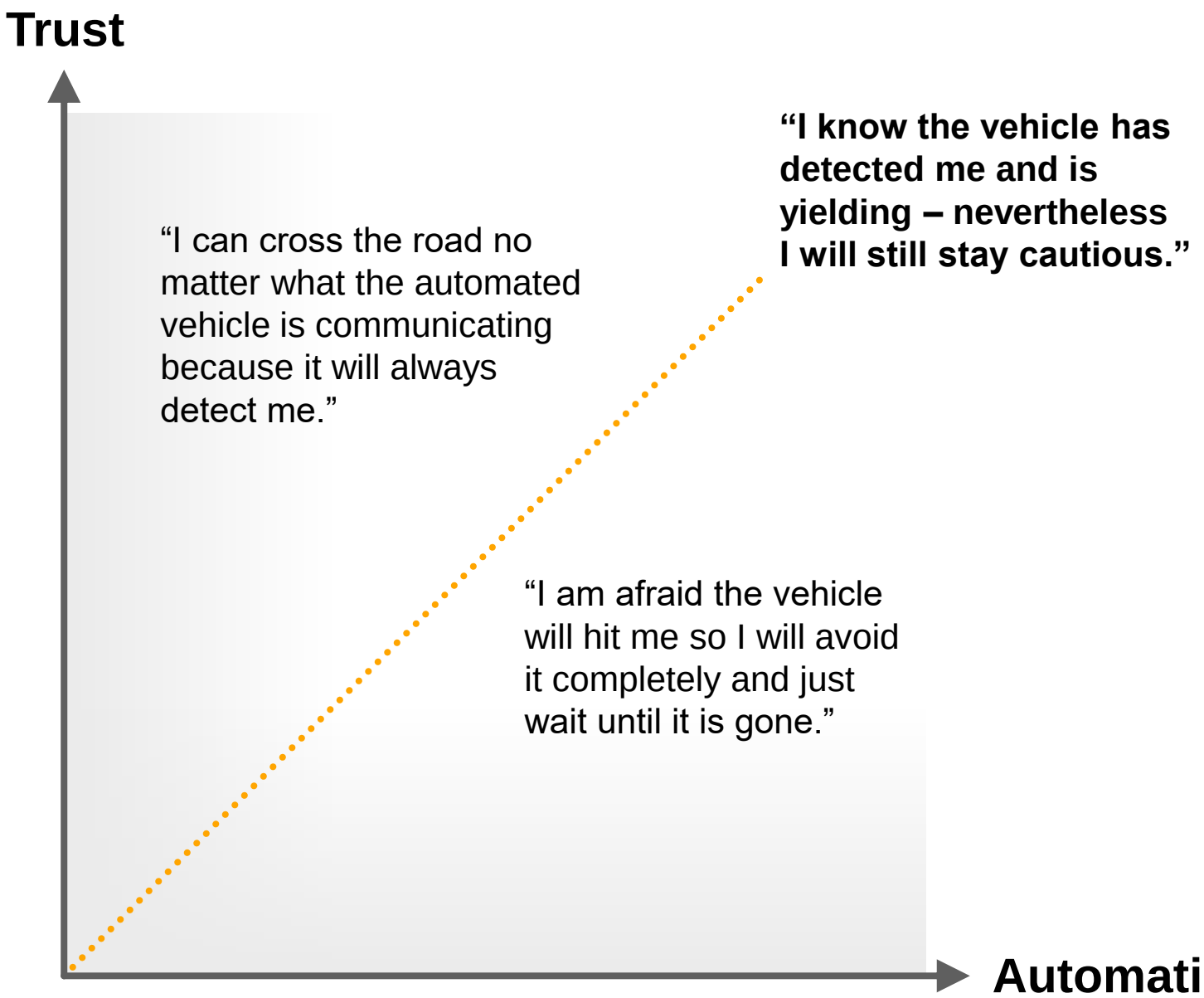
Lee & See (2004)


Autopilot mode
100m
48
mph

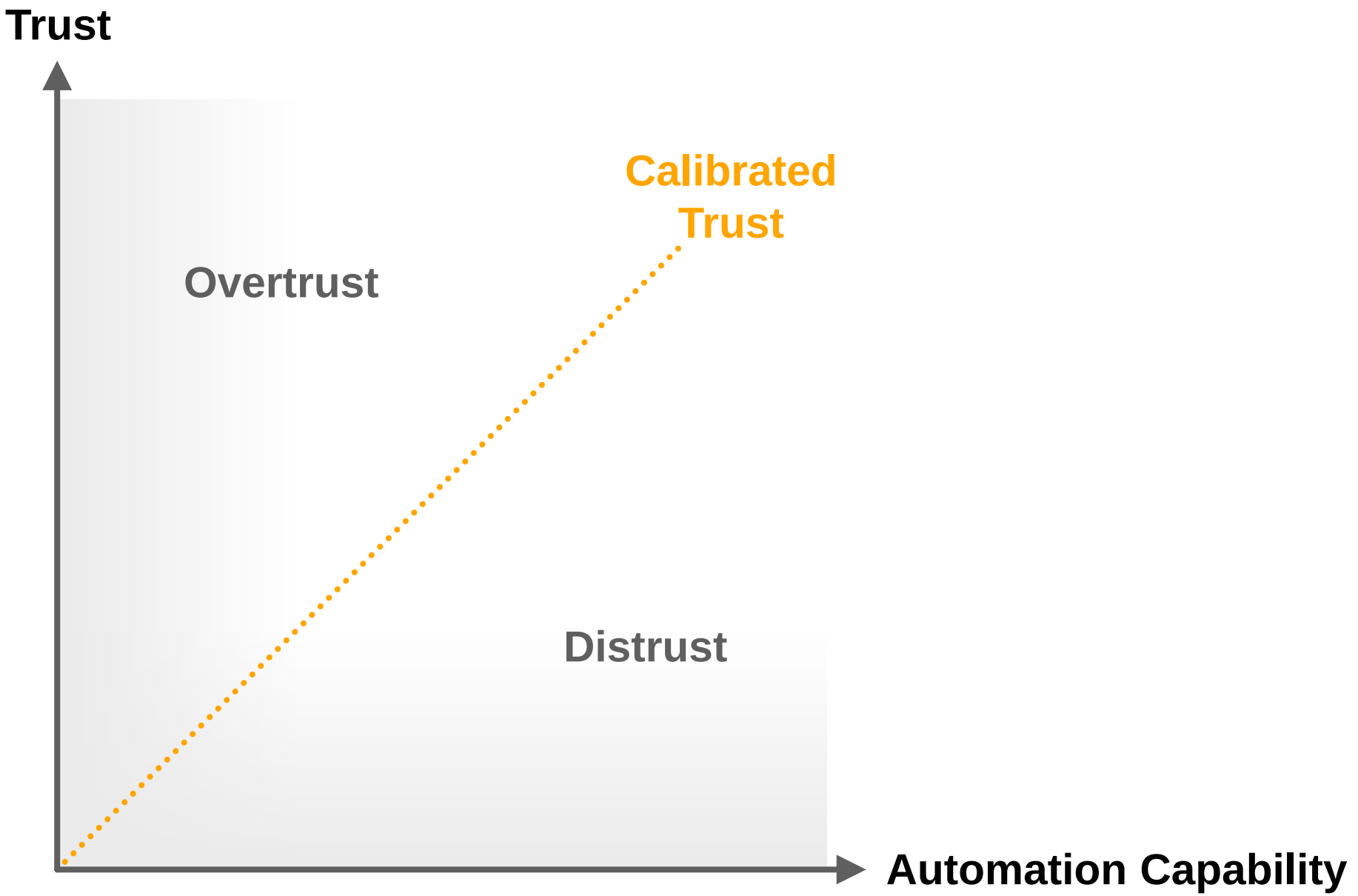


Lee & See (2004)

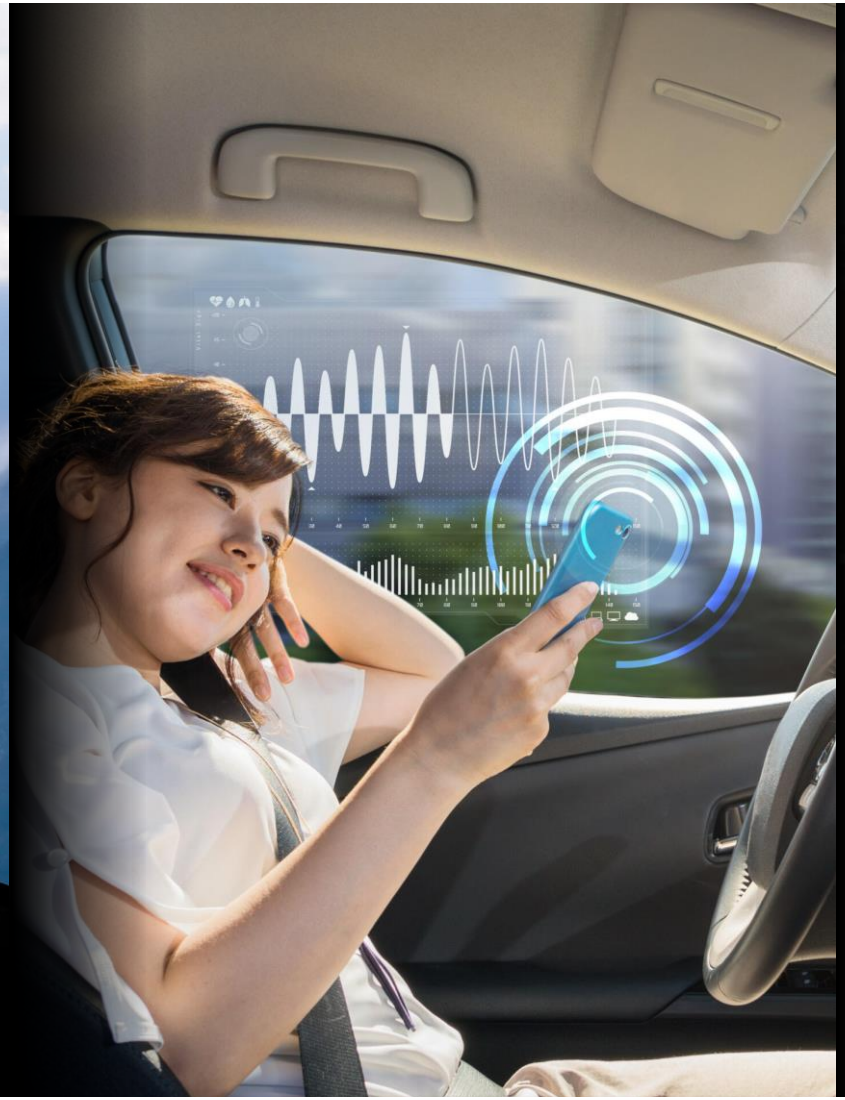

Continental
Leib & Seele


Trust
“I can cross the road no matter what the automated vehicle is communicating because it will always detect me.”
“I know the vehicle has detected me and is yielding – nevertheless I will still stay cautious.”
“I am afraid the vehicle will hit me so I will avoid it completely and just wait until it is gone.”
Automation Capability

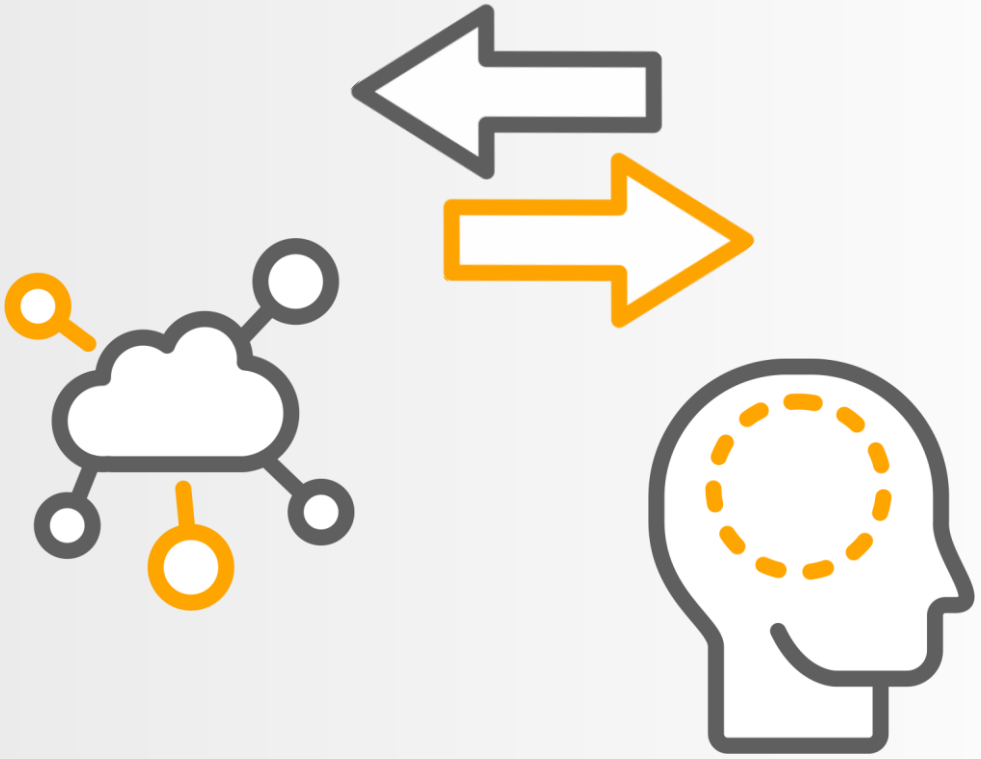
Lee & See (2004)


Trust
Calibrated Trust
Overtrust
Distrust
Automation Capability

Lee & See (2004)



Why is it challenging to calibrate trust?

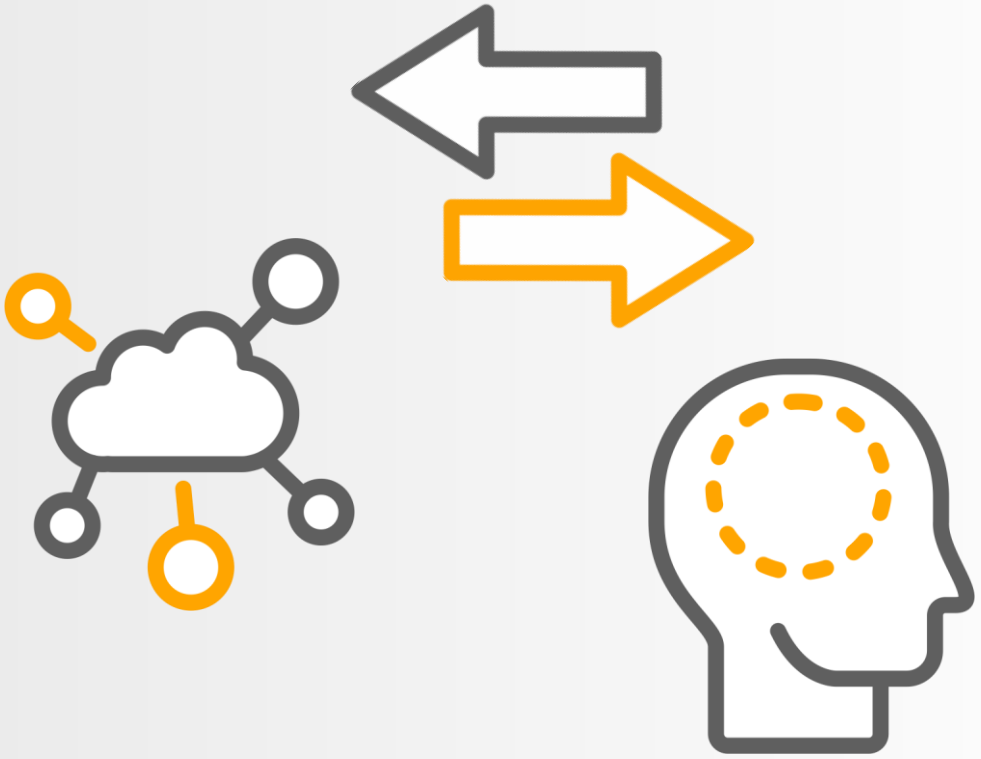


TRUST

- Other people
- Environment
- Time

- Appearance
- Level of Control
- Ease of Use
- Communication
- Transparency

- Personality
- Age
- Technical Affinity
- Cultural Background
- Prior Knowledge



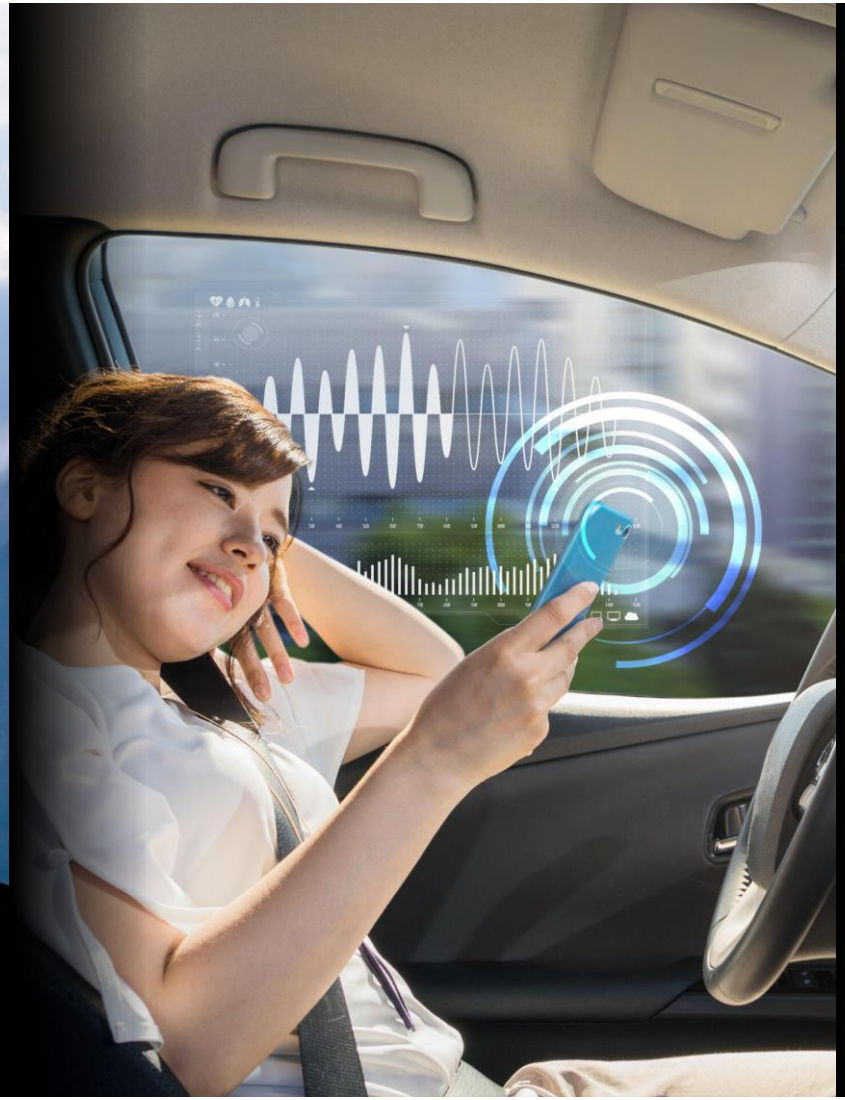
TRUST

Safety

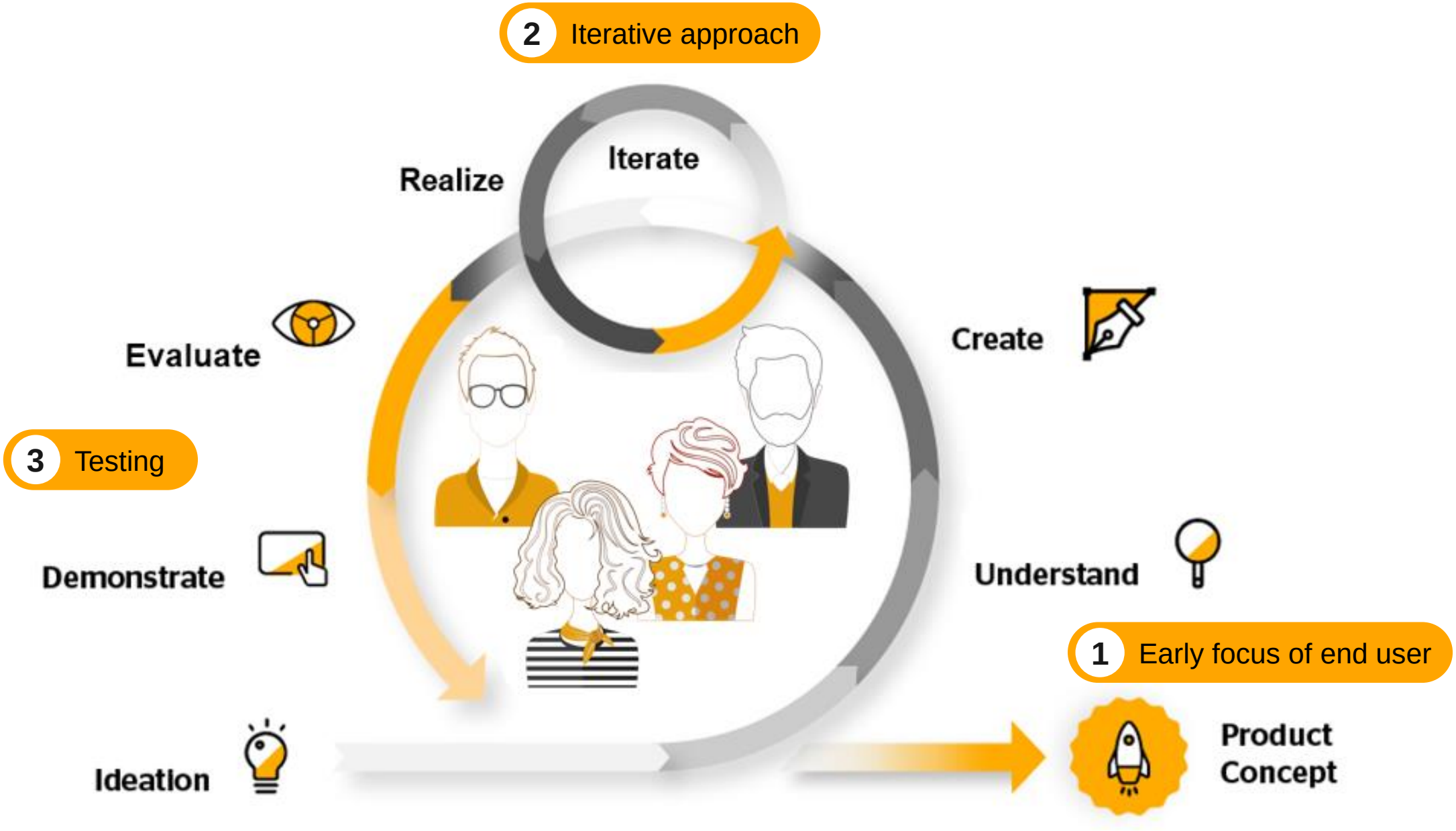
Acceptance

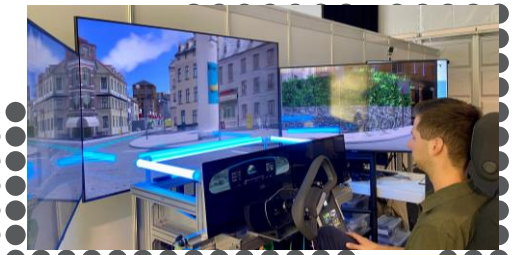
Usage

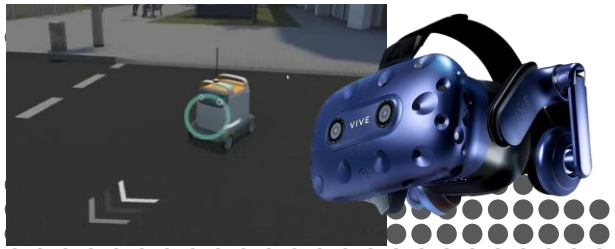
Hoff & Bashir (2015)



How do we develop to meet the challenges?


2 Iterative approach
Realize
Iterate
Evaluate
Create
3 Testing
Demonstrate
Understand
1 Early focus of end user
Ideation
Product Concept

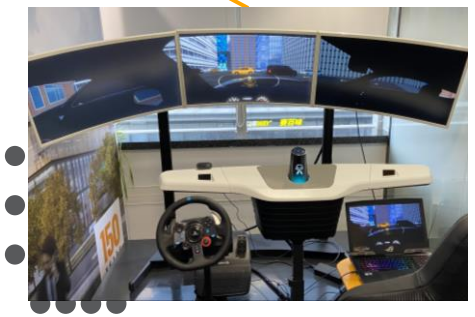




Babenhausen
Germany

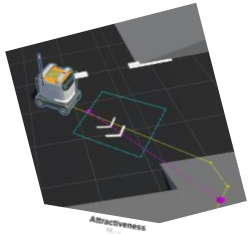
Rambouillet
France

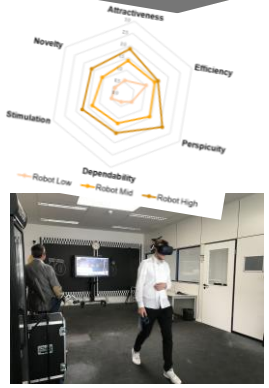
Shanghai



Singapore


FPS: 29
14:07:48
Currently Tracking: Bod
VIVE





Evaluate

Set-up of VR environment for the user study

Demonstrate

Ideation

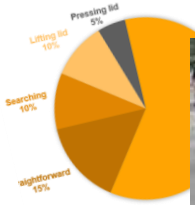
Realize

Iterate

New product design, Human Machine Interface and behavior for the delivery robot

Create

Understand



Present delivery robot: Corriere LM

Product Concept

Stable Virtual Reality environment

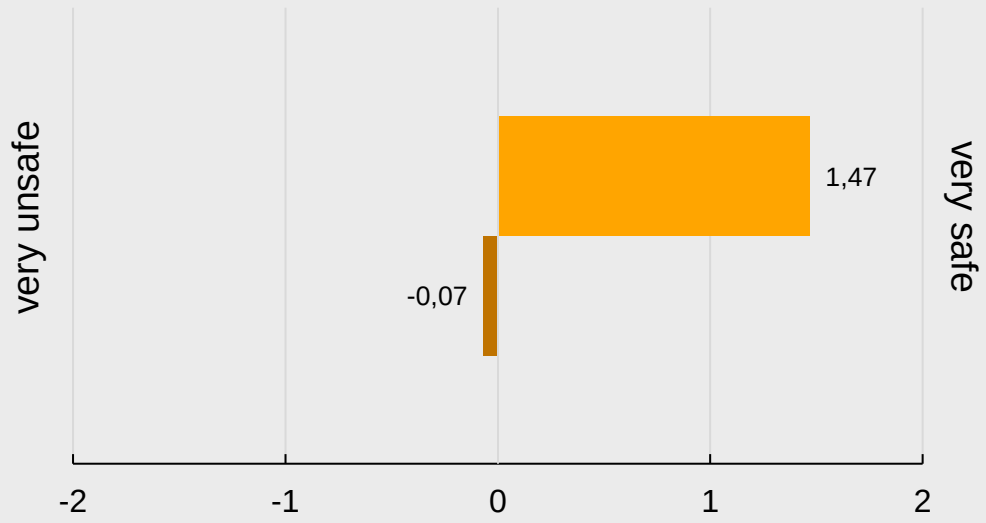
Robots with different HMI features

>30 Participants
in Singapore & Germany
Different age groups
Various prior experience with robots

More humanoid communication

Which robot do you trust more?

Perceived Safety



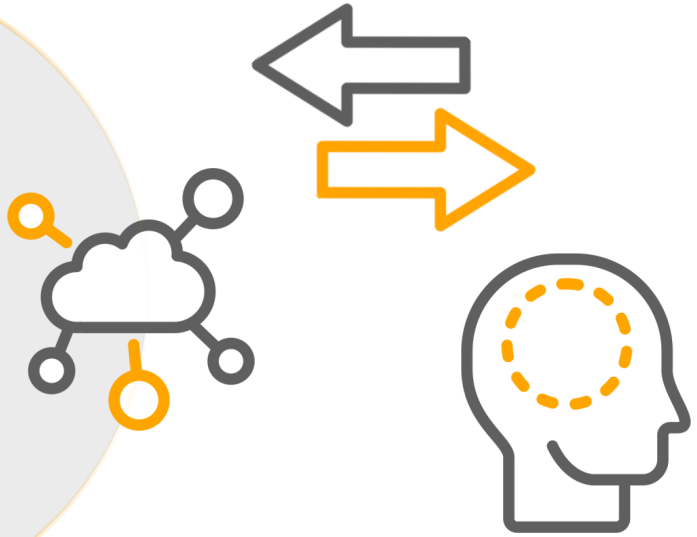
User Experience

Scales range from
-3 (poor) to **+3** (good)

No humanoid communication

Humanoid communication

- Appearance
- Level of Control
- Ease of Use
- Communication
- Transparency



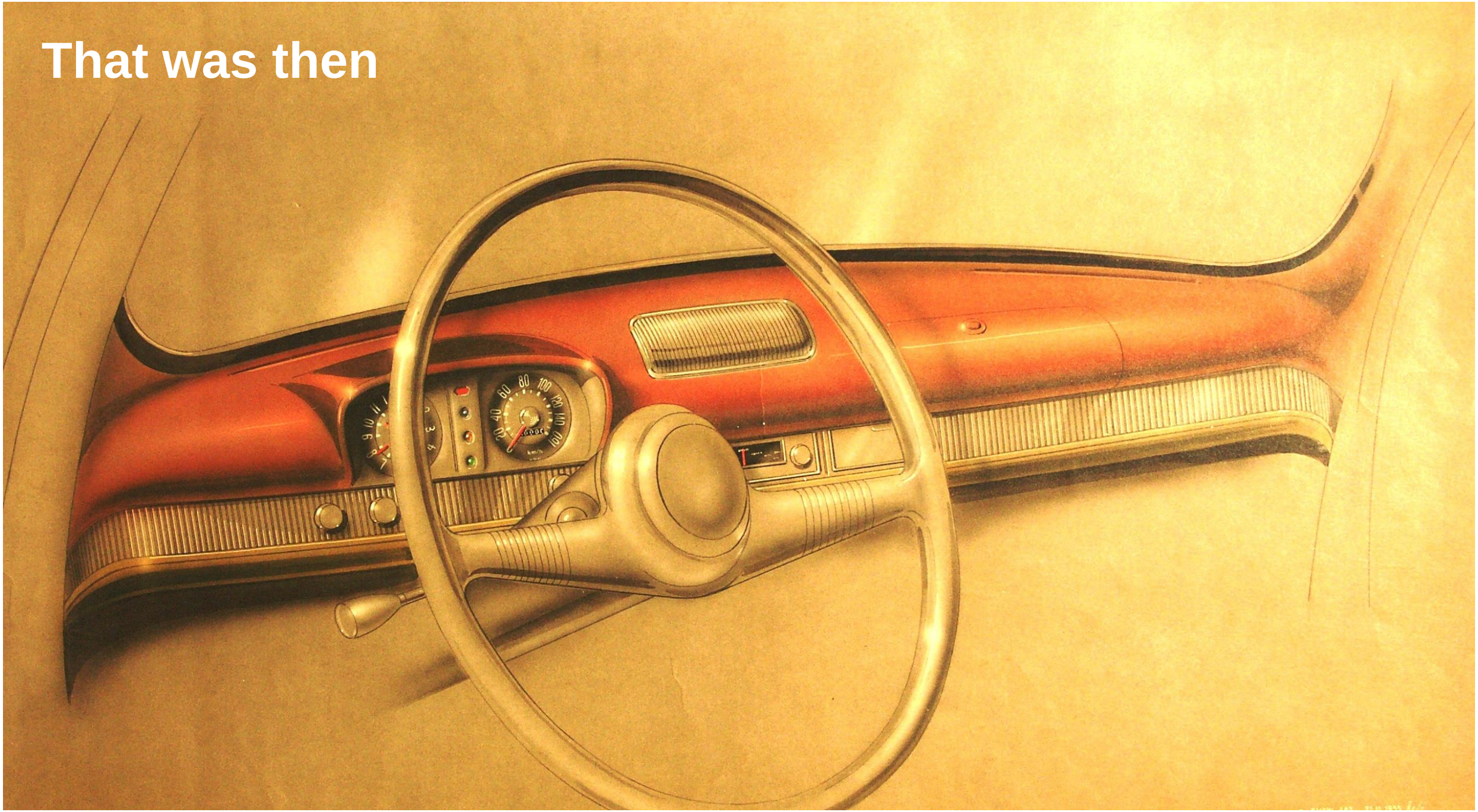
This is what we at Continental thrive for:

- To provide the right information at the right time and place.
- To help to achieve the user's individual goals in a situation characterized by uncertainty and vulnerability.
- To build calibrated trust – so you do not have to trust blindly.

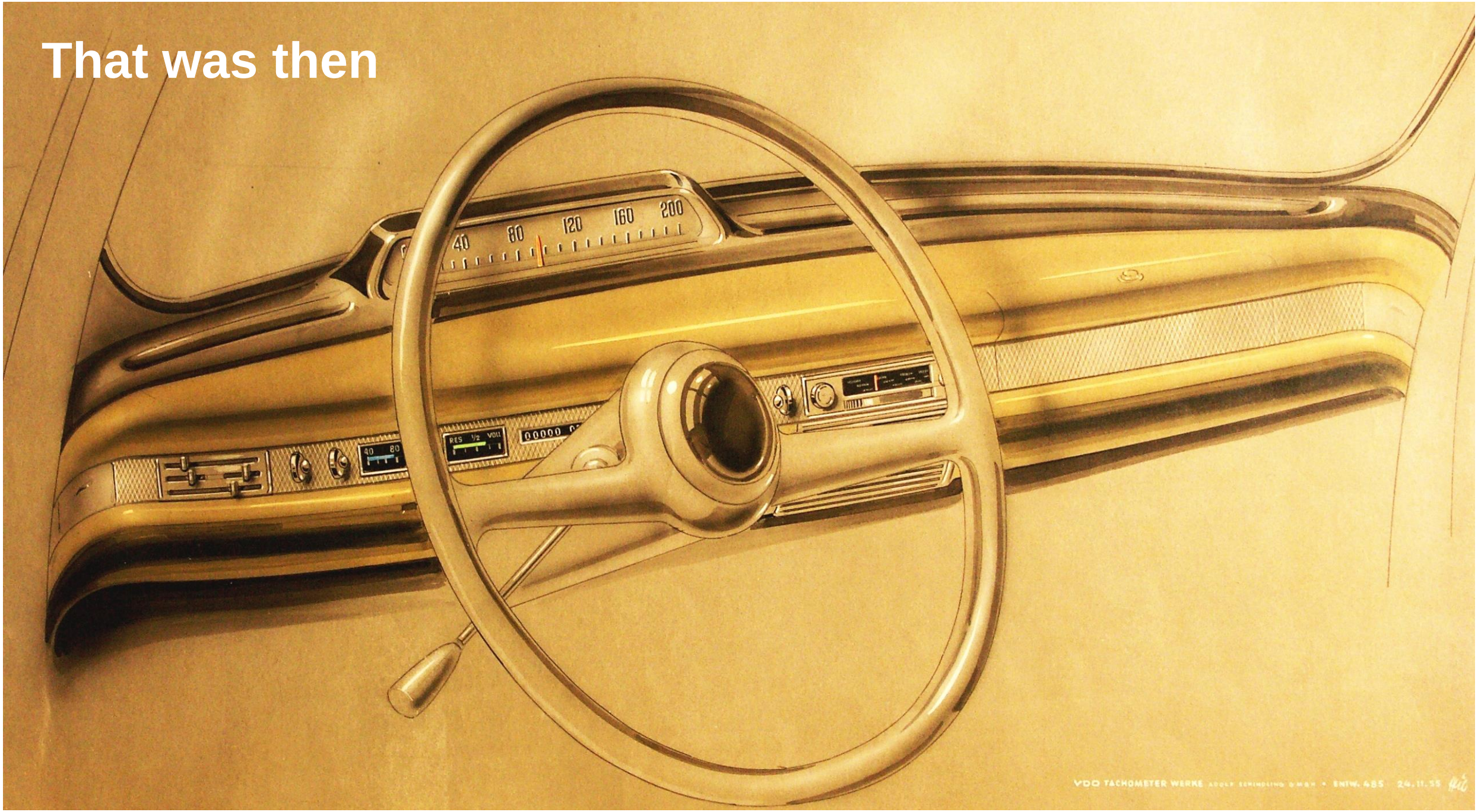
UX and Link to Innovations & Products…?

Jochen Möller

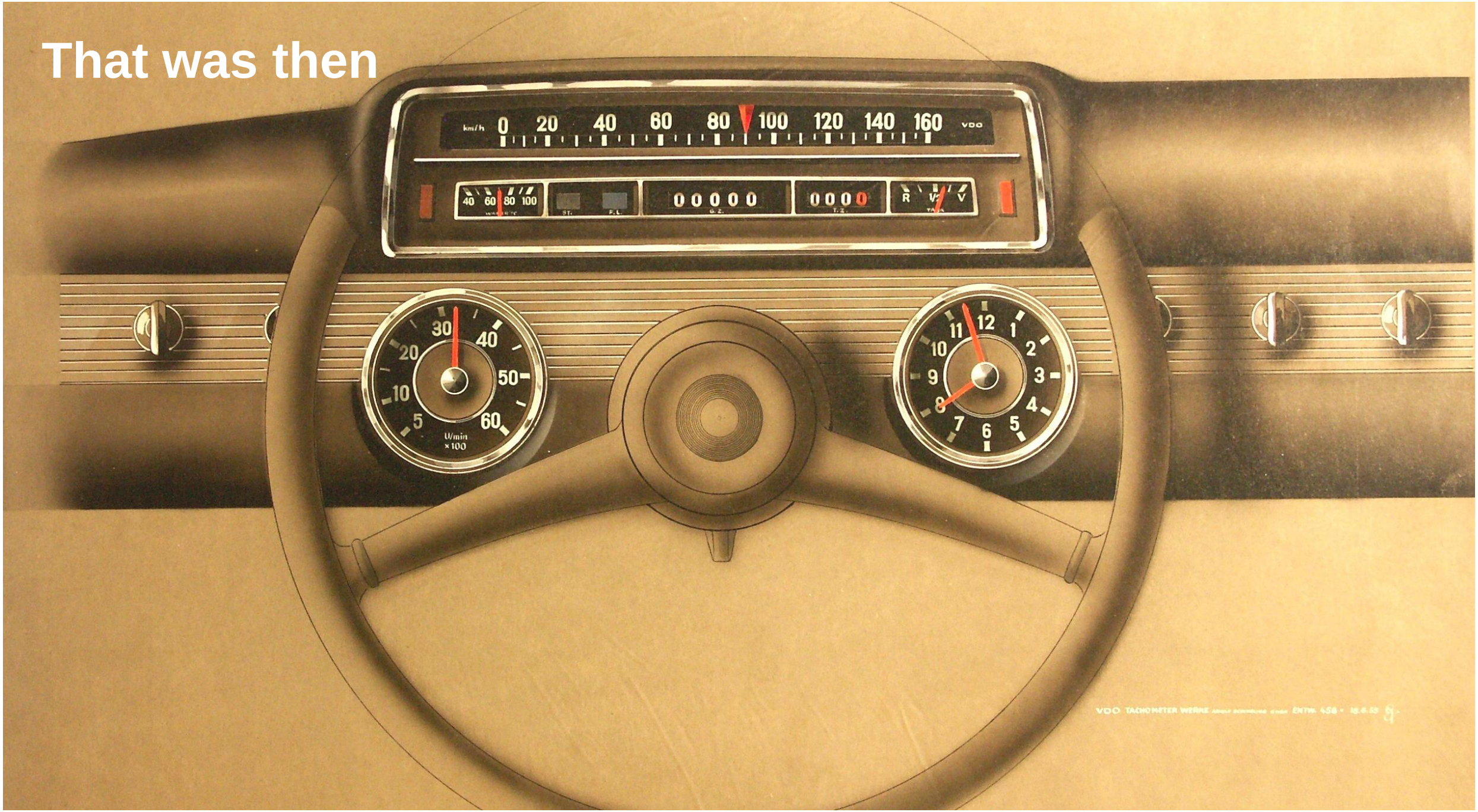
That was then



That was then



That was then



This is now

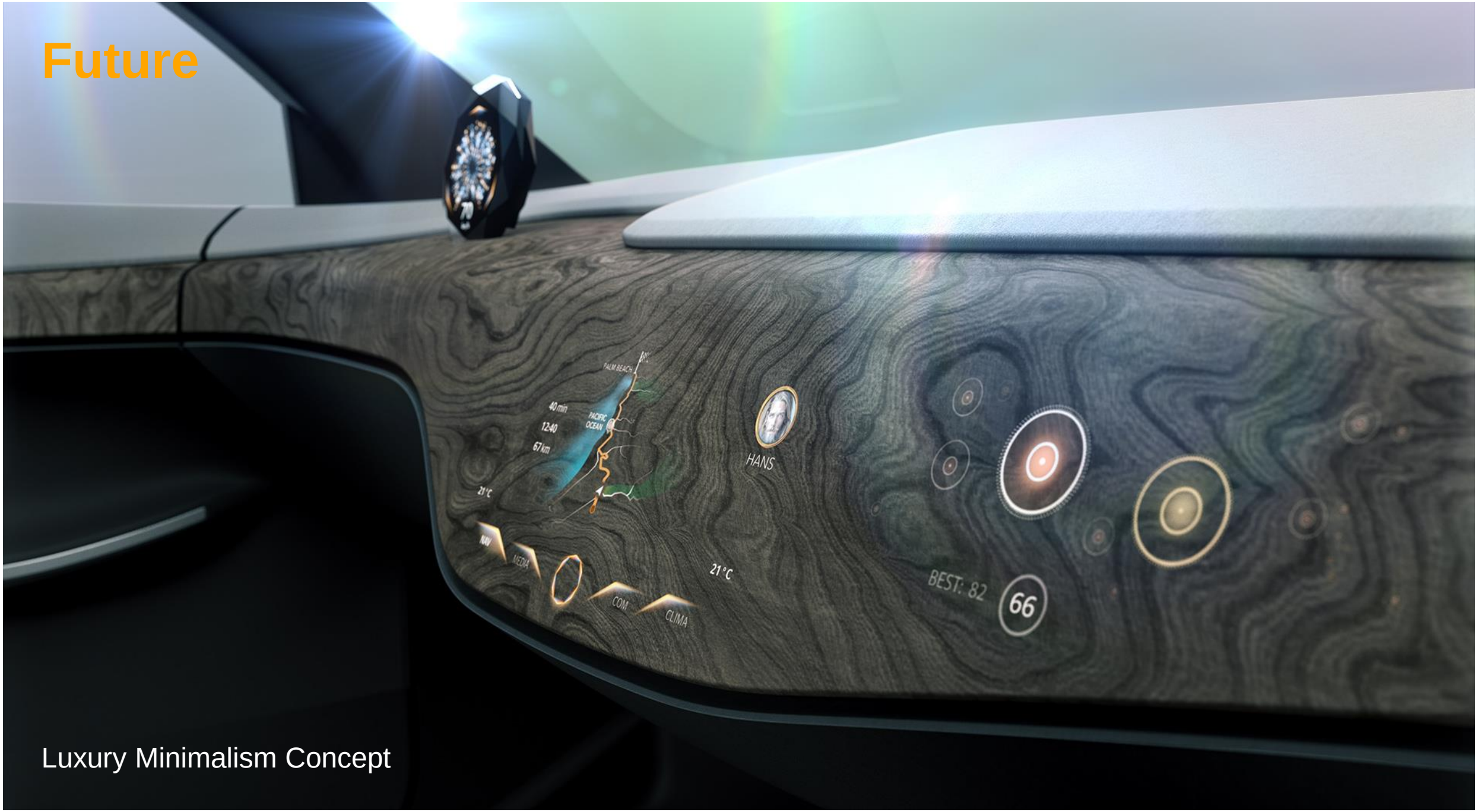

PAUL
CARLIFORNIA ROAD
10.5 MI
20 MI
35 MI
FUEL CONSUMPTION
Ø 32
MPG
55
MPH
30
01:52
03:34
FLYING BIRDS
BLUE MILES
SANTA MONICA CALIFORNIA
68°F
PALM BEACH
WEST DRIVE
TITLES
63
MEDIA
72

Movie

Haptic Relief Print on Surface

Minimalism

Future



Luxury Minimalism Concept

Continental
The Future in Motion

UX Cockpit Concept 2026

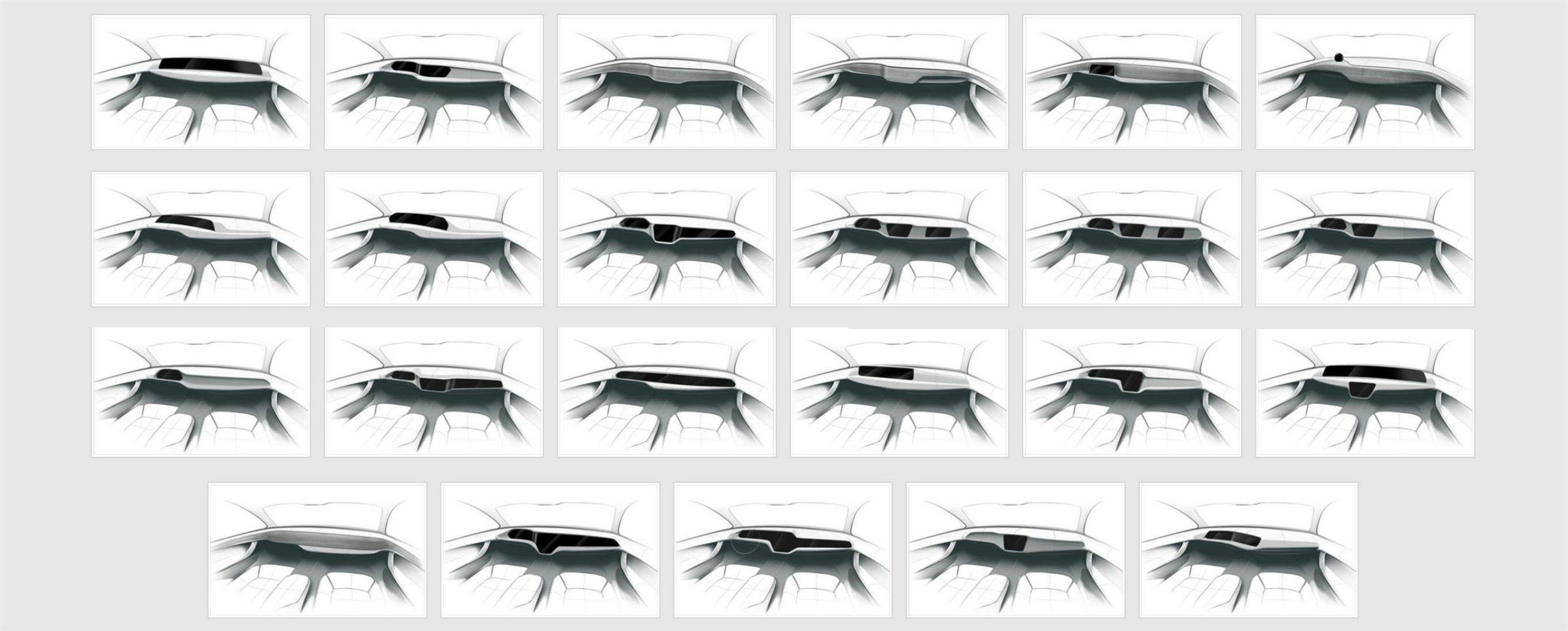
Luxury Minimalism

00:00,00

Luxury

The Future?

Many Cockpits Thinkable



Q&A

Speakers:

- Christoph Bernhard
- Guido Meier-Arendt
- Sebastian Weiß
- Jochen Möller