

Fluid Interface Concept for Automated Driving

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Virtual Vehicle Research



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HMI CHALLENGE

Provide enough information

Induce rapid, appropriate response

Avoid cluttering and overload



IN AUTOMATED VEHICLES

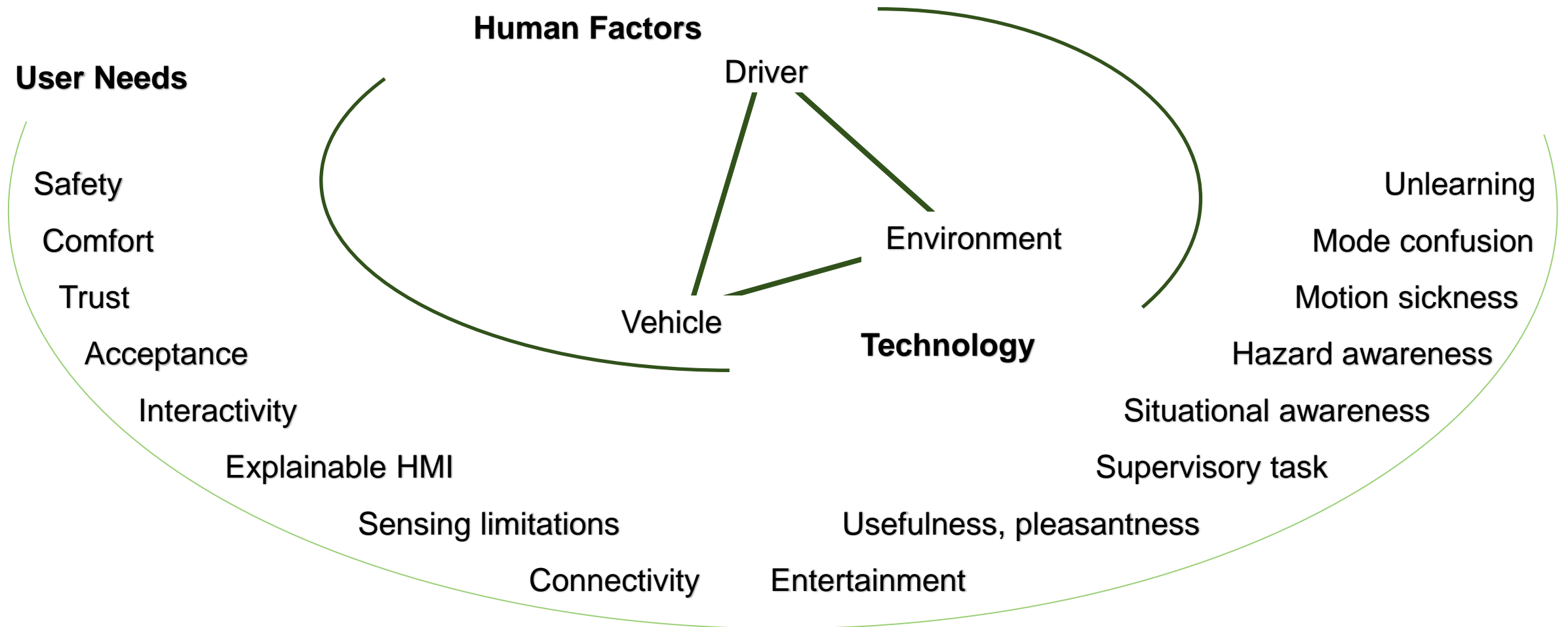
Human operator not engaged

Accommodate different functions

Taylorred and flexible



NEED FOR NEW CONCEPT



CONCEPTS

Mercedes-Benz F015



BMW ZeroG Lounger



Audi Experience Ride



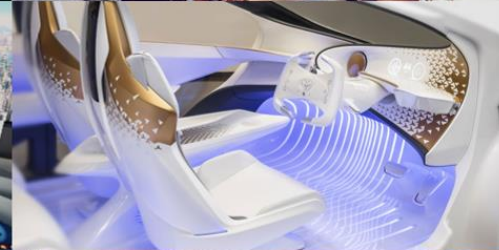
Renault Symbioz



Nissan Invisible-to-Visible



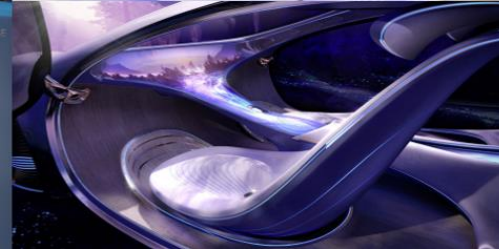
Toyota Concept-I



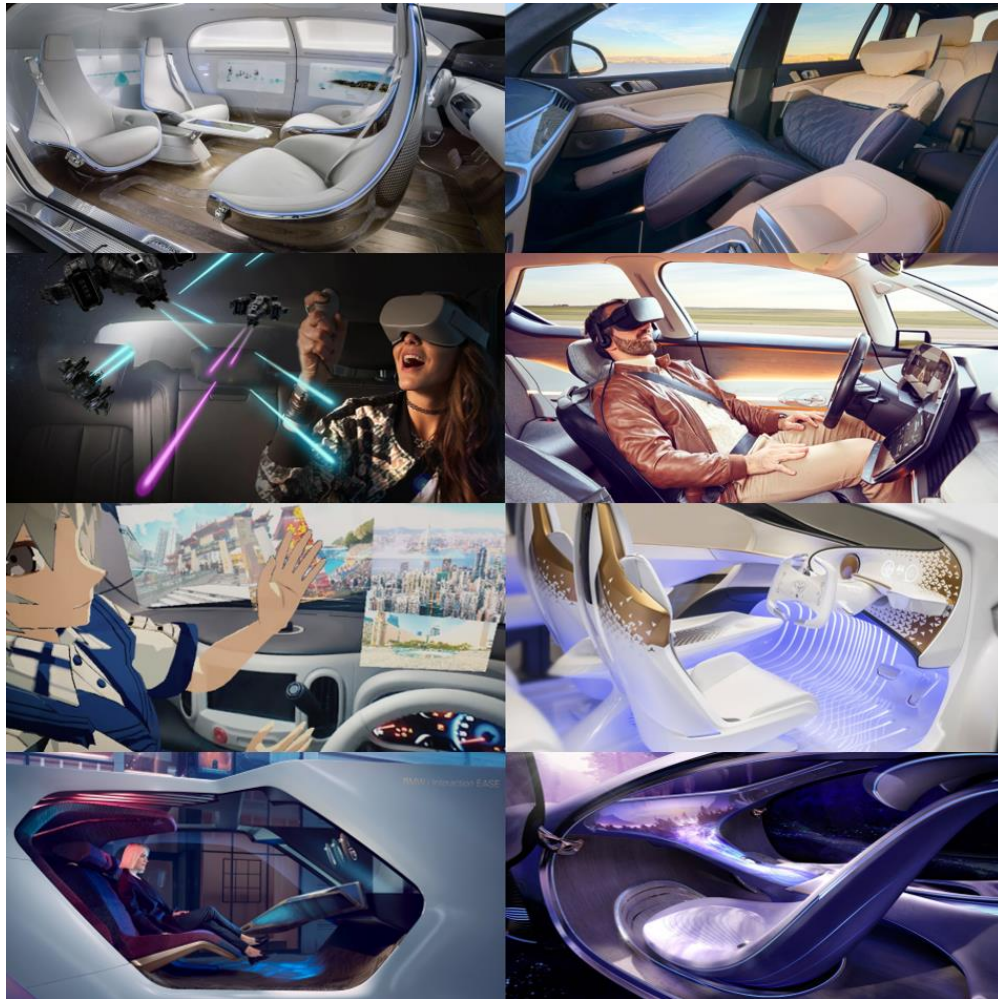
BMW i Interaction EASE



Daimler Vision AVTR



CONCEPTS



- Immersive visual experience
- Connection between interior and exterior
- Humanized interface
- Spacious and comfortable

Take on the shape of any container

Support any exerted force

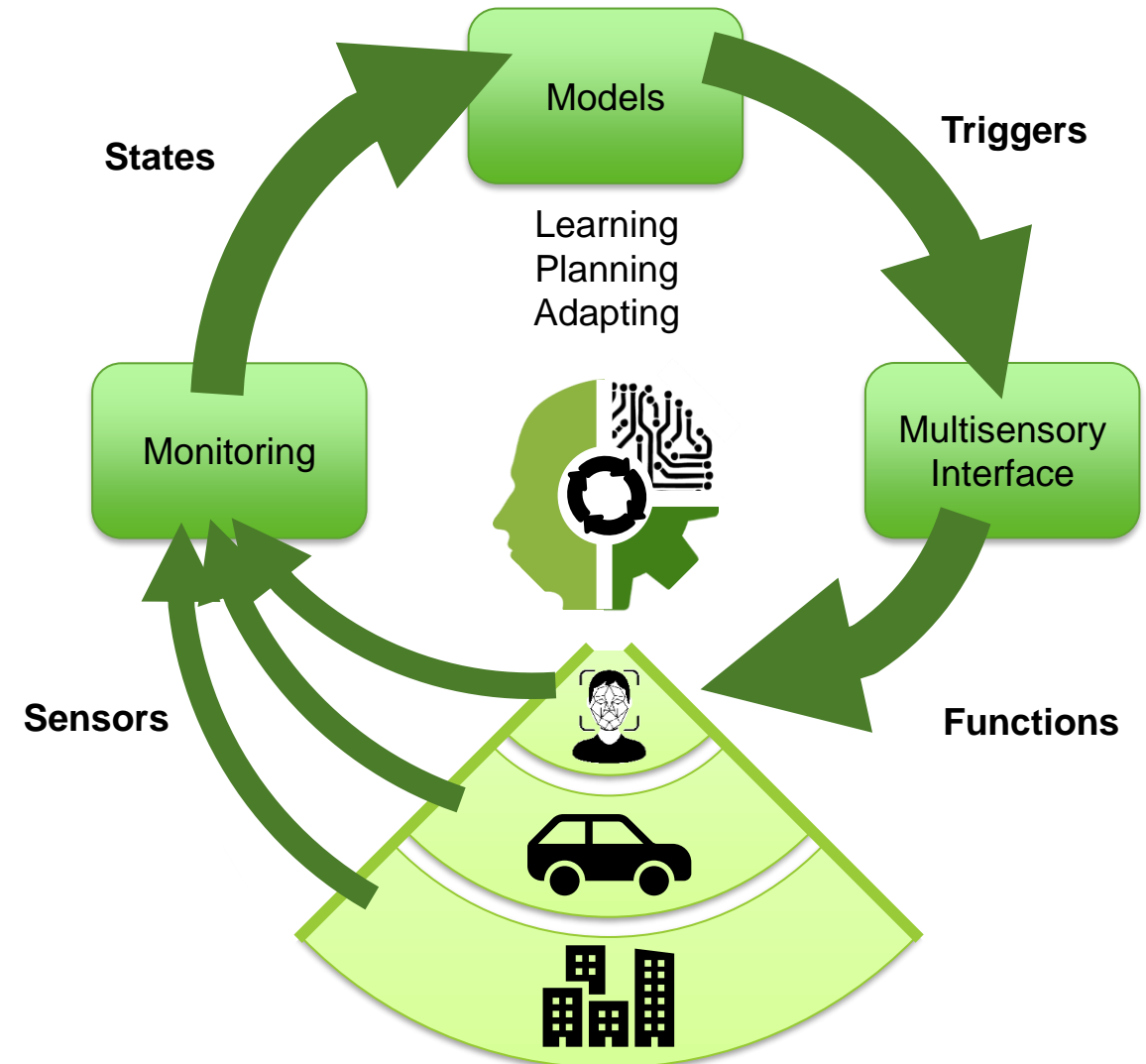
Fill any available gap

FLUID surrounds the driver and continuously adapts
to support any change in psychophysical state

FLUID CHARACTERISTICS

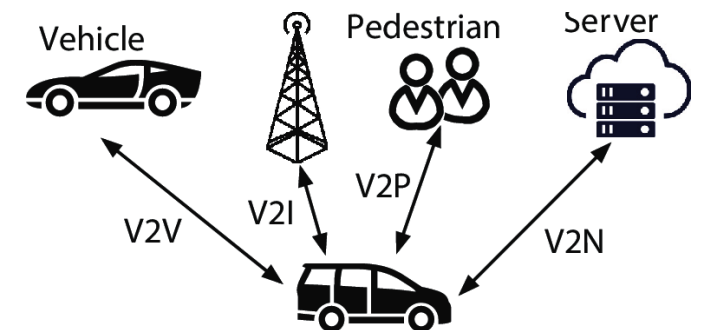
Multisensory, omnipresent and omnidirectional

- Visual, auditory and haptic displays allow information to “flow” across senses
- Continuous adaptation to driver depending on changes among driver, vehicle and environment
- Extend beyond physical boundaries of dashboard to include windshield, seats, door panels and roof/floor



FLUID FUNCTIONS

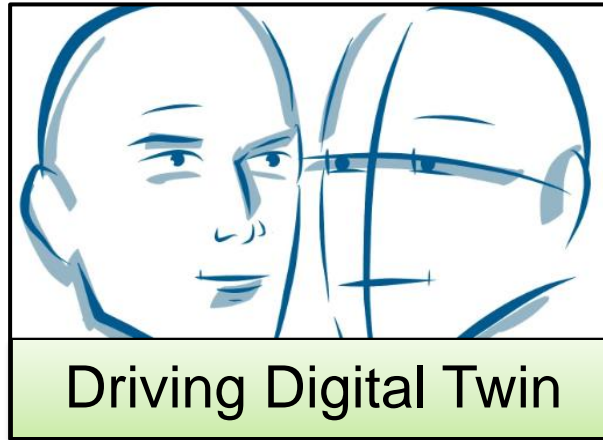
- **Monitoring** driver state, activity, task; passengers, vehicle and environment
- **Transitioning** control, including TOR and across automation levels
- **Informing** driver about vehicle-environment state and incoming situations
- **Learning** driver preferences and individual needs (car settings, driving style)
- **Communicating** to/from outside (V2X)
- **Tutoring** driver towards higher automation: context-sensitive, step-by-step, personalized
- **Transfer** of Training to other vehicles (design independent)
- **Adapting** driving style to resemble human-like traffic (safe, agile, local)





Automatic scoring of human/AV driving style

Design of automated vehicles driving style (safe, agile, local)



Integrated driver, vehicle, environment representation

Adaptation to user needs



Shared driver state among road users

Disclosing drivers' intention to prevent hazards

IMPACT

- Reduce distraction in pre-critical situations
- Reduce cognitive load to elicit proper response
- Build and calibrate trust by personalized tutoring
- Reduce obtrusiveness (no abrupt or unexpected intervention)
- Enhance connectivity/isolation for non-driving related activities
- Provide information and services (only) when and where needed
- Increase acceptance via better system understanding and predictability
- Increase situational awareness (relevant information available in-context)
- Allow brand-specific custom design in shapes, graphics, surfaces, hardware



OUTLOOK

- 2020 first prototypes in HADRIAN consortium
- Validation for selected personas and scenarios:
elderly, truck driver, car-as-office
- 20 studies in driving simulator / field
- Combining different technologies:
haptic steering wheel, head-up display, turning seat,
ambient lighting, driver monitoring systems, Fit2Drive



Thank you!

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