

ARIVE



ARIVE Lecture Series XR: Virtual and Augmented Reality

Pervasive Augmented Reality



Technology & Ethics

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1. Our Profession and Ethics
2. Pervasive Augmented Reality—Definition and Technology
3. Example Scenarios
4. Ethical Considerations

Information and Computer Scientists as Engineers

ABSTRACT *Most American engineers believe that they have a responsibility for the safety and well-being of society, but whence does this responsibility arise? What does it entail? After describing engineering practice in America as compared with the practice of other professions, this paper examines two standard types of accounts of the social responsibilities of professionals. While neither provides a satisfactory account of the social responsibilities of American engineers, several lessons are learned by uncovering their weaknesses. Identifying the framework in which professional rights and responsibilities are justified, I argue that an end or primary good is the starting place for conceptualizing a profession, and justifying its existence and shape. Too little attention has been paid to the end(s) of engineering. The social responsibilities of American engineers as defined in the present system of engineering are ambiguous and weak. I indicate how the case for assigning American engineers stronger social responsibilities must be made by starting with the end(s) of engineering. I argue that, at present, American engineers do not have social responsibilities as engineers, though they do have social responsibilities as persons.*

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Do engineers have social responsibilities?.
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Duties to Society

Duties to Employers

Duties to Clients

Duties to Co-Professionals

Johnson (1992)

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Pervasive Augmented Reality



See-through head-mounted display

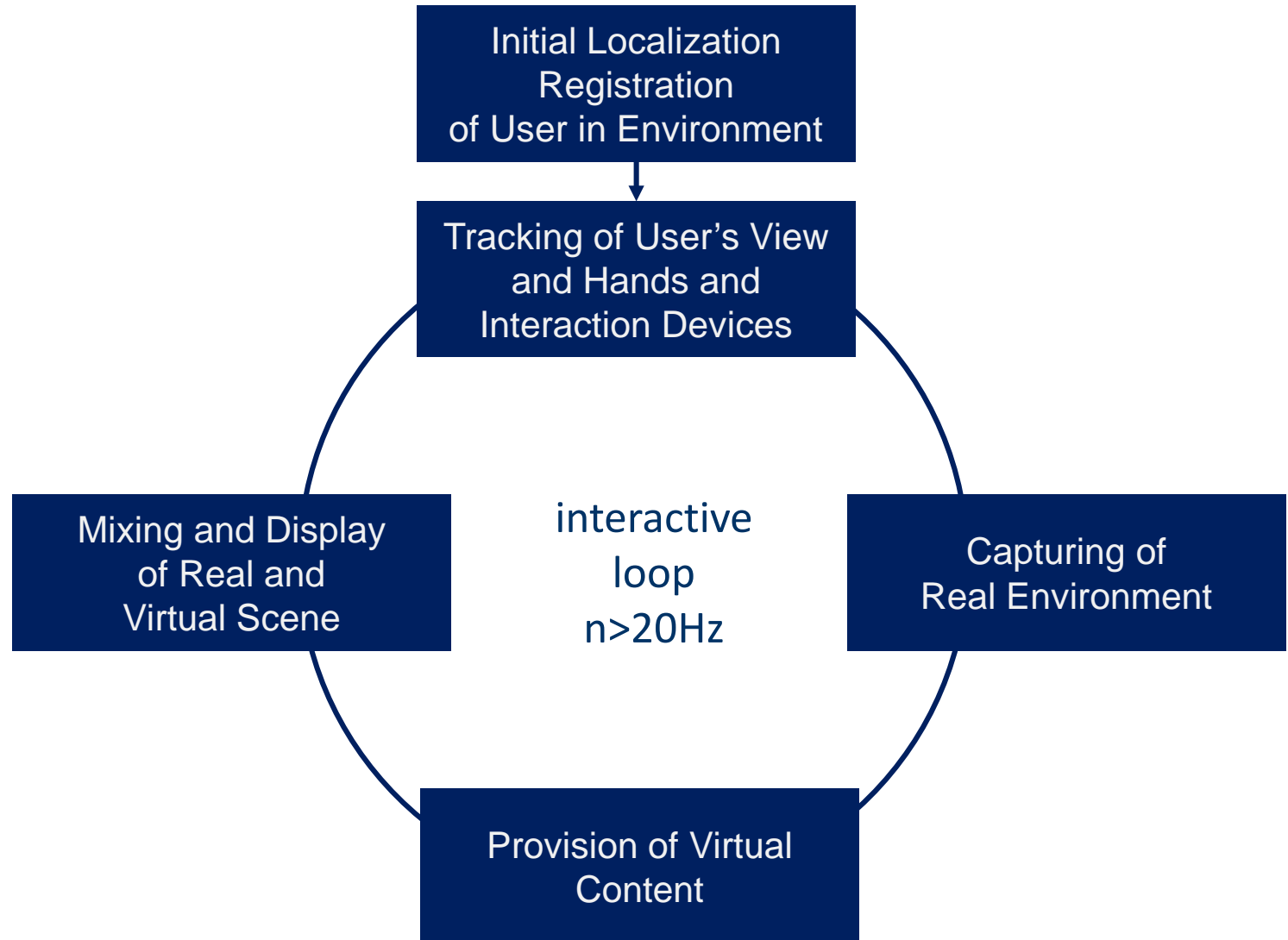
User tracked in space



Virtual (3D) Content

Real Environment





Pervasive Augmented Reality is the continuous experience of computer-mediated reality.



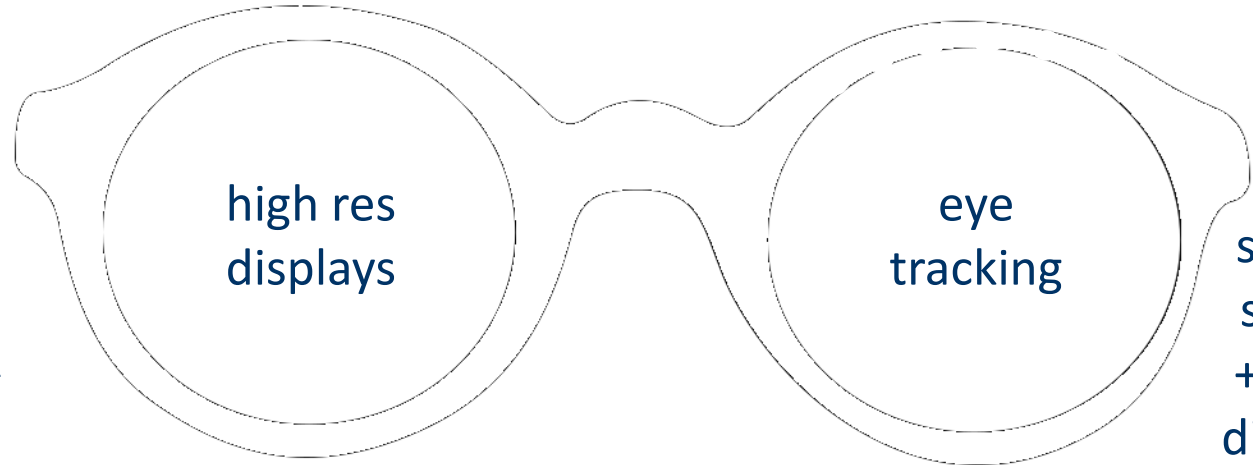
	Conventional Augmented Reality	Pervasive Augmented Reality
Use	Sporadic	Continuous
Control	User Controlled	Context-Controlled
Applications	Specific or Niche	Multi-Purpose
Hardware	General Purpose	Tailored/Specific
Context of Use	Specific/Restricted	Multi-Purpose/Adaptive/Aware
User Interface	Prototypical/No Standard/Obtrusive	Subtle/Disappearing/Unobtrusive
Mode of Use	Task- or Goal-Oriented	Context-Driven
Information Access	Information Overlay	Information Augmentation
Information Visualization	Added	Integrated/Embedded
Environment	Indoors OR Outdoors	Indoors AND Outdoors
Flow of Information	User Seeking Information	Information Seeking Users
Use of Device	One Size Fits All	Individualized

Grubert, J., Langlotz, T., Zollmann, S., & Regenbrecht, H. (2017). Towards pervasive augmented reality: Context-awareness in augmented reality. *IEEE transactions on visualization and computer graphics*, 23(6), 1706-1724.

PAR::Fictional Future (Facebook, Apple, Google, Microsoft, ...) Glasses

lidar, location/orientation sensors

cameras, microphones



°C
HR
GSR
ECG
EEG
...

built-in computing power
and wireless connectivity

spatial
sound
+other
displays

Main Technical Challenges

Registration
Tracking

Visual++
Displays

Computation
Integration

Modulating
Reality





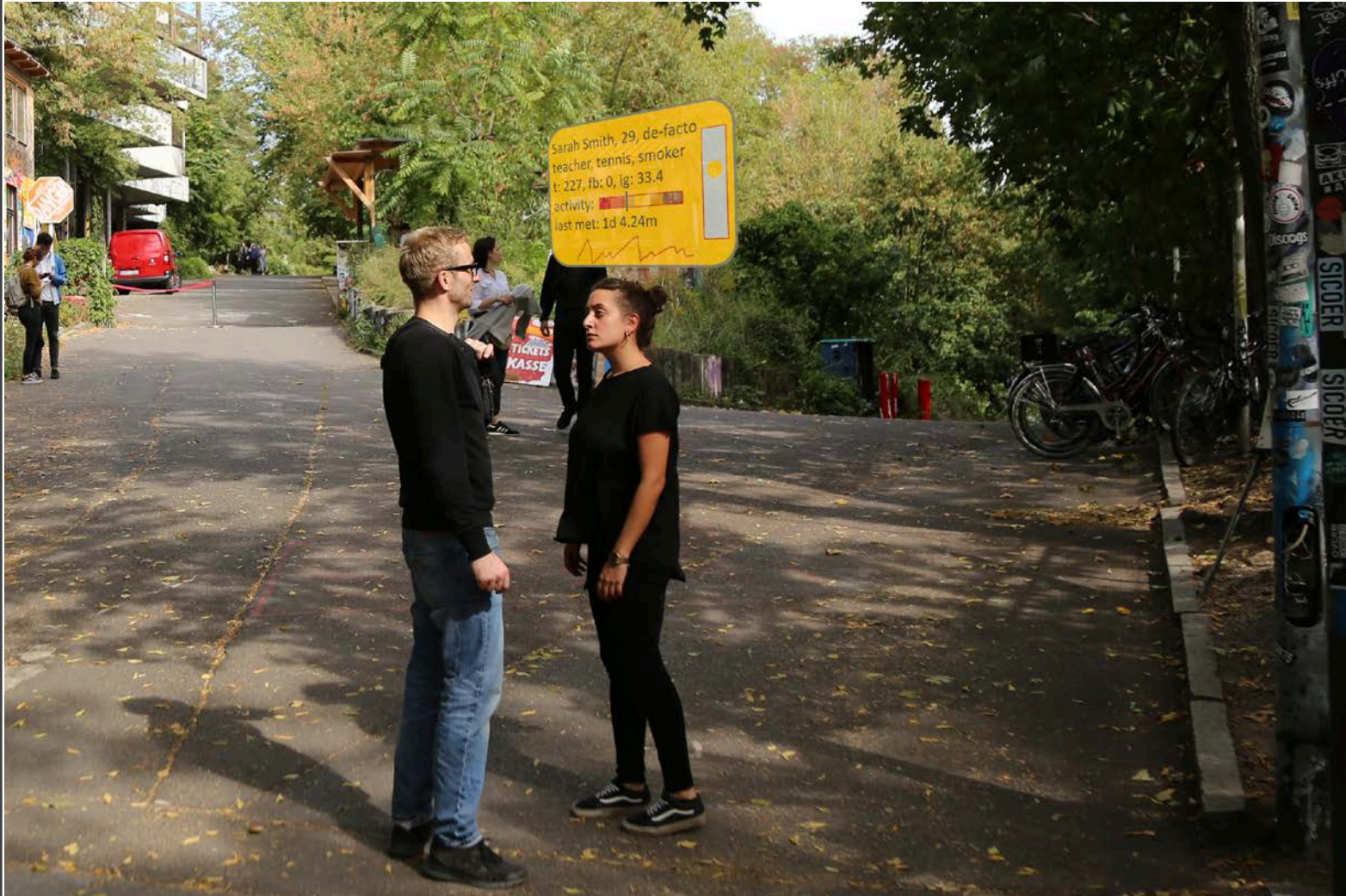
Example Scenarios













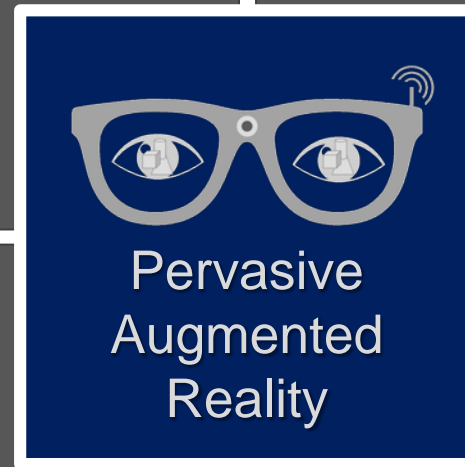


Ethical Considerations



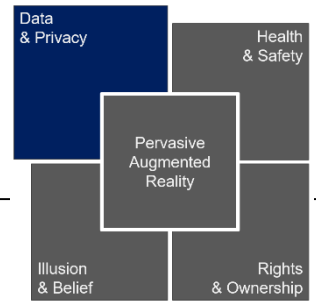
Data
& Privacy

Health
& Safety



Illusion
& Belief

Rights
& Ownership



Lessons learned from Google Glass (2013) [even if not really AR]

1. built-in camera which can be used to continuously observe the environment
2. built-in location and movement sensors which can continuously collect data about its user





Facebook Project Aria



© Facebook





Head, hand & object tracking



AI & semantic understanding

- 1x 8 Megapixel RGB camera
- 110°HFOV x 110°VFOV
- Up to 30FPS

Head, hand & object tracking

- 2x 640x480 pixel mono cameras
- 150°HFOV x 120°VFOV
- Up to 90FPS

Non-visual tracking

- Dual IMU
- Magnetometer
- Barometer
- GPS

Audio capture & eye movement tracking

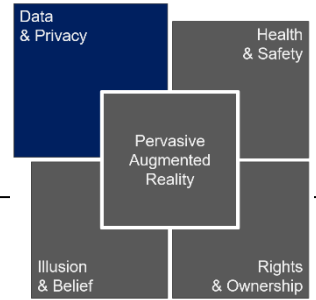
Spatial audio input

- 7x microphone array
- 48KHz 32bit



Stereo eye movement tracking

- 2x 320x240 pixel IR cameras
- IR illumination
- Up to 90 FPS

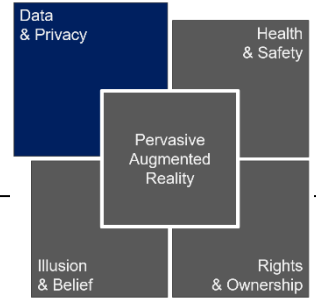


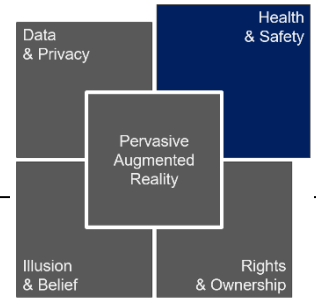
Facial Analysis

Category	Attribute	Confidence
Demographic Data	Male	97.4%
	Image Quality	
Sentiment Expressed	Happy	96.0%
	Smiling	96.3%
Facial Landmarks	Eyes are open	100%
	Mustache	100%
General Attributes	Beard	65.3%

Amazon Rekognition





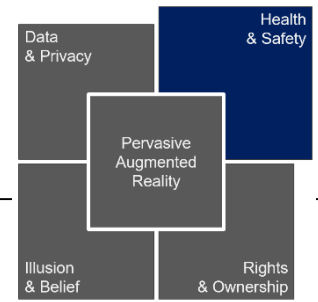


Physical and Psychological Wellbeing

Long-term
PAR
Use

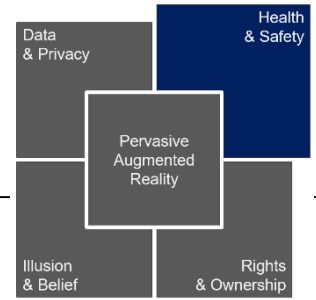
Perceptual
Distraction

Human-
Information
Interaction



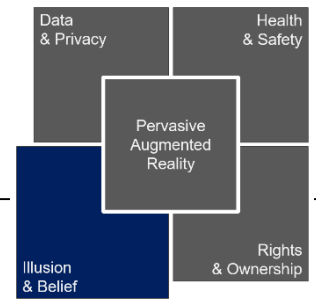
- Occlusion, Information Overload, Saliency modulation
- HUD similarities
- Focal plane issues: accommodation, convergence; (cf lightfields)
- Interaction issues: gesturing, additional interaction devices, automatic triggering of actions (context-responsive PAR behaviour)
- Contrast and brightness: will everything be seen and noticed? (same if not in focus)
- Acoustic isolation/distraction: similar to wearing headphones; but also as an issue when simultaneously communicating with other in reality while receiving audio signals through PAR
- Long-term effects of constant display use; cf monitor use and ergonomic guidelines; perhaps phases of rest needed (contradicts the intention of PAR)
- Field of view difference augmentation / real world->consequences?
- Long-term effects of continues information overlay (->research)



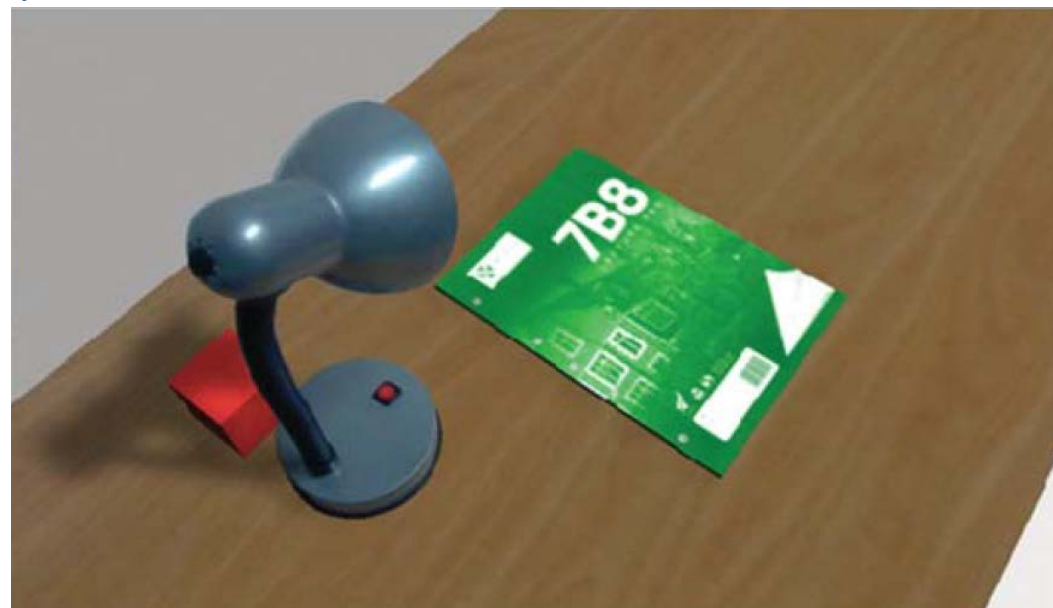


Galileo.tv



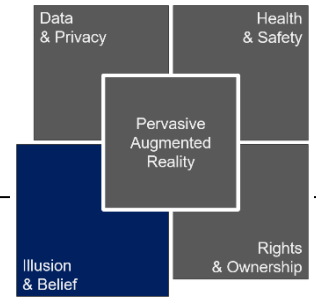


- The perfect Illusion; Coherence, Magic
- PAR no “Device Gap”
=> the disappearing interface
- What is real?
- PAR’s potential illusion=>belief



Collins et al. (2017)

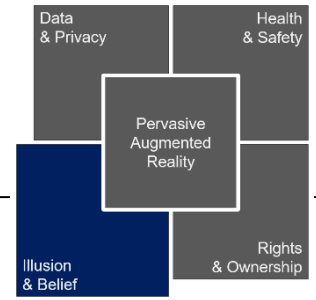




“Breaking the Magician's Code”

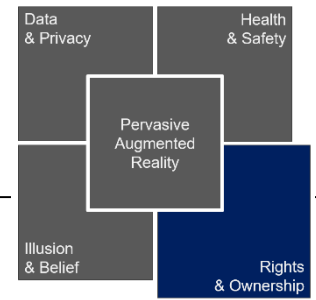


blog.codinghorror.com









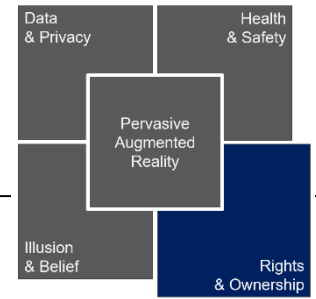
PAR will change the notion of private and public property ownership and use.

Places and spaces defined by streets and buildings, gardens and trees, and monuments and sculptures will be augmented by virtual reality. Potentially permanently.

E.g.:

- Authority to augment?
- Digital twin ownership?
- Highjacking of public (and private) places
- Virtual Graffiti







Cascales, A., Pérez-López, D., & Contero, M. (2013).
Study on parent's acceptance of the augmented reality use
for preschool education.
Procedia Computer Science, 25, 420-427.

A Case Example



- “Useful, facilitating the learning process and promoting motivation, knowledge, reading and writing, creativity and degree of satisfaction.”
- Tasks could be executed in several contexts and for variety of learning levels
- Parents liked didactical resources (shown to increase comprehension, creating more effective learning)



BUT

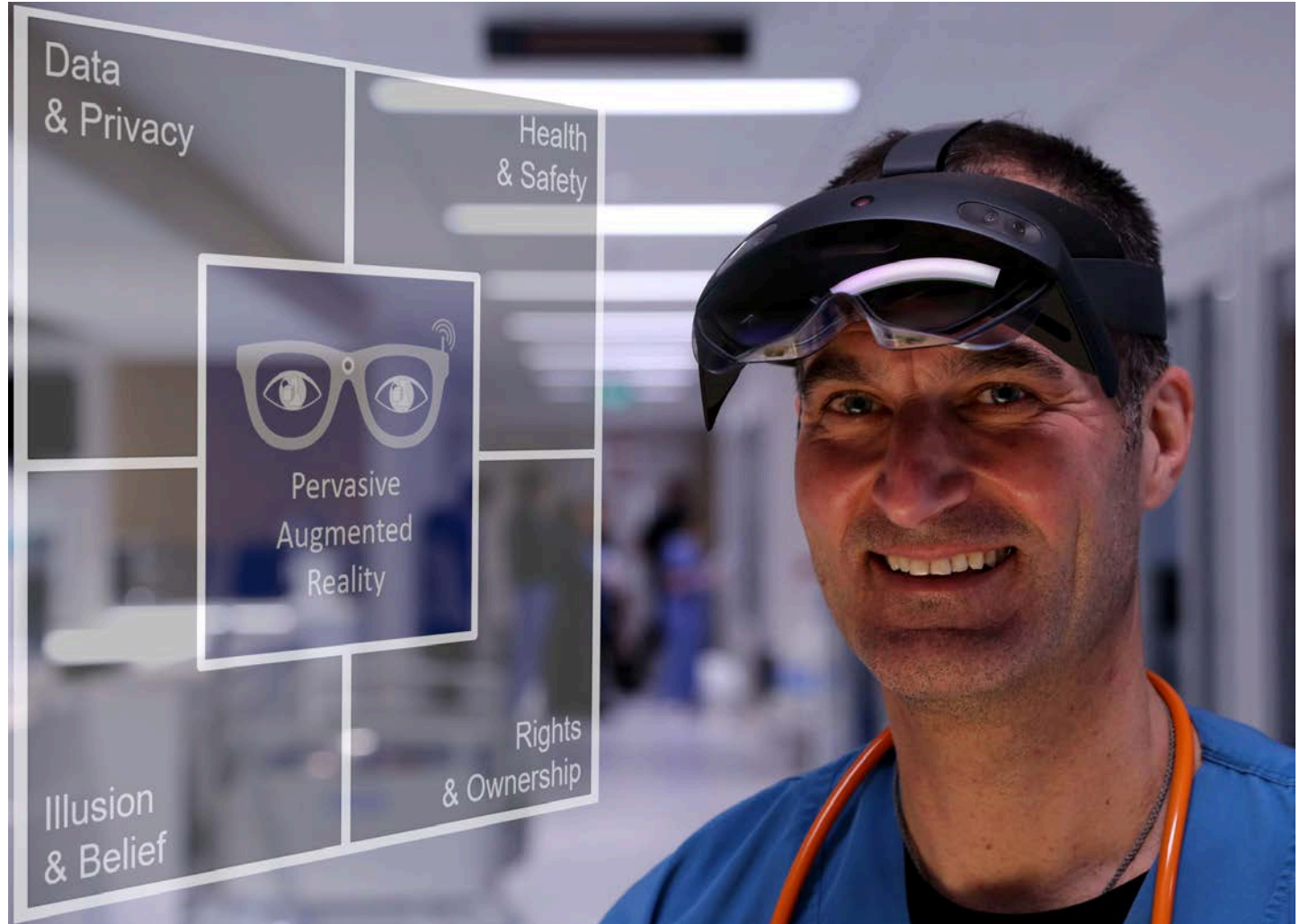
- Long term effects and prolonged exposure
- Impact of Environment on agency and behaviour
- Aggravating Pre-existing Psychological or Emotional Issues
- (Un)Reality and Diminished Real World Interactions
- Privacy and data gathering



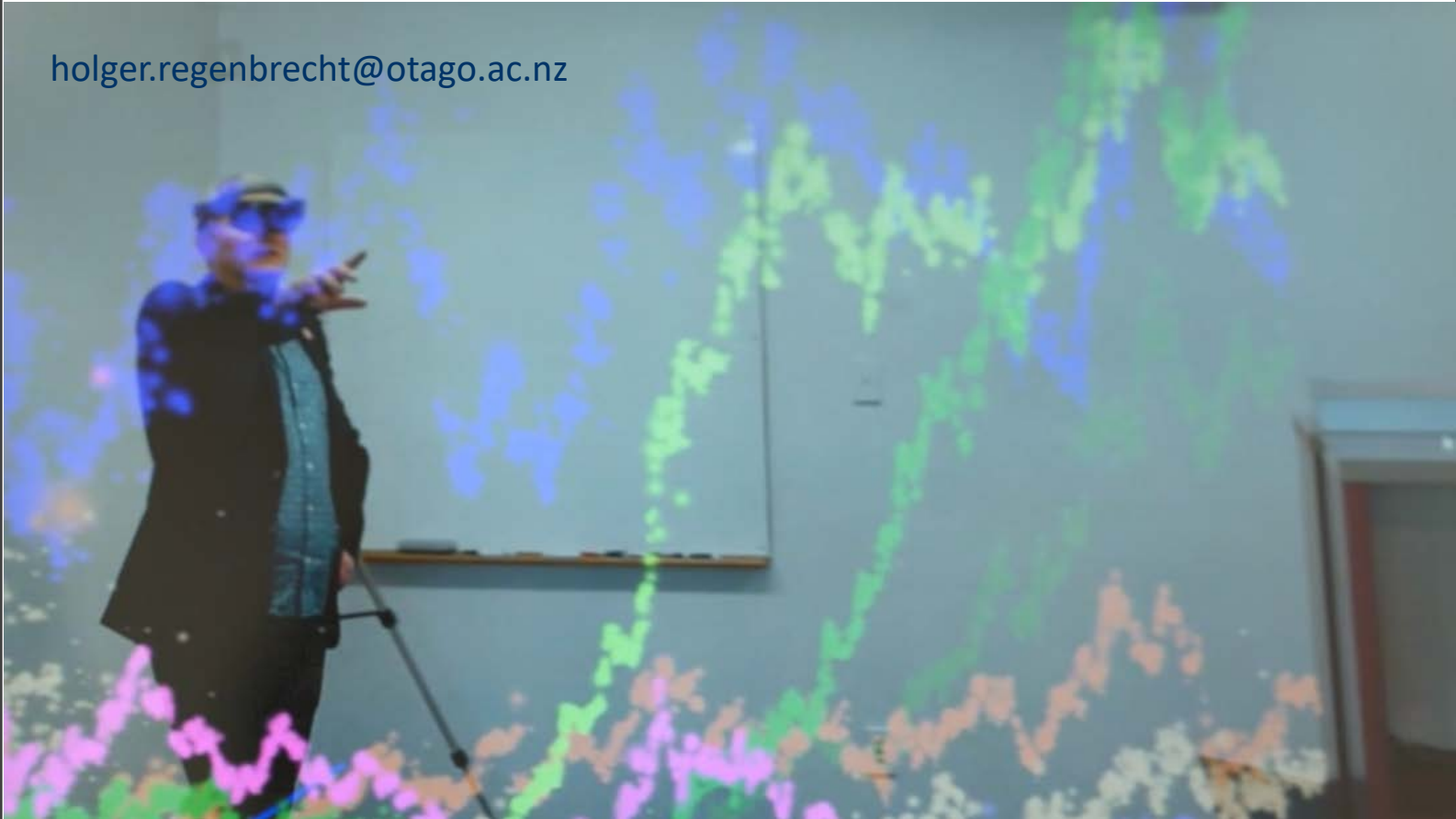


Whereto from here?





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Thanks to Markus, Max, Sima, and Chontira for being photo models.

