Shaping the Future of Mobility

Dr. Mark Colley, UCL

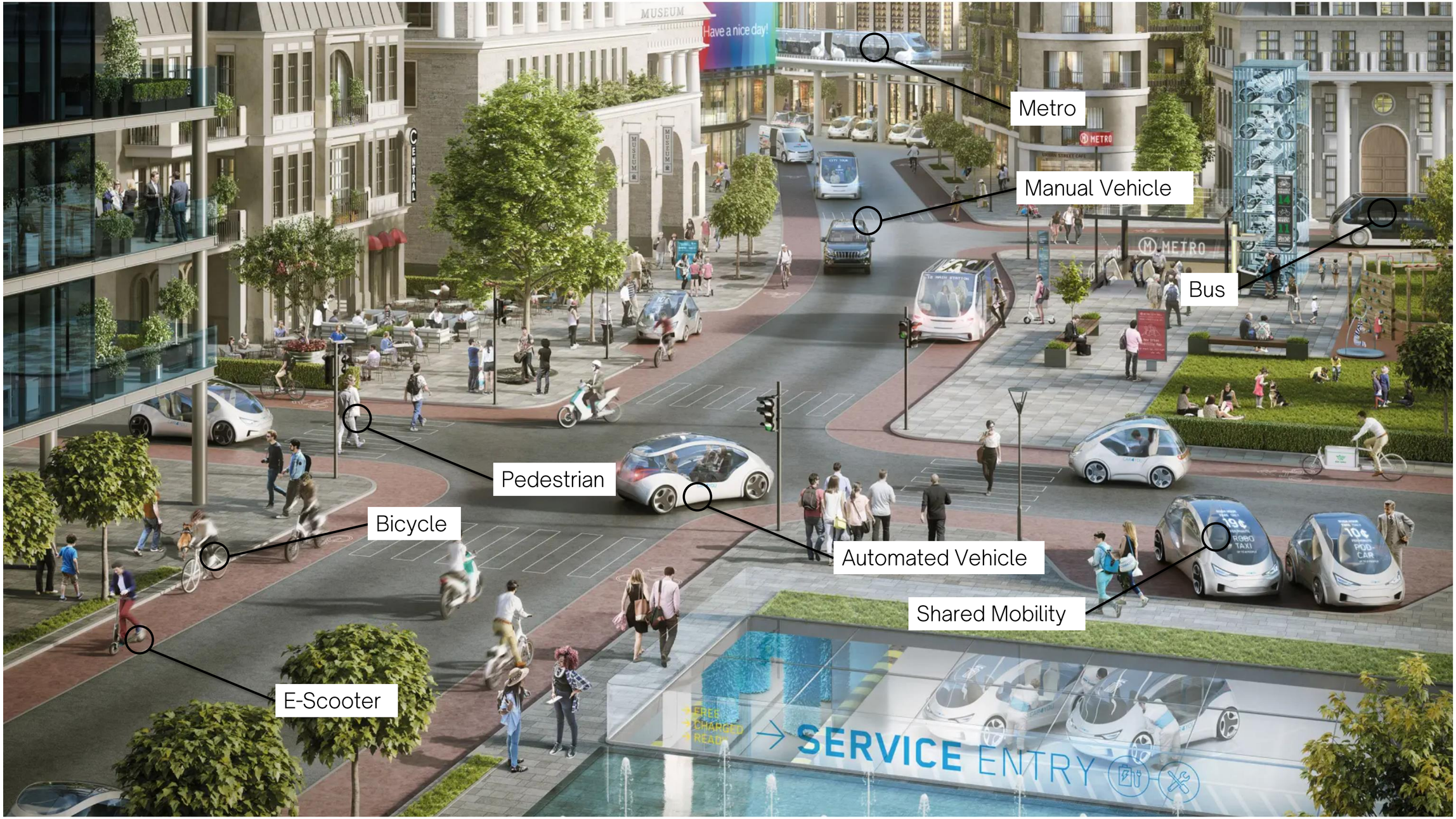
rea-EU Horizon Europe Researchers Networking Forum

Research Vision

Accessible Future Mobility Leveraging Computational Modeling and Simulation

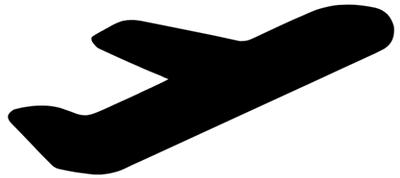
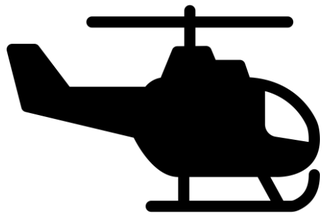
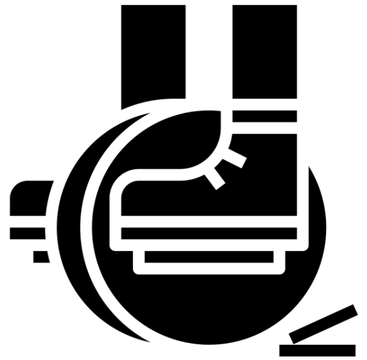
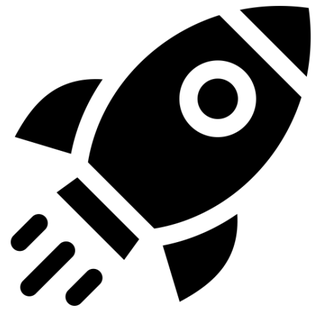
“The Only Constant in Life Is Change”

Heraclitus

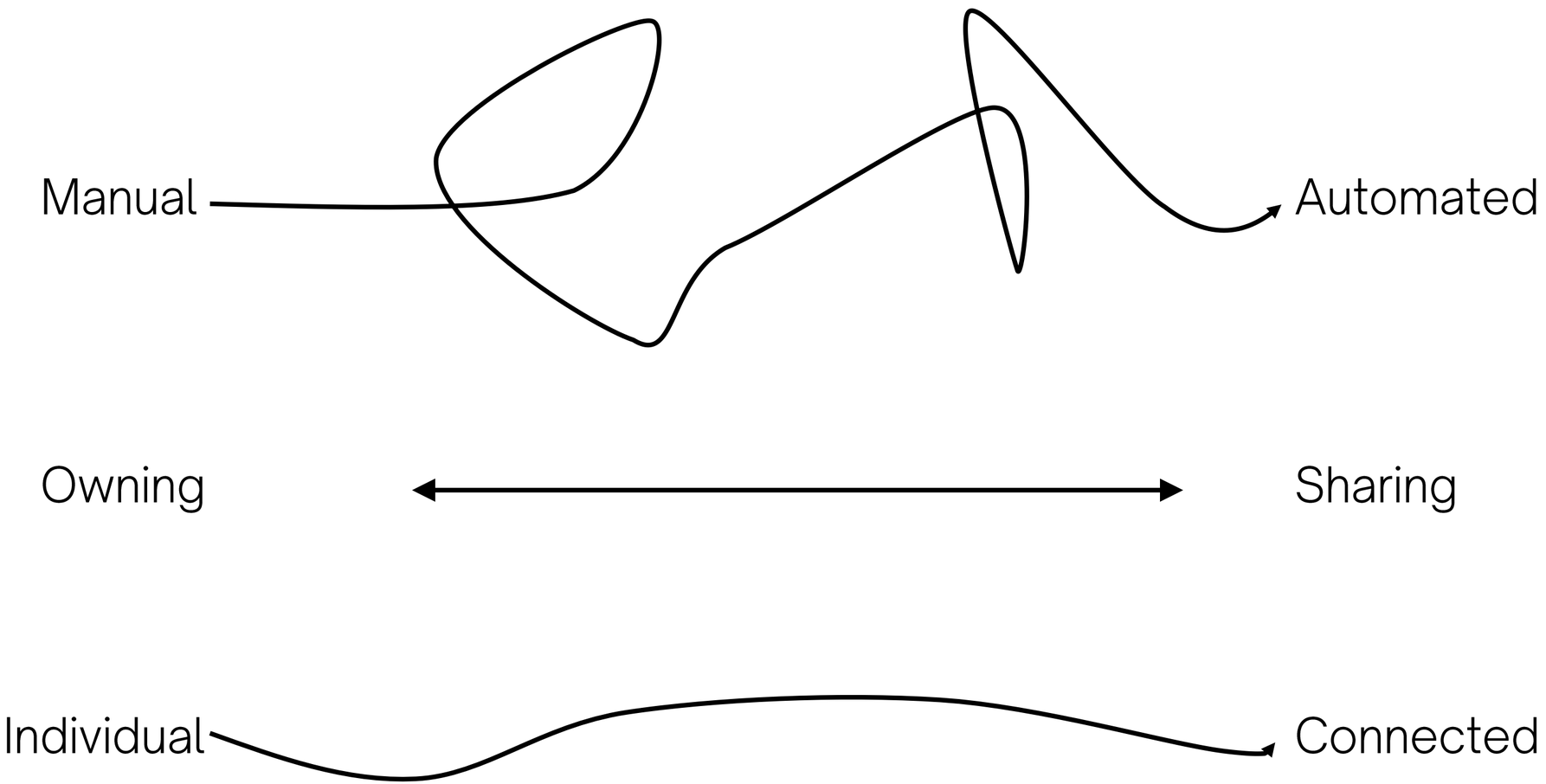


Bosch 2018; https://www.bosch.com/de/stories/der-stadtverkehr-der-zukunft/

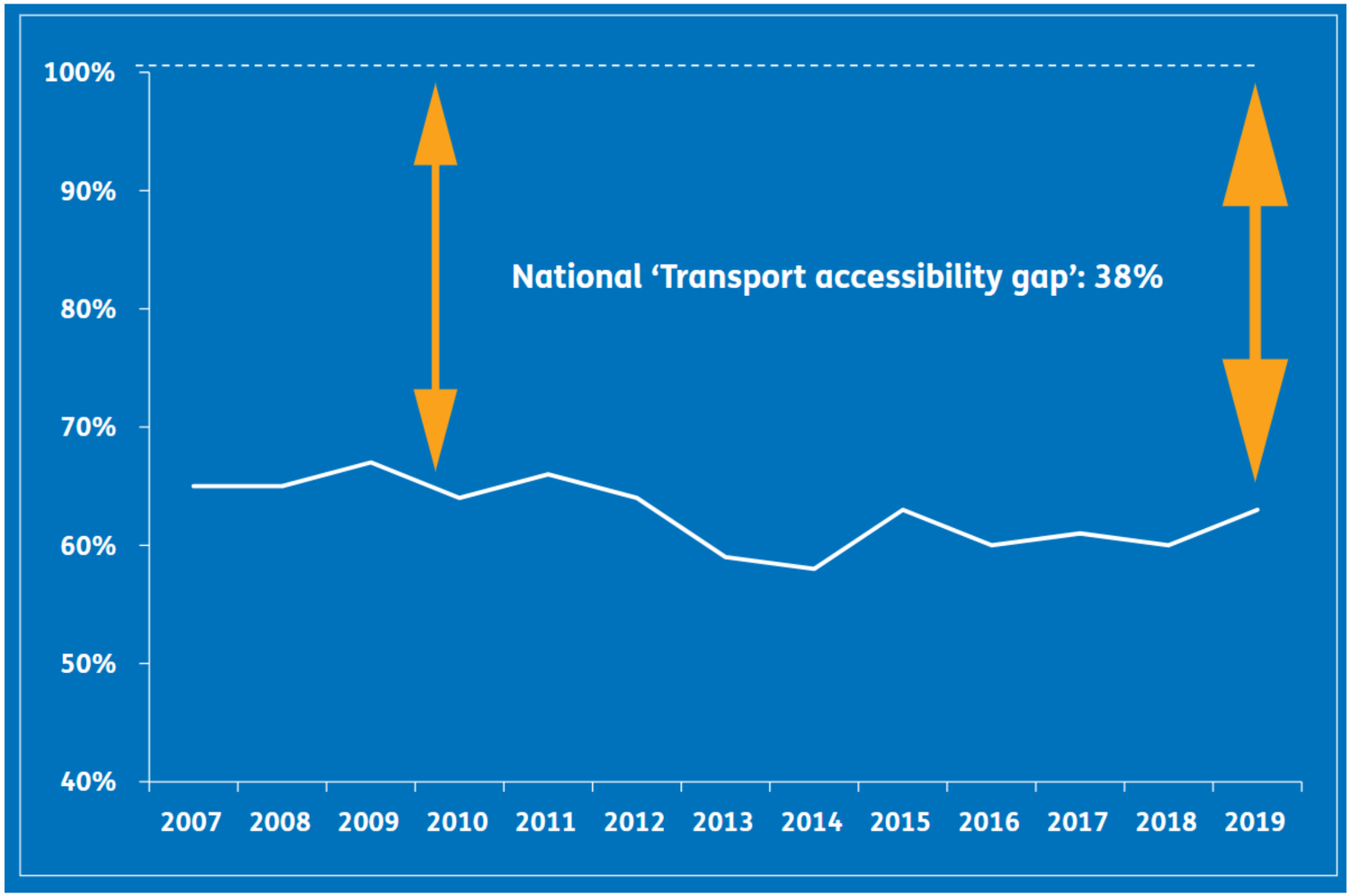
Even More Changing Mobility Modes

Mega-Trends in Mobility



The Transport Accessibility Gap



https://www.motabilityfoundation.org.uk/media/iwaidhxk/motability_transport-accessibility-gap-report_march-2022_final.pdf

Research Vision

Accessible Future Mobility Leveraging Computational Modeling and Simulation

… to study and shape future mobility in an accessible way for everyone along the entire journey

Age, Capabilities,
Background,
Preferences

Scooter
Hoverboard
Walk to parking lot
Wheelchair

bus
plane
Enter shared automated vehicle
metro
ship

Encounter automated vehicle
at street-crossing

Support understanding and
receive additional information

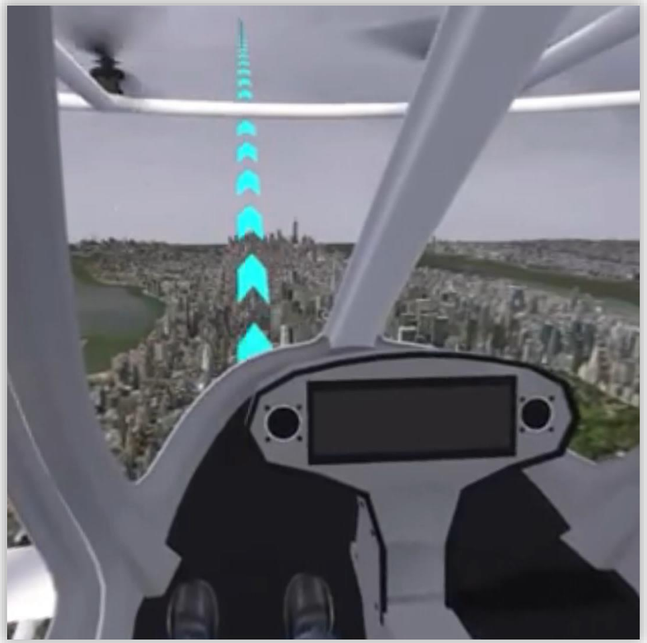
Watch movies
Work
Games

Requirement to adjust
A/C, position, volume

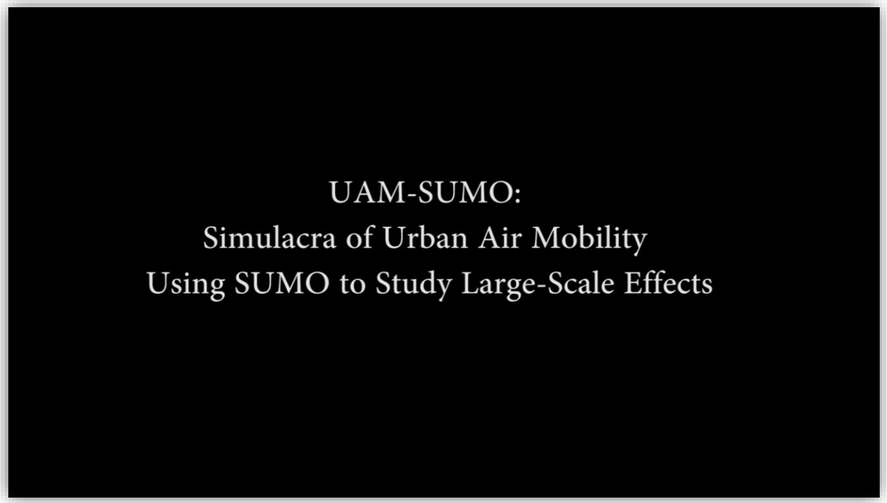
Emerging Mobility Forms

(Urban) Air Mobility

- Simulator Design
- Integration into Multimodal traffic
- Studying modality changes
- Interaction in Constrained Spaces



IMWUT23



HRI25

Emerging Mobility Forms - Simulators

No motion

Real Vehicle

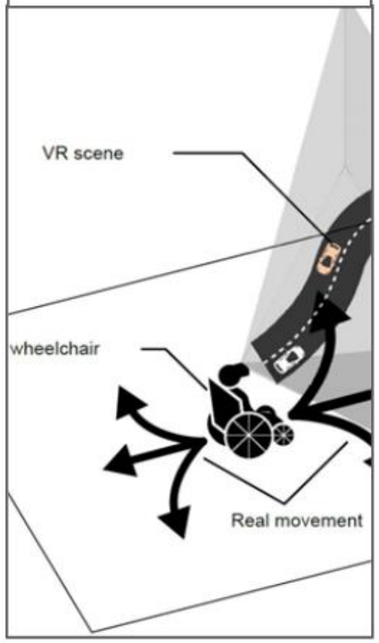
Monitor Driving

VR Driving

©Exquadro - stock.adobe.com

SwiVR-Car-Seat
1 DOF

VRealChair
2 DOF



VeMo-VR
4 DOF

NADS

On-Road

https://www.scientificamerican.com/article/self-driving-cars-begin-to-emerge-from-a-cloud-of-hype/

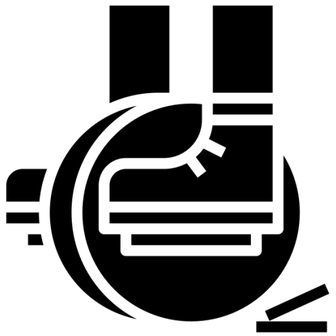
Portobello

Bu, F., Li, S., Goedicke, D., Colley, M., Sharma, G., & Ju, W. Portobello: Extending Driving Simulation from the Lab to the Road. CHI'24

Emerging Mobility Forms

Micromobility

- Prosocial behavior



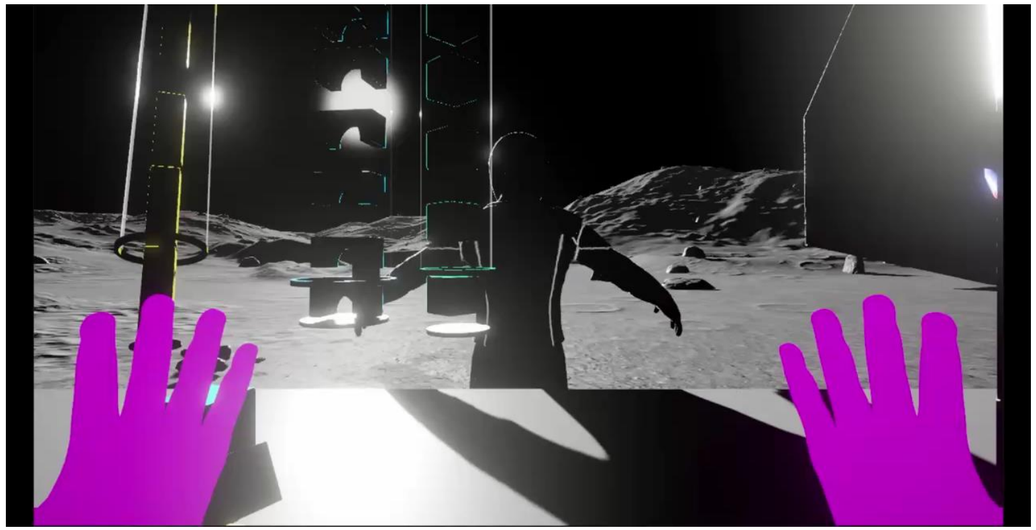
In preparation

Emerging Mobility Forms

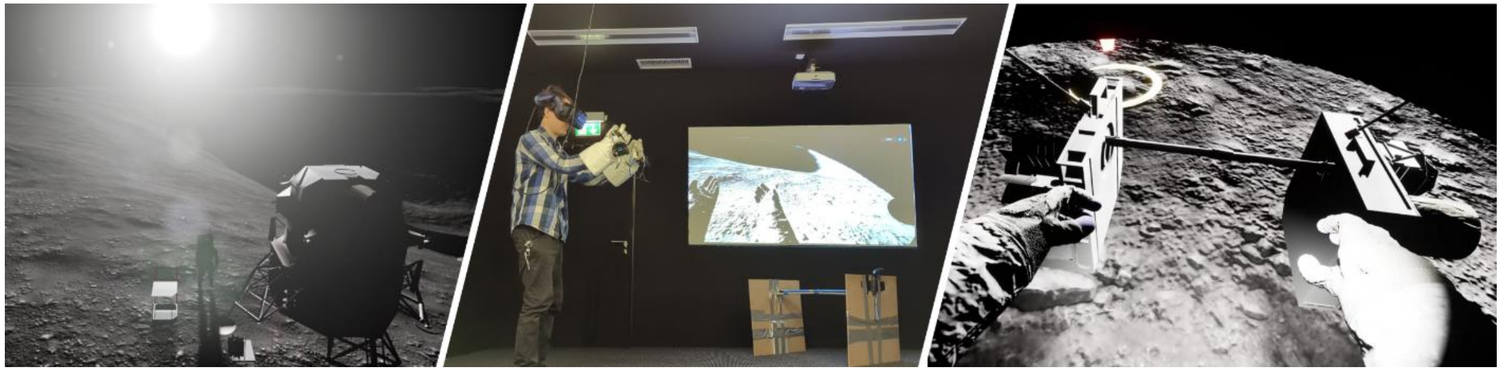
Space Travel

- Simulator Design
- Education
- Interaction Design

Contact established with
the German Space Agency



Under Preparation



Dufresne et al. Touching the Moon: Leveraging Passive Haptics, Embodiment and Presence for Operational Assessments in Virtual Reality. CHI24

Accessibility

Design for even more diverse population

- Cognitive
- Auditory
- Multiply affected
- Situational disability
- Children

MobileHCI22

Accessibility

Support designers in their workflows and design mobility (interfaces)

- Interaction designer
- Infrastructure designer
- Politicians

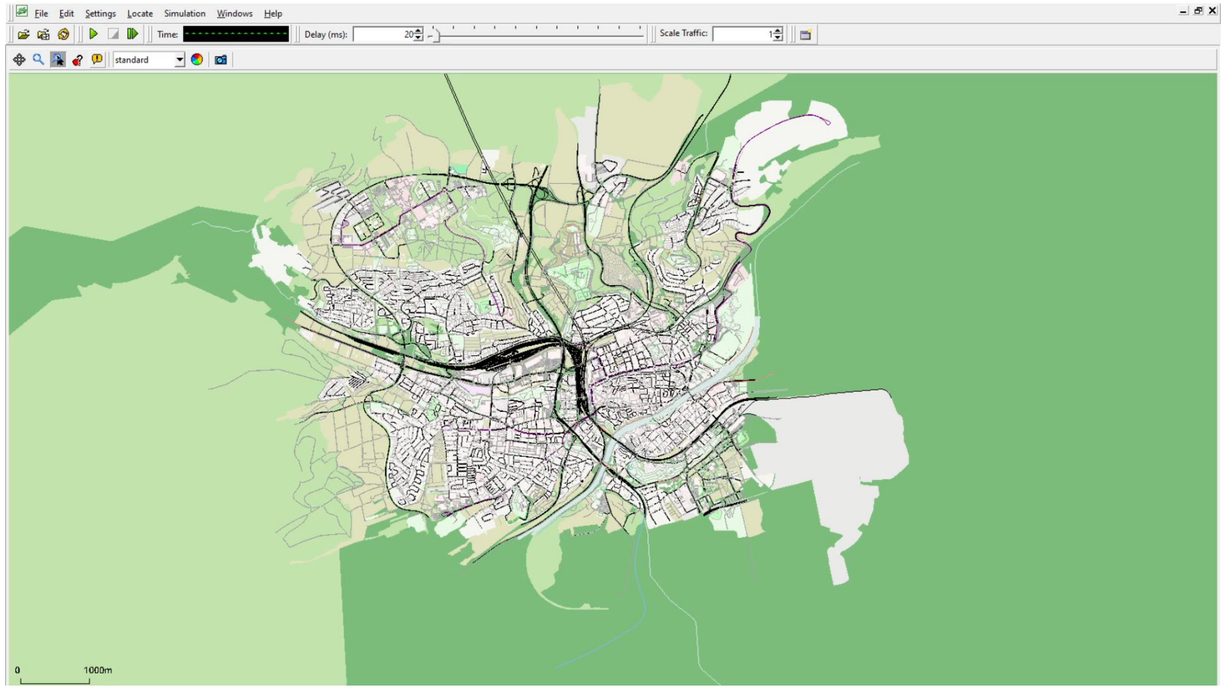
UIST25 - VIP-SIM

CHI25

Computational Modeling & Simulation

Leverage simulation capabilities

- Reinforcement Learning
- Microscopic Simulation
- Generative Agents

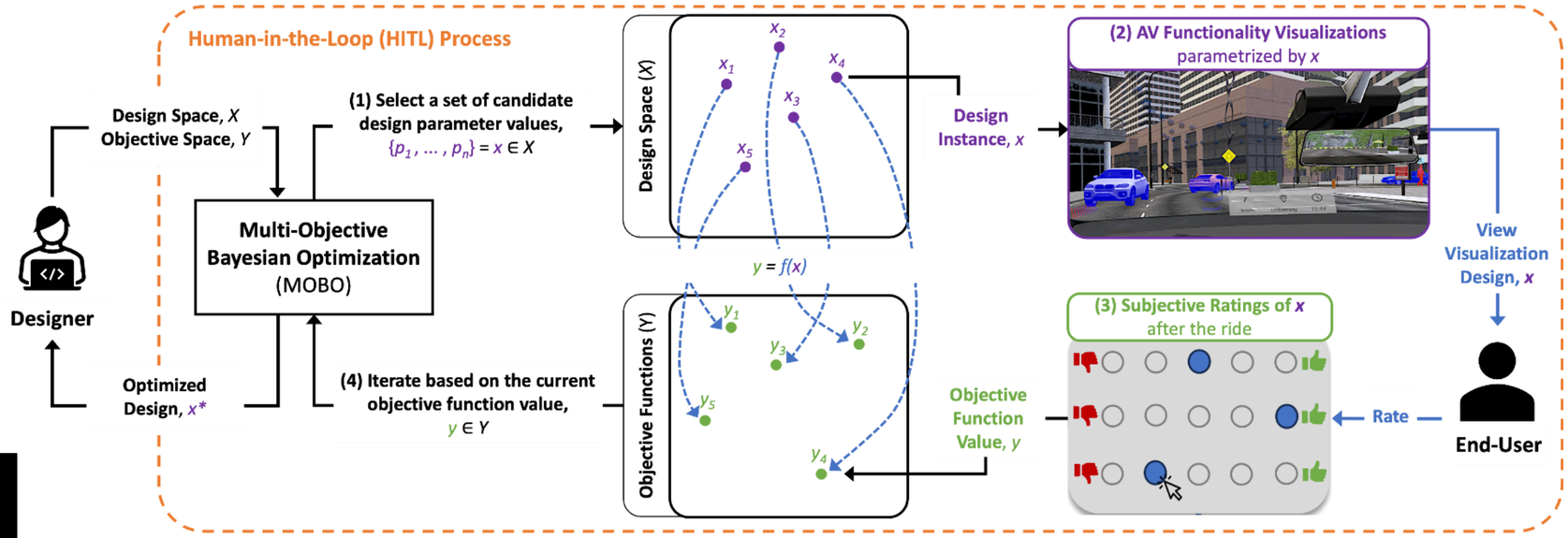


HRI24

Computational Modeling & Simulation

Human-in-the-loop
Bayesian Optimization

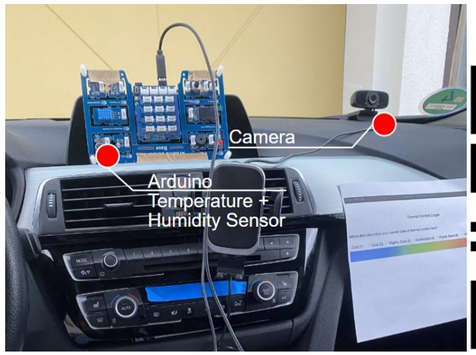
- Design(er) Support
- Personalization
- Datasets



CHI25

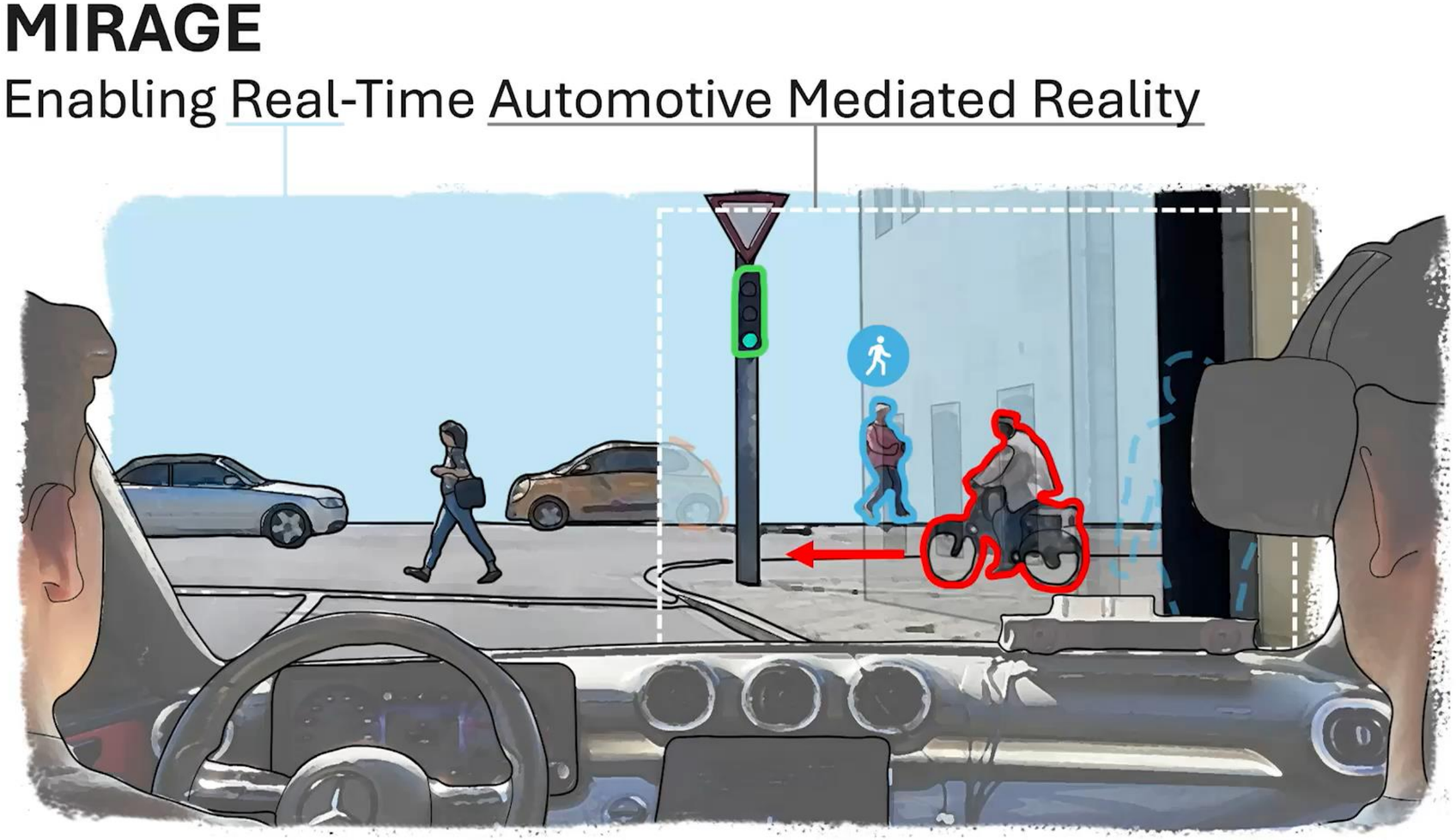
Bumpy Ride? Understand the Effects of External Forces on Spatial Interactions in Moving Vehicles

CHI25



IMWUT24

What if we could personalize the world around us?



Under Review

Bridging the Academia – Industry Gap

Mercedes-Benz

PORSCHE

BENTLEY

JAGUAR

BOSCH

International Collaborations (Excerpt)

Wendy Ju
Cornell Tech
USA

Enrico Rukzio
Ulm University
Germany

Paul Fink
Grand Valley State University, USA

Andreas Riener
TH Ingolstadt
Germany

Patrick Ebel
Leipzig University
Germany

Wenge Xu
Birmingham City University
UK

Pavlo Bazilinskyy
Eindhoven
The Netherlands

Michael Knierim
KIT
Germany

Jonas Andersson
RISE
Sweden

Alexander Mirnig
Salzburg University
Austria

- Interaction Design
- Computational Interaction
- Accessibility
- Sensing
- Tangible Interfaces
- Mobility

Calls - Experience

Human-Computer Interaction Lead for 1 EU-Call

EPSRC grants – 2 under preparation

DFG (Germany) – Support for 4 accepted grants

ISPF (Royal Society) Grant – Under Review

NSF-EPSRC – Under Preparation (invited)

Project Ideas - Calls

HORIZON-CL5-2026-01-D6-04: Integration of **human driving behavior** in the validation of CCAM systems

HORIZON-CL5-2026-01-D6-13: Safety of **Cyclists**, **Pedestrians** and Users of **Micromobility** Devices

HORIZON-CL5-2026-01-D6-14: **Predicting** and avoiding road crashes based on Artificial Intelligence (AI) and big data

HORIZON-CL5-2027-06-D6-08: Enhancing Mobility for **All**: affordable, reliable and accessible multimodal transport for inclusive rural and urban connectivity –Societal Readiness pilot

HORIZON-CL5-2026-10-D6-03: Generative AI for smarter CCAM: enhancing perception, decision-making, and validation

HORIZON-CL5-2026-10-D6-07: Supporting sustainable and smart urban mobility in Europe (CIVITAS)

HORIZON-CL5-2027-10-D6-10: Enhanced resilience in **multimodal passenger transport** through digital technologies and generative and discriminative AI

Project Ideas – Possible Contributions

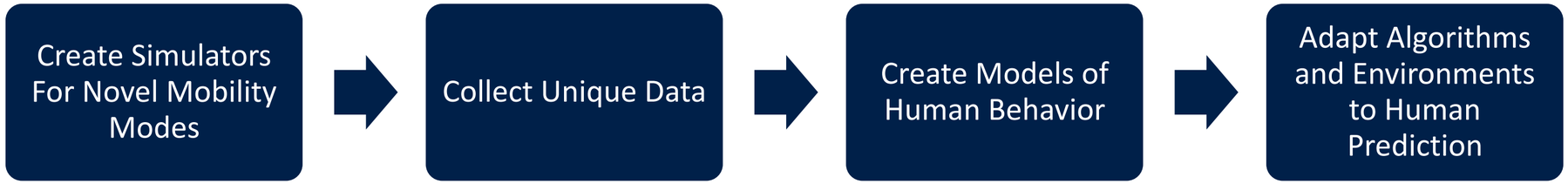
Understand human behavior (as drivers, cyclists, pedestrians; **D6-04, D6-13**)

To **model human behavior** leveraging state-of-the-art ML approaches and unique data **(D6-14)**

Using models to **predict behavior** and necessary **HMI adaptions (D6-14; D6-03)**

Integrate the perspectives of people with **impairments** (calls are targeted “for All”; **D6-08**)

Create **simulations and simulators** that enable studying human behavior and novel approaches (e.g., service design, HMI, multimodal behavior; **D6-08, D6-10**)



Thank you for your attention!

Dr. Mark Colley

Contact

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https://m-colley.github.io/

Icons by the Noun project