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Ubiquitous Mixed Reality

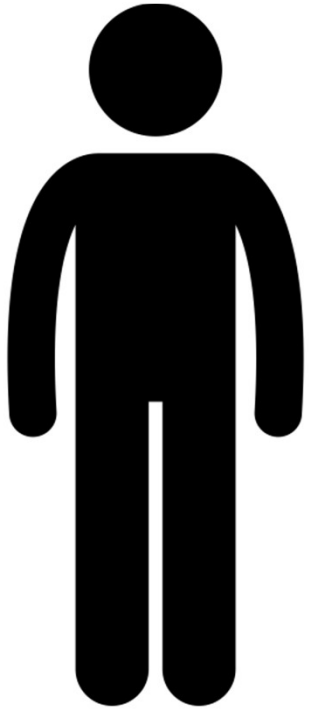
Designing Mixed Reality Technology to Fit into the Fabric of our Daily Lives

Avec le soutien de la Fondation Mines-Télécom

FONDATION Mines-Télécom
La Fondation de l'IMT

Jan Gugenheimer | Télécom Paris / LTCI / Institute Polytechnique de Paris

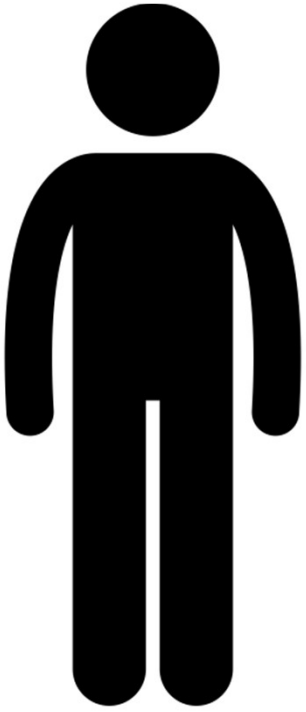
Ubiquitous Mixed Reality:
Human-Computer Interaction and our Path Towards Ubiquitous Mixed Reality



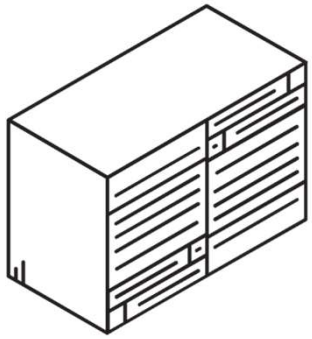
Interaction

Human

Computer



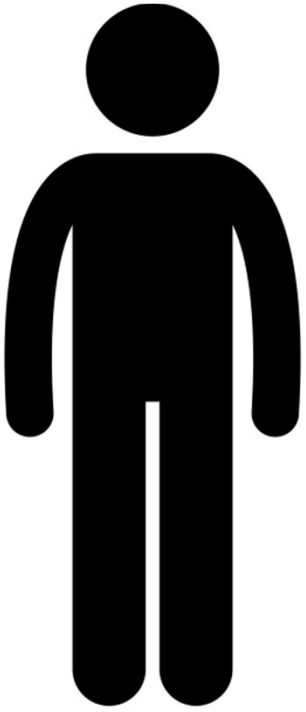
Mainframe



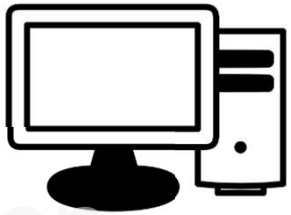
Human

Computer

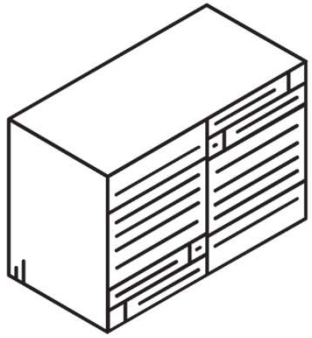
Weiser, M. (1999). The computer for the 21st century. Mobile Computing and Communications Review, 3(3), 3-11.ISO 690



Personal



Mainframe



Human

Computer

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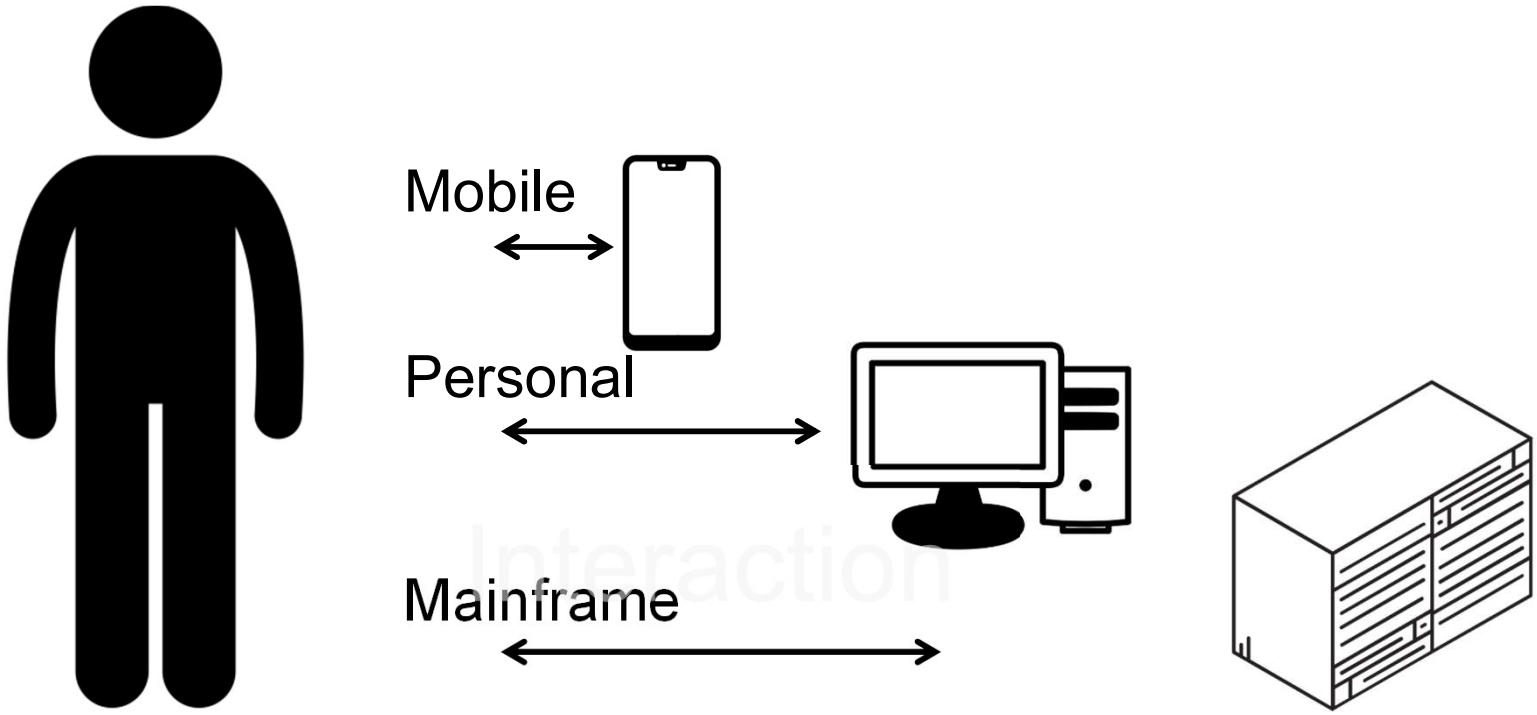

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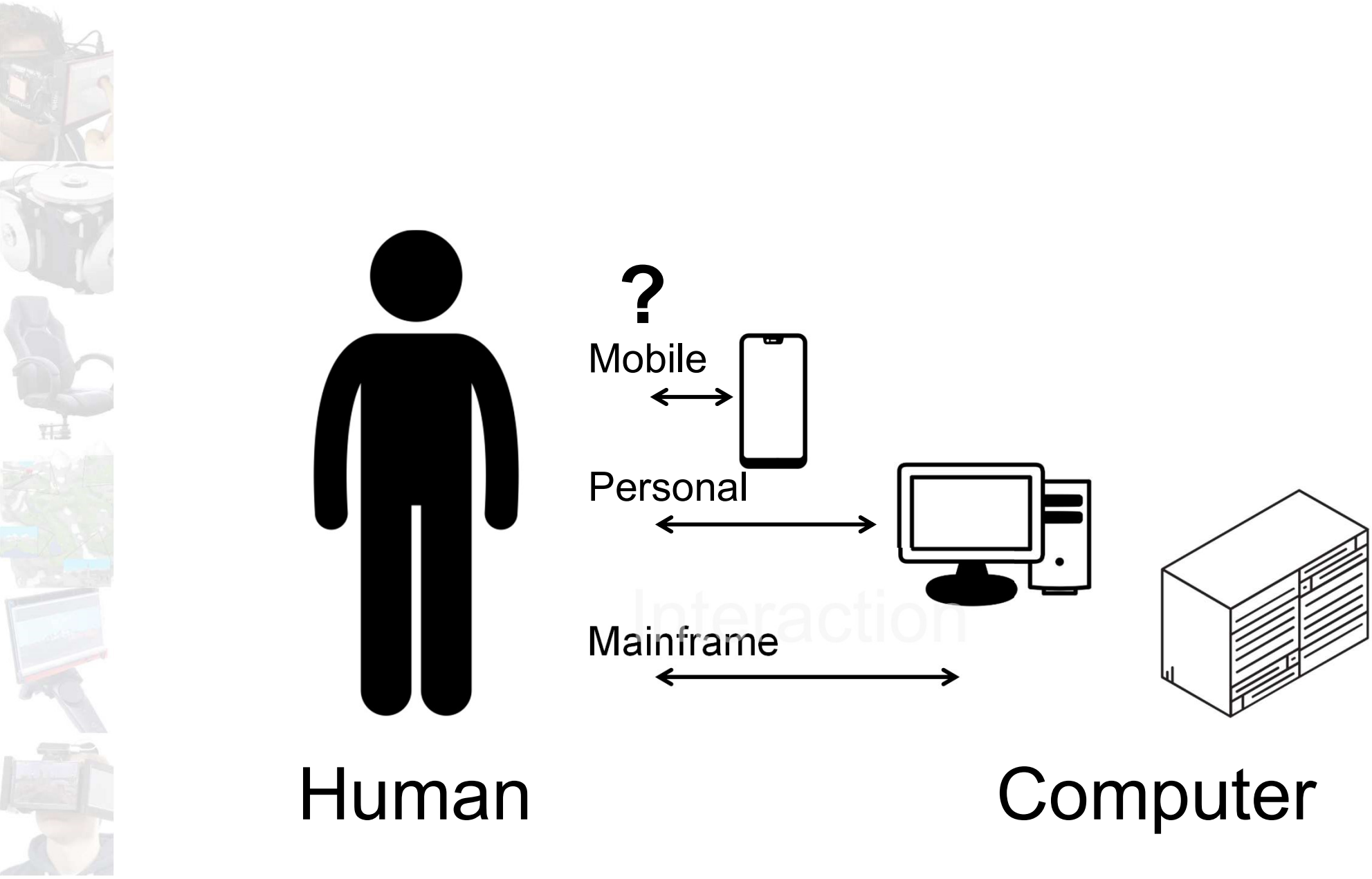
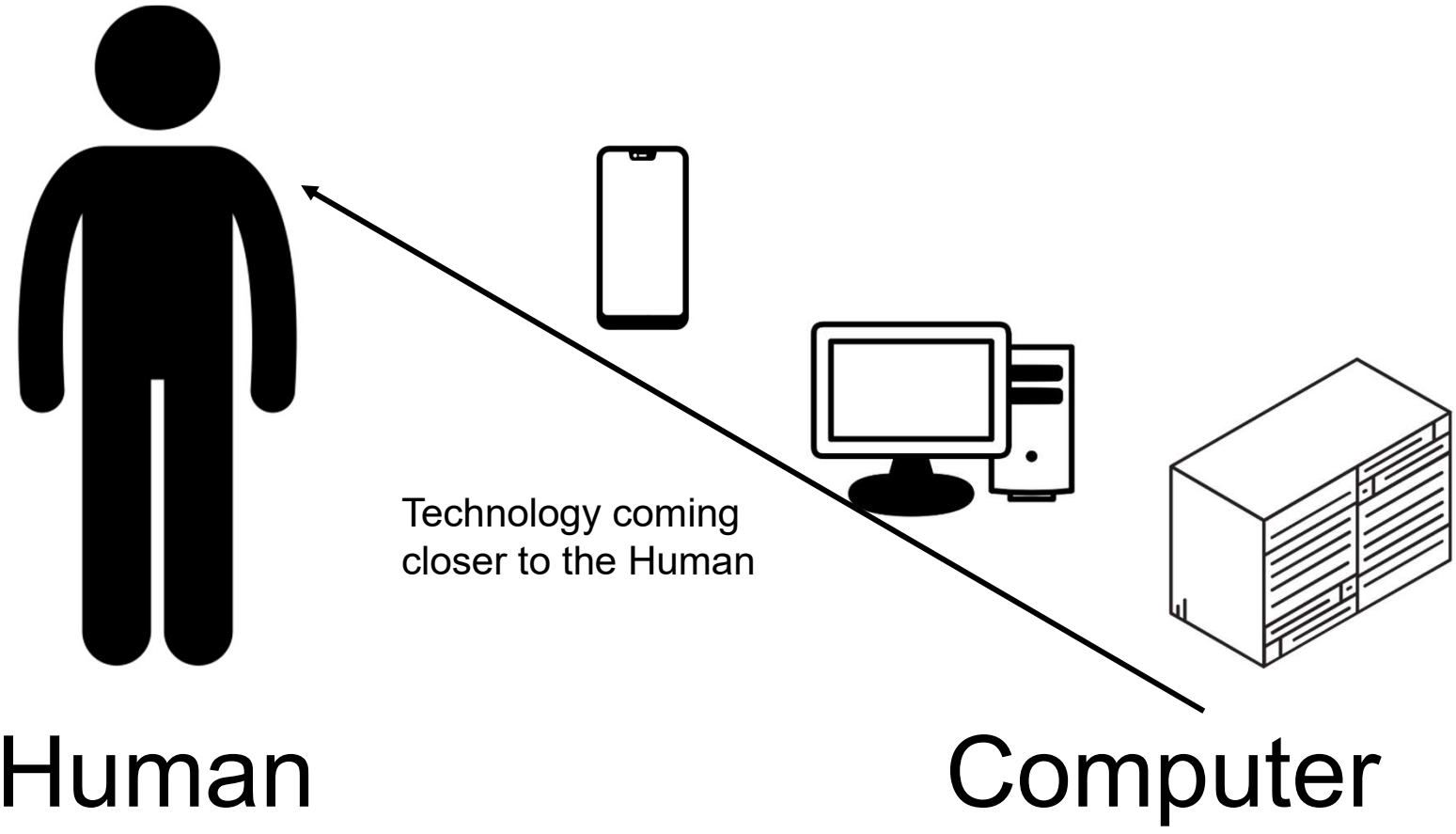
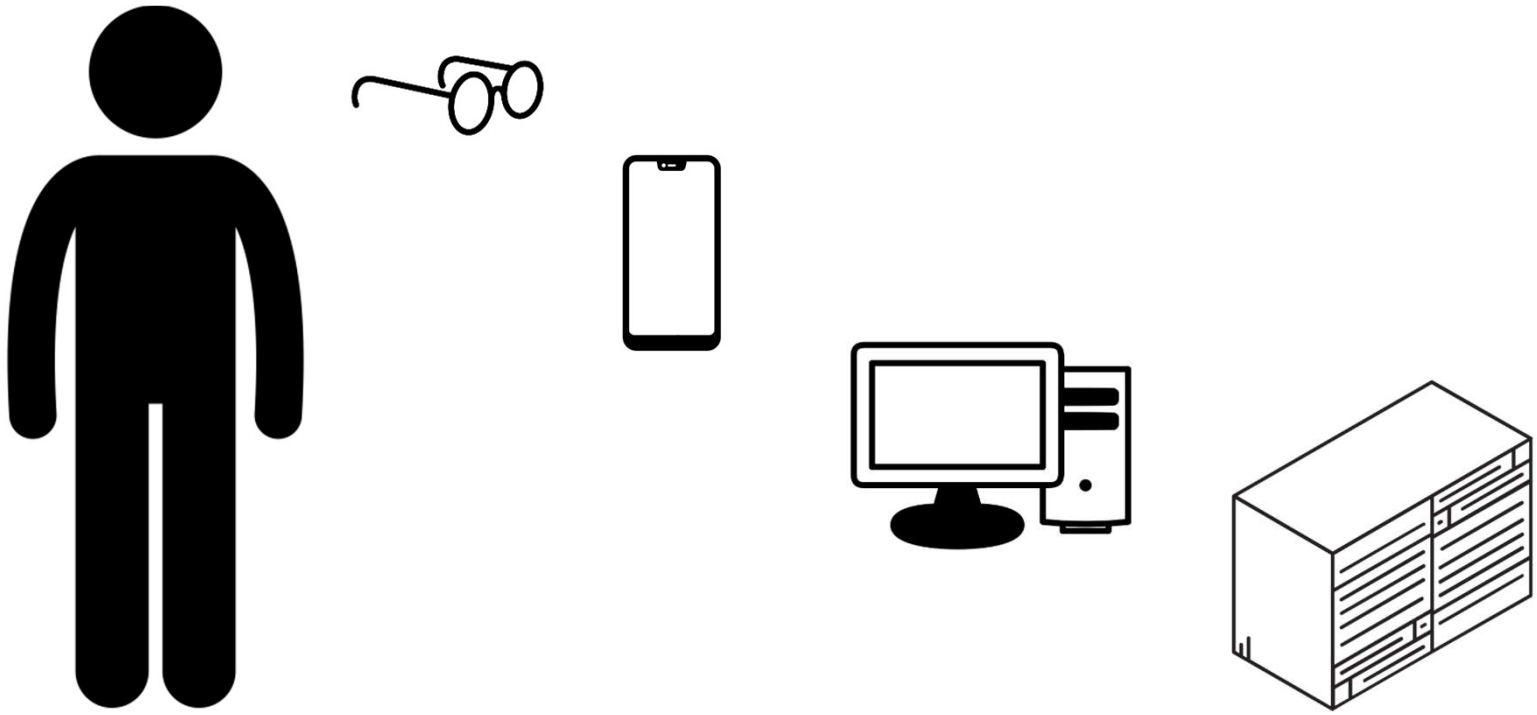

?
Mobile
Personal
Mainframe
Human
Computer


Technology coming
closer to the Human
Human
Computer



Human

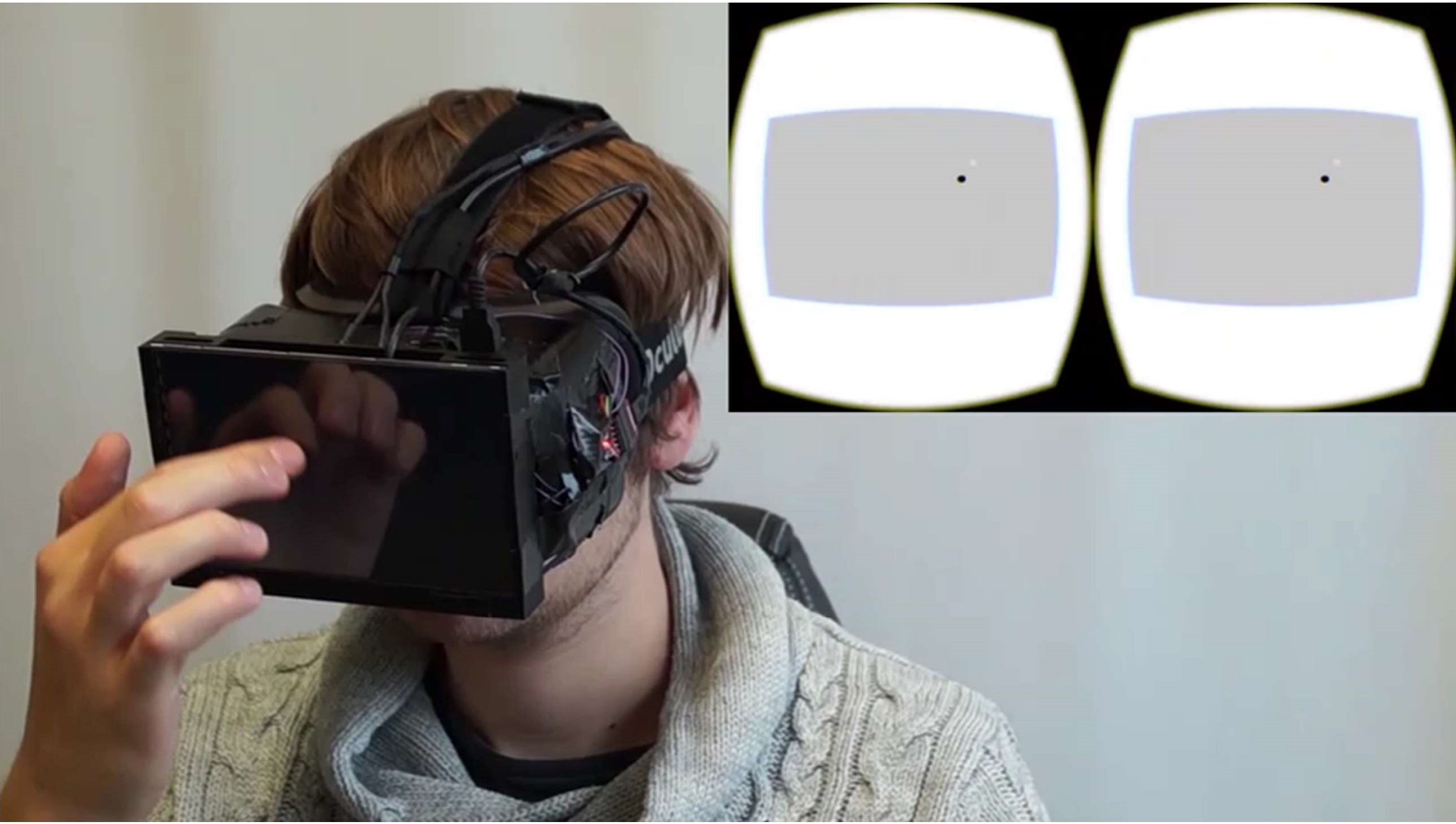
Computer

Ubiquitous Mixed Reality:
Or how Facebook (sorry I mean META) calls it: The Metaverse


LIVE
21.7K

Ubiquitous Mixed Reality: How do we get there ?

Ubiquitous Mixed Reality:
New types of Input



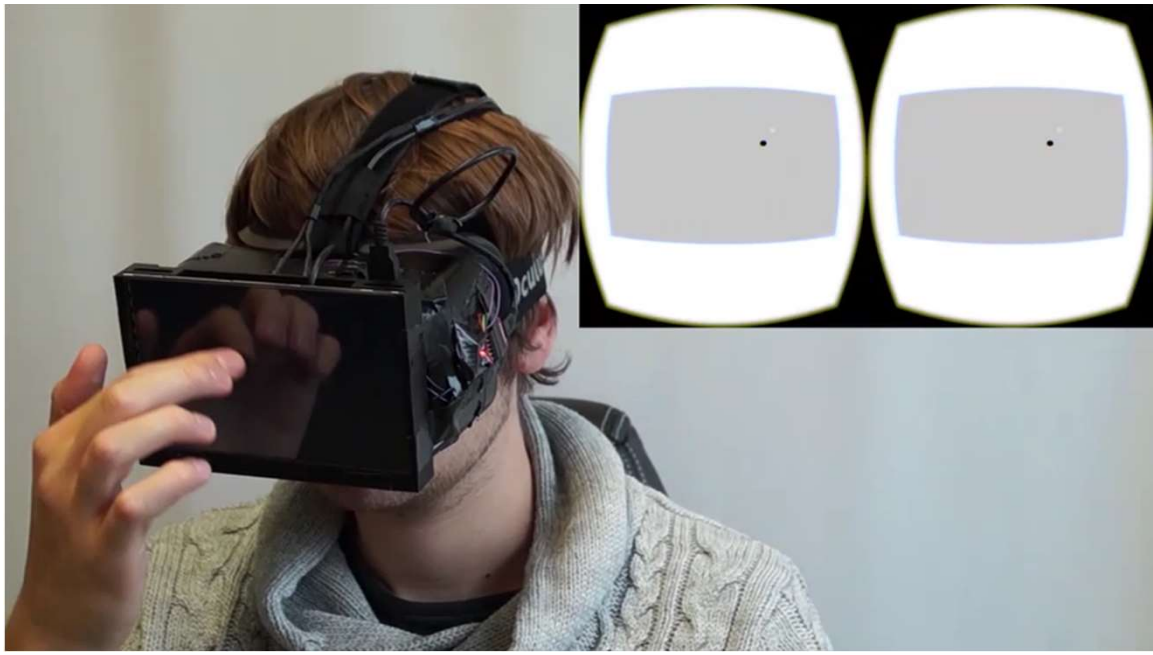
FaceTouch

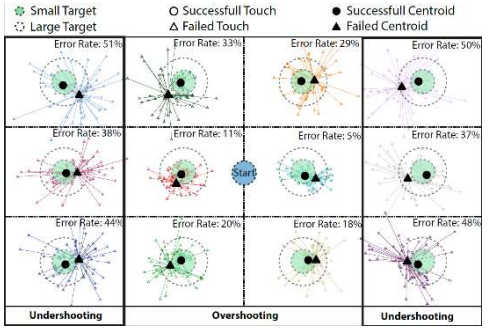
Enabling Touch Interaction in Display Fixed UIs for Mobile Virtual Reality

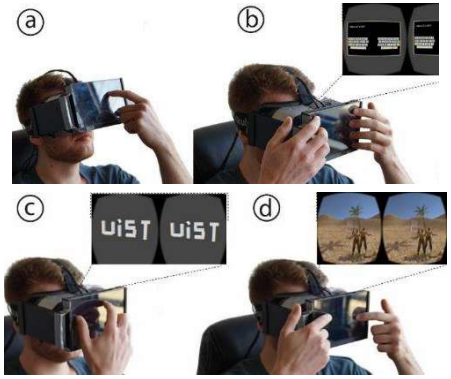
Jan Gugenheimer[1], David Dobbelstein[1], Christian Winkler[12], Gabriel Haas[1], Enrico Rukzio[1]

[1]Institute of Media Informatics, Ulm University, Germany
[2]Daimler Protics GmbH, Stuttgart, Germany

In Proceedings of UIST 2016







Artifact

Modified Oculus DK2 with touch digitizer

Empirical

Two Fitt's Law Studies on accuracy (n=18) and mounting position (n=18)

Theoretical

Three example applications, exploring the Design Space


Gaming

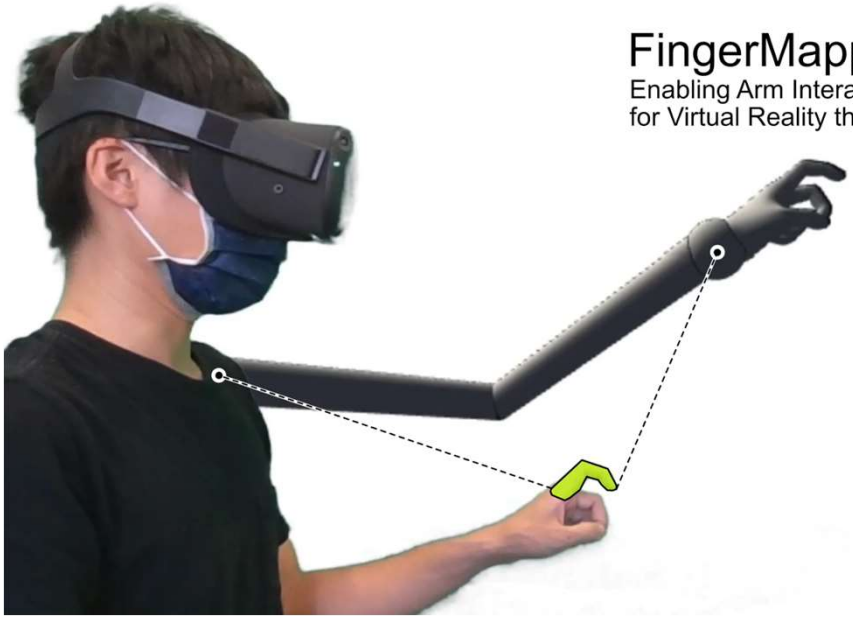
FingerMapper

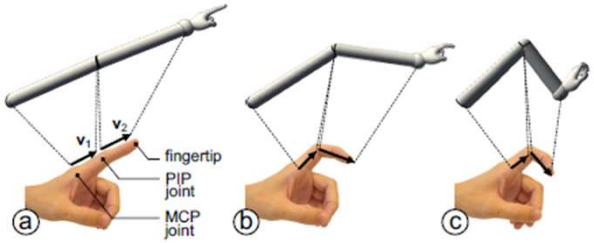
Enabling Arm Interaction in Confined Spaces for Virtual Reality through Finger Mappings

Wen-Jie Tseng, Samuel Huron, Eric Lecolinet, Jan Gugenheimer

Télécom Paris, Institut Polytechnique de Paris, France

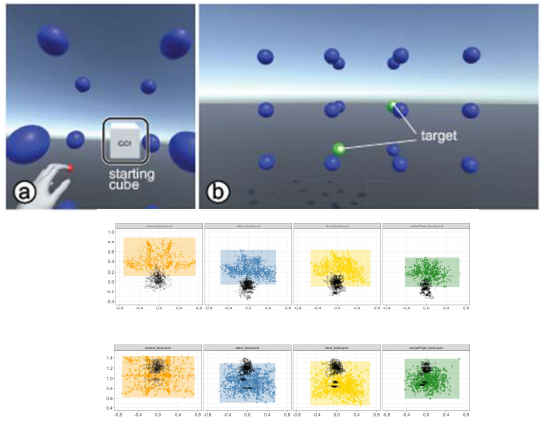
Demo (Extend Abstract) at CHI 2021
Poster at IEEE VR 2022





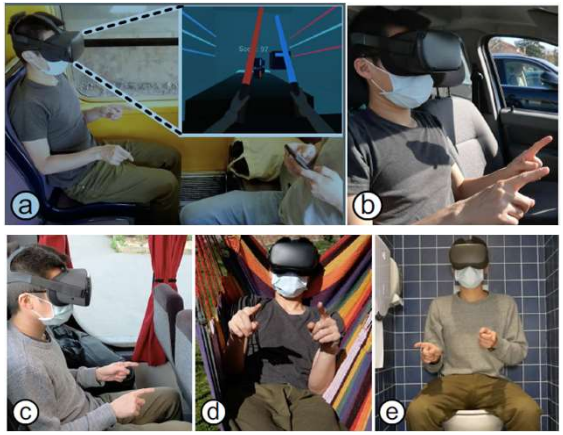
Artifact

Two different mappings between finger and arm



Empirical

Two Fitt's Law Studies on accuracy (n=18) and mounting position (n=18)



Theoretical

Three example applications, exploring the Design Space

Ubiquitous Mixed Reality:
New types of Feedback

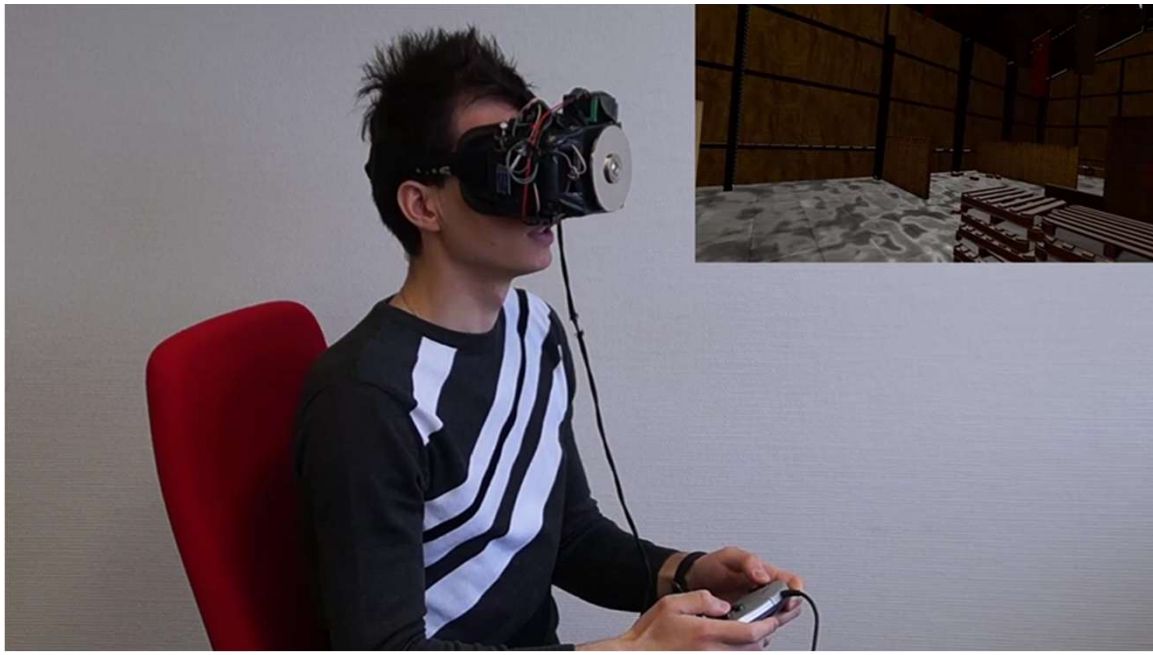
GyroVR

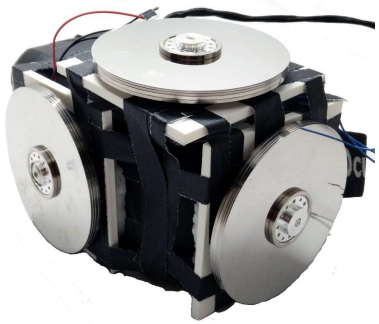
Simulating Inertia in Virtual Reality using Head Worn Flywheels

Jan Gugenheimer[1], Dennis Wolf[1], Eythor R. Eiriksson[2], Pattie Maes[3], Enrico Rukzio[1]

[1]Institute of Media Informatics, Ulm University, Germany
[2]TU Denmark, Lynbyrg, Denmark
[3]MIT Media Lab, Cambridge, USA

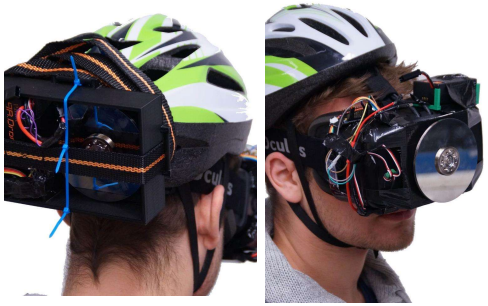
In Proceedings of UIST 2016





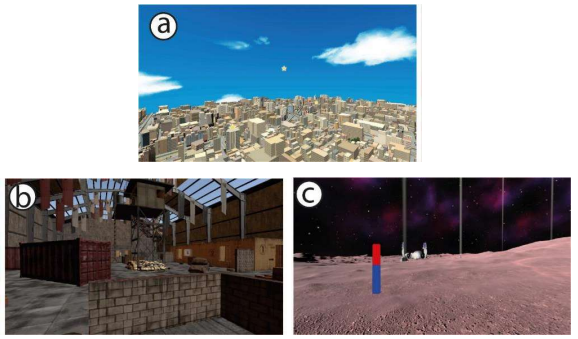
Artifact

Modified Oculus DK2 with flywheels of old HDDs



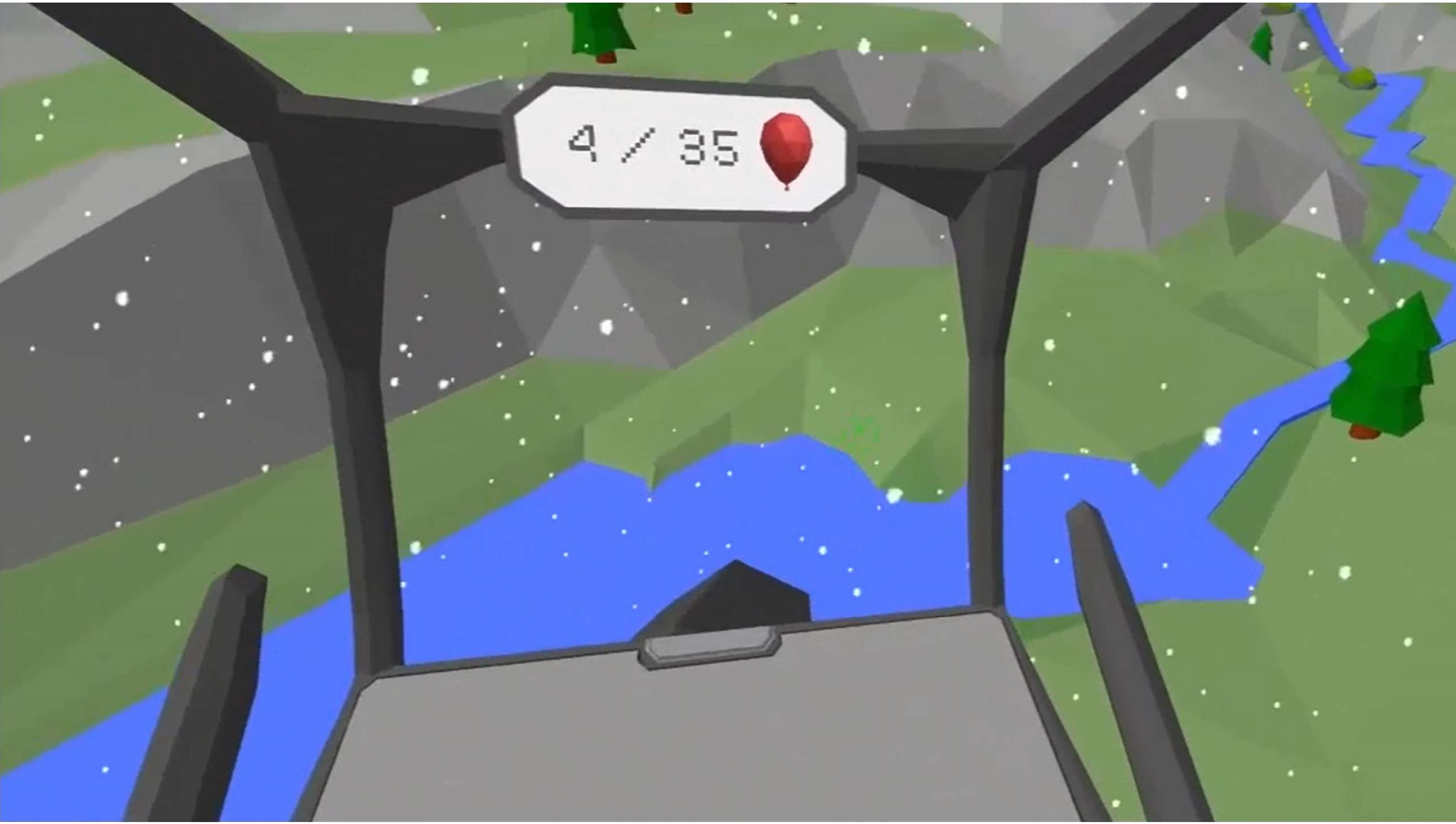
Empirical

One mounting study (n=12) evaluating: Enjoyment, Immersion and Simulator Sickness



Theoretical

Three example applications and mapping techniques exploring the Design Space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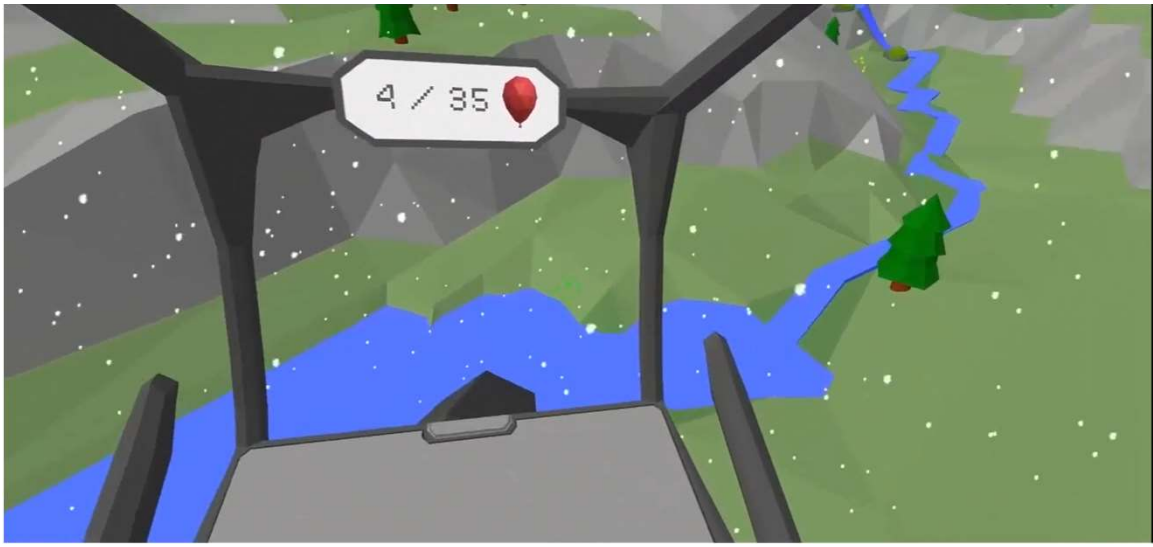
CarVR

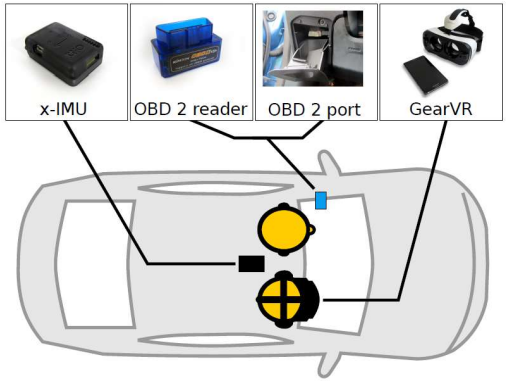
Enabling In-Car Virtual Reality Entertainment

Philipp Hock, Sebastian Benedikter, Jan Gugenheimer, Enrico Rukzio

Institute of Media Informatics, Ulm University, Germany

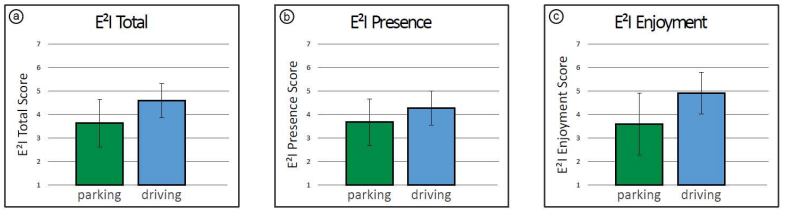
In Proceedings of CHI 2017





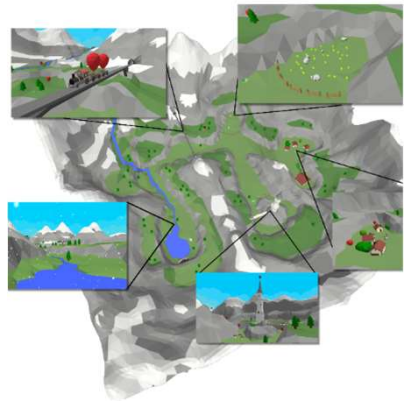
Artifact

Sensing car using IMU and OBD Reader + Samsung GearVR



Empirical

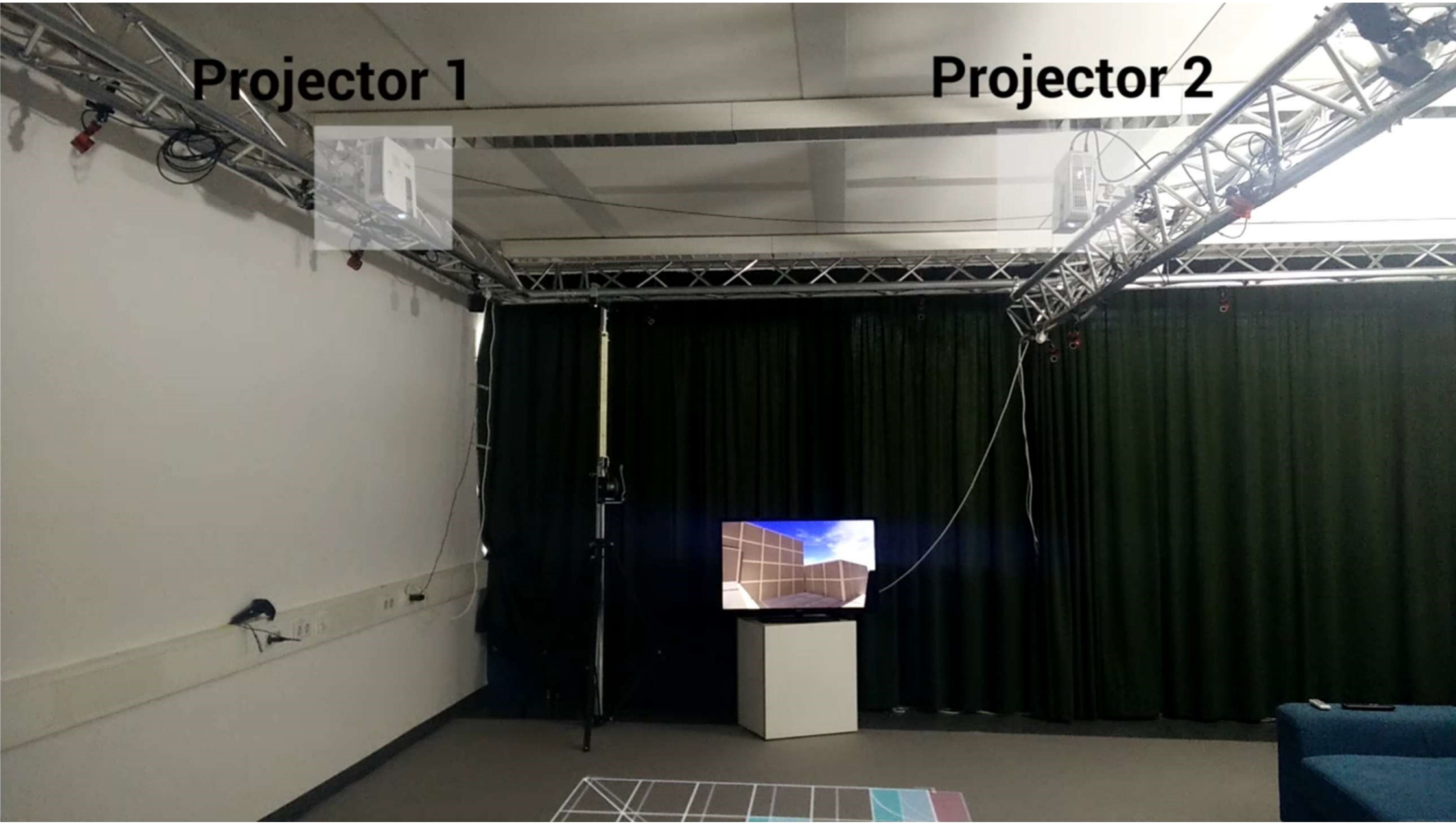
Comparing driving condition vs standing (n=23) in terms of enjoyment, immersion and simulator sickness



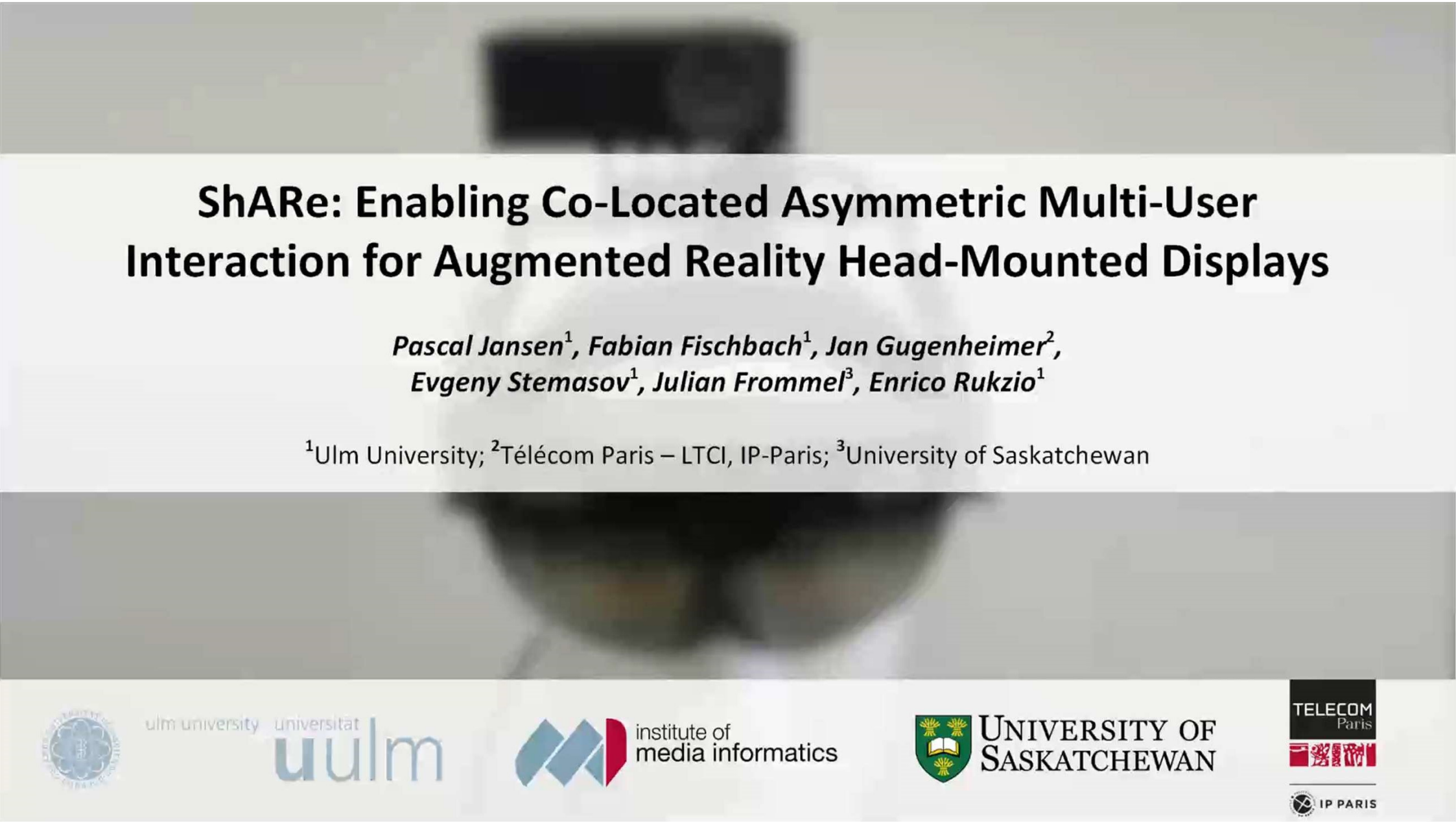
Theoretical

Design space exploration and design guidelines

Ubiquitous Mixed Reality:
New types of Collaboration


Projector 1
Projector 2


FruitSlicer

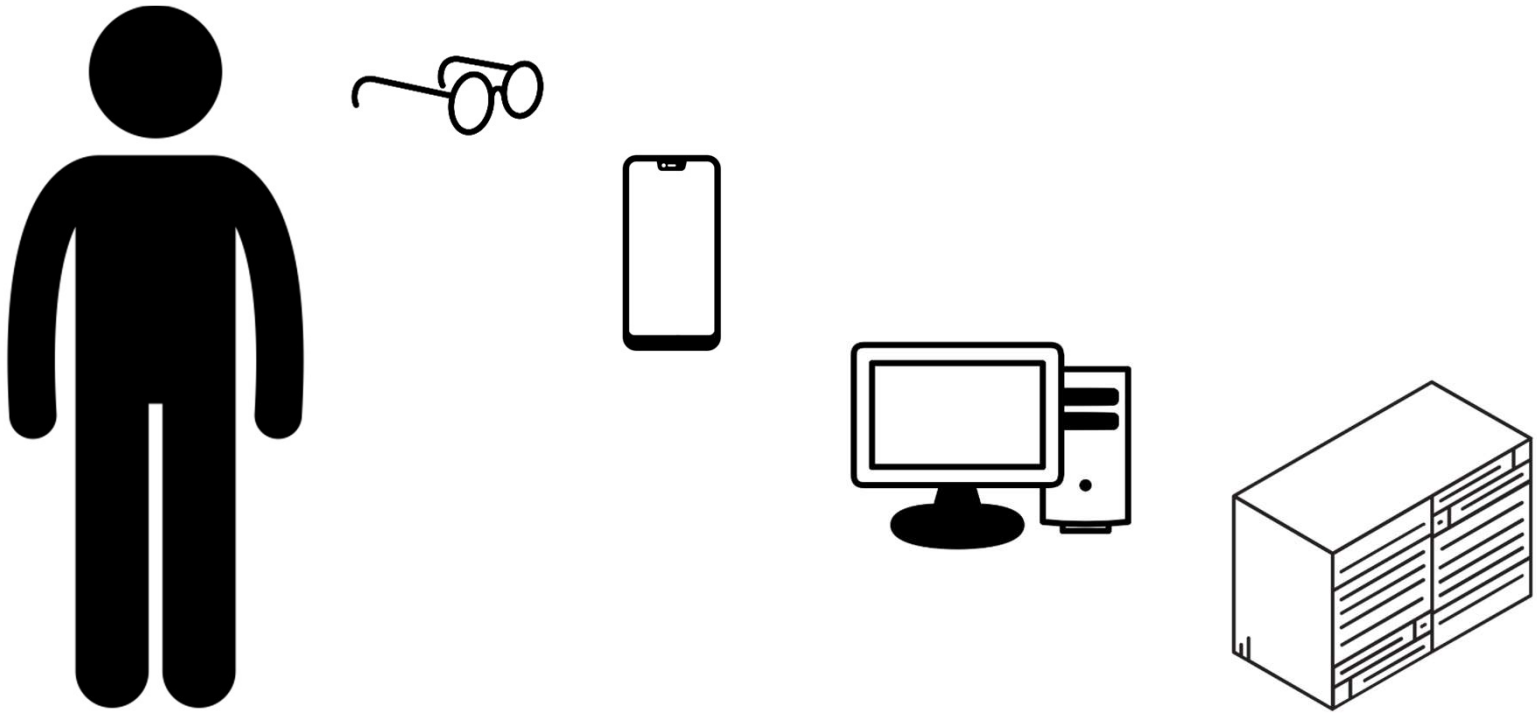


ShARe: Enabling Co-Located Asymmetric Multi-User Interaction for Augmented Reality Head-Mounted Displays

Pascal Jansen[1], *Fabian Fischbach*[1], *Jan Gugenheimer*[2], *Evgeny Stemasov*[1], *Julian Frommel*[3], *Enrico Rukzio*[1]

[1]Ulm University; [2]Télécom Paris – LTCI, IP-Paris; [3]University of Saskatchewan

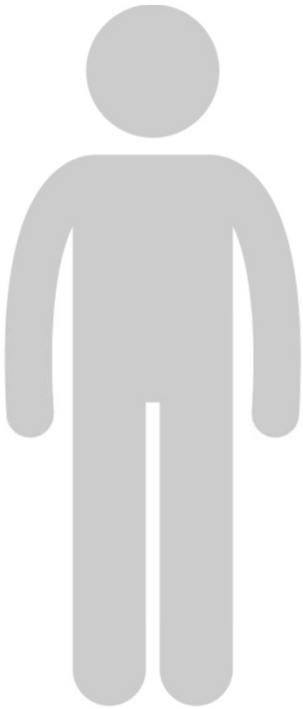
Ubiquitous Mixed Reality: How do we get there ?



Human

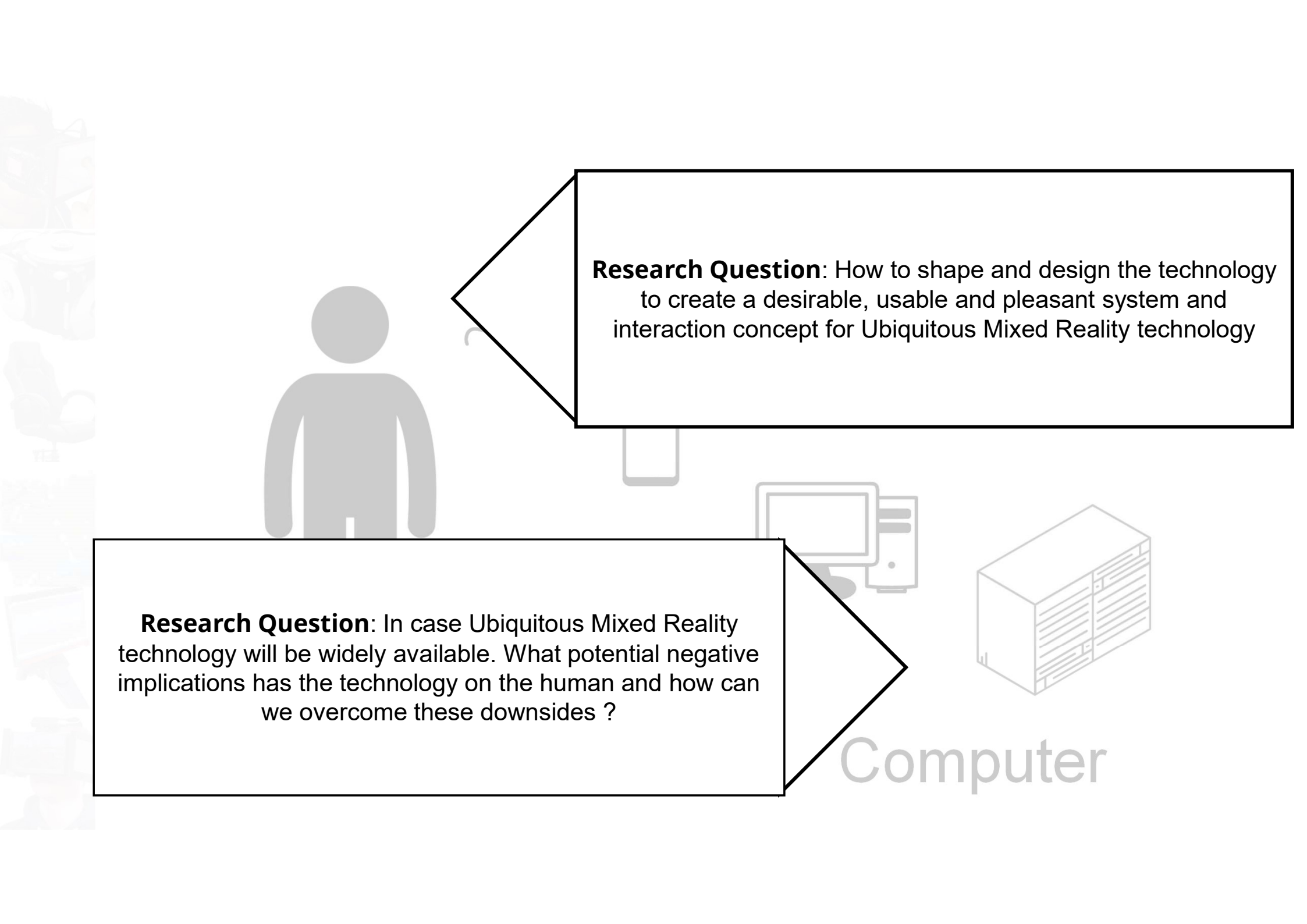
Computer

Research Question: How to shape and design the technology to create a desirable, usable and pleasant system and interaction concept for Ubiquitous Mixed Reality technology



Human

Computer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Research Question: In case Ubiquitous Mixed Reality technology will be widely available. What potential negative implications has the technology on the human and how can we overcome these downsides ?
Computer

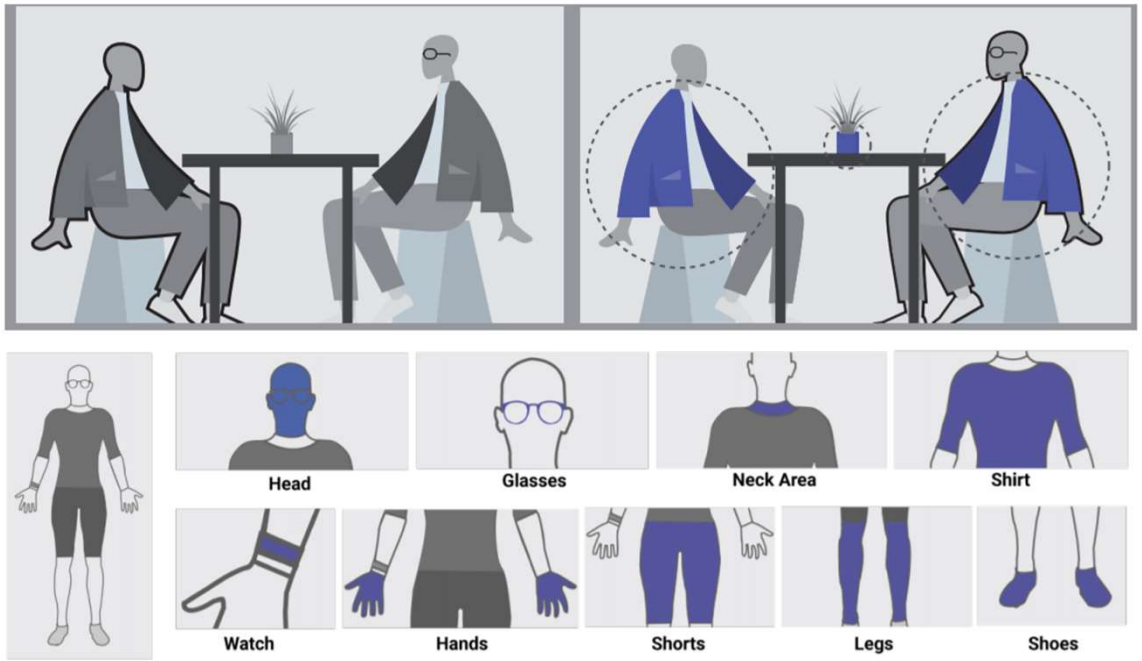
Ubiquitous Mixed Reality
Potential negative implications around Privacy

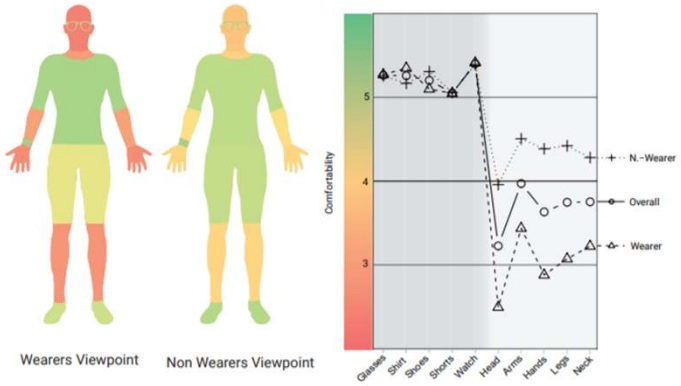
Exploring Augmented Visual Alterations in Interpersonal Communication

Jan Ole Rixen[1], Teresa Hirzle[1], Mark Colley[1], Yannick Etzel[1], Enrico Rukzio[1], **Jan Gugenheimer**[2]

[1]Institute of Media Informatics, Ulm University, Germany
[2]Telecom-Paris/IP-Paris/LTCI

Accepted CHI 2021





“Should we have the ability to alter the visual appearance of our conversational partner even if its only perceived by us” ?

Empirical

(N=64), we measured the user's comfort, acceptance of altering and being altered, and how it is impacted by being able to perceive or not perceive the alteration

Opinion

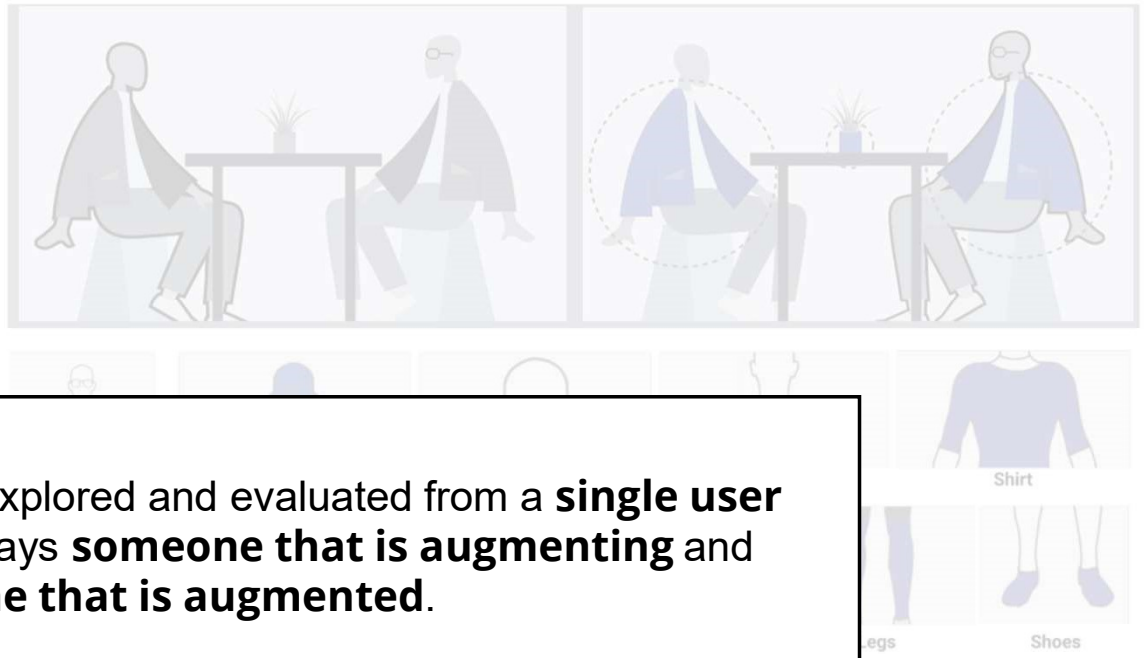
Discussion of the potential implications for future Technology

Exploring Augmented Visual Alterations in Interpersonal Communication

Jan Ole Rixen[1], Teresa Hirzle[1], Mark Colley[1], Yannick Etzel[1], Enrico Rukzio[1] **Jan Gugenheimer**[2]

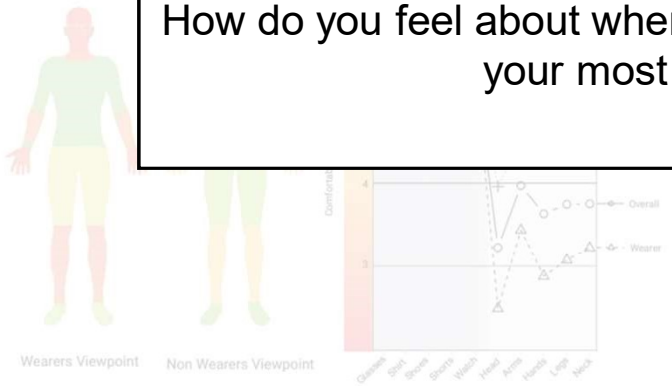
[1]Institute of Media I
[2]Telecom-Paris/IP-P

Accepted CHI 2021



Mixed Reality can **not** be explored and evaluated from a **single user** perspective ! There is always **someone that is augmenting** and **someone that is augmented**.

How do you feel about when I am able to change your appearance and see your most recent social media footprint ?



Empirical

(N=64), we measured the user's comfort, acceptance of altering and being altered, and how it is impacted by being able to perceive or not perceive the alteration

"Should we have the ability to alter the visual appearance of our conversational partner even if its only perceived by us" ?

Opinion

Discussion of the potential implications for future Technology

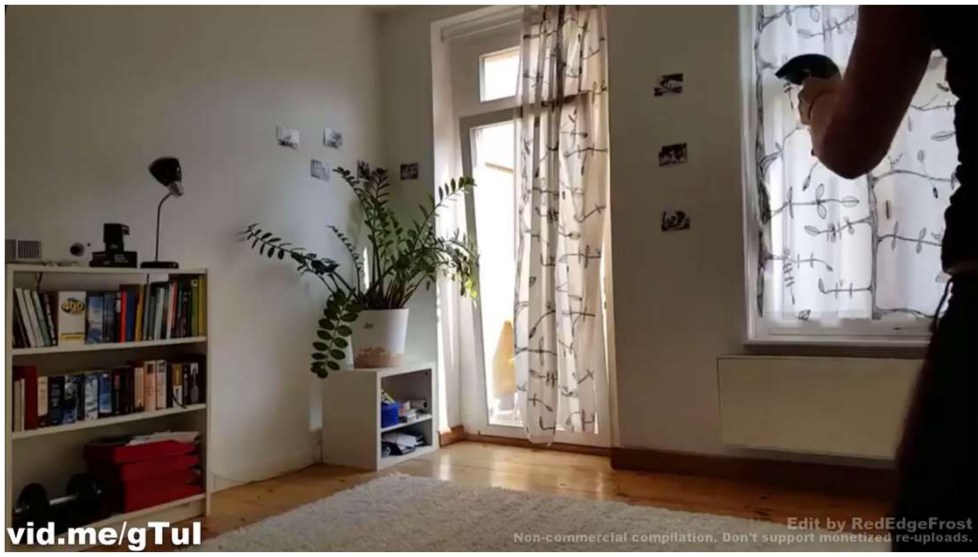
Ubiquitous Mixed Reality
Potential negative implications around Safety

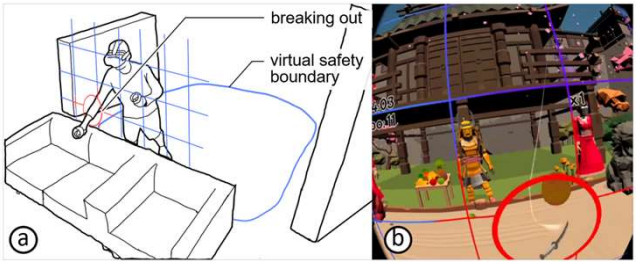
Understanding the Experience of Breaking Out of Virtual Reality Safety Boundaries

Wen-Jie Tseng, Petros Dimitrios Kontrazis, Samuel Huron, Eric Lecolinet and **Jan Gugenheimer**

Telecom-Paris/IP-Paris/LTCI

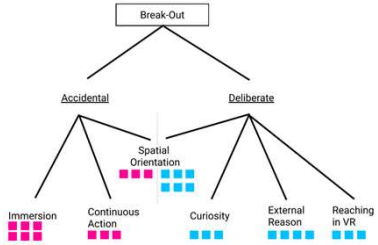
In submission UIST 2022

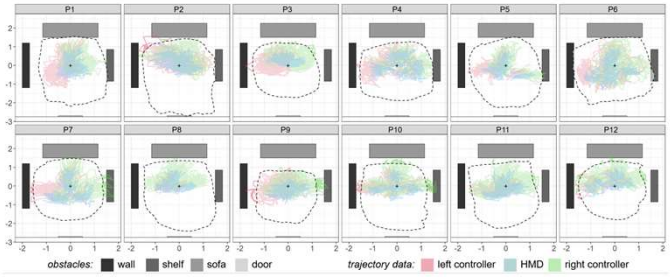




Artifact

We developed an application that is able to induce “breaking out” experiences in the lab





Empirical/Theoretical

We ran an online survey (n=148) and created a first framework to explain breaking out experiences which we verified in a consecutive lab experiment (n=12)

Understanding the Experience of Breaking Out of Virtual Reality Safety Boundaries

The Dark Side of Perceptual Manipulations in Virtual Reality

Wen-Jie Tseng[1], Elise Bonnail[1], Mark McGill[2], Mohamed Khamis[2] , Samuel Huron[1], Eric Lecolinet[1] and **Jan Gugenheimer[1]**

[1] Telecom-Paris/IP-Paris/LTCI
[2] University of Glasgow

In proceedings of CHI 2022

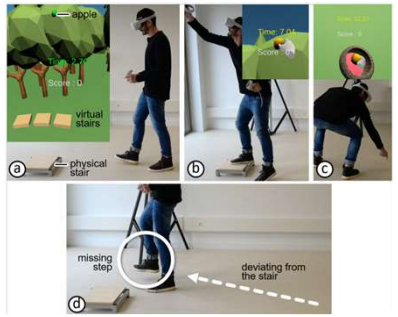
"Virtual-Physical Perceptual Manipulation (VPPM) refers to Extended Reality (XR) driven exploits that alter the human multi-sensory perception of our physical actions and reactions to nudge the user's physical movements"

Theoretical

We define, conceptualize and demonstrate the existence of Visual Perceptual Manipulations in the field of HCI and XR

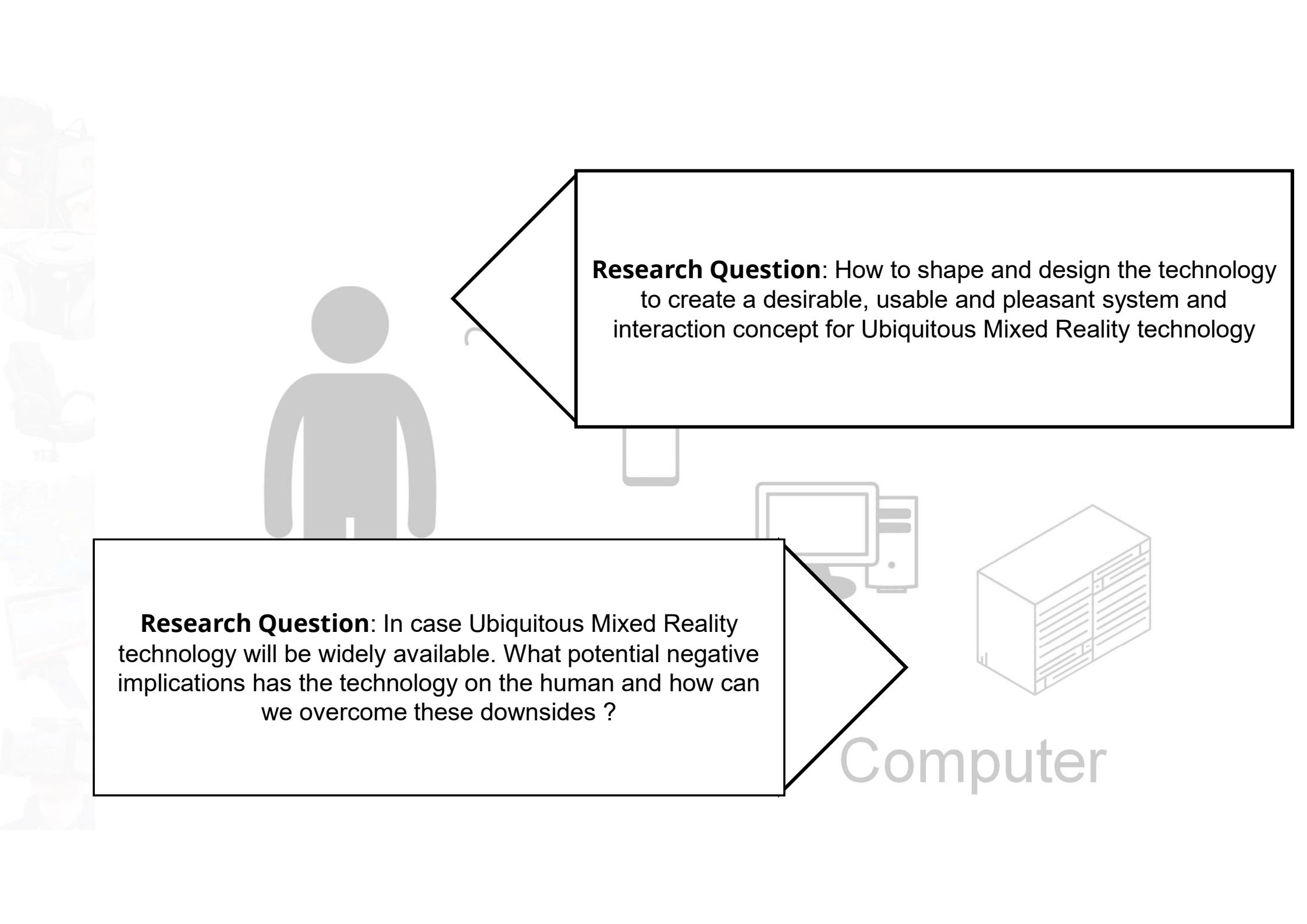
Empirical

Using speculative design workshops, we explore and characterize the threats/risks posed, proposing mitigations and preventative recommendations against the malicious use of VPPMs



Artifact

We implement two sample applications as an evaluation-by-demonstration showing how existing VPPMs could be trivially subverted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Research Question: In case Ubiquitous Mixed Reality technology will be widely available. What potential negative implications has the technology on the human and how can we overcome these downsides ?
Computer

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Ubiquitous Mixed Reality

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