

If I were to give you one of these right now....
What would you do with it?





Why AI/XR? Bridging Empathy, Assistance and Augmentation



Yun Suen PAI

Lecturer/Director of Inclusive Reality Lab

School of Computer Science, UoA

Associate Director of Empathic Computing Lab

Auckland Bioengineering Institute, UoA

Who am I?

- Director of Physionetic Interactions Group
- Director of Inclusive Reality Lab, Associate Director of Empathic Computing Lab
- Undergraduate and Master's at UM, Malaysia (2009–2013)
- PhD at Keio, Japan (2015 – 2018)
- Postdoc at UoA, NZ (2019-2021)
- Asst Prof at Keio, Japan (2021 - 2022)
- Senior Asst Prof at Keio, Japan (2022 – 2023)
- Lecturer at UoA, NZ (2023 – current)



60%

Decline in AR/VR headset shipment year over year. Yet...

20%

Increase in global AI adoption year over year.

The meh-taverse

Unfortunately, the lack of a "killer app", the lack of comfort, and the lack of good pricing is making XR fall behind.

The use of AI is ubiquitous. But the use of XR isn't.

“

Apple Vision Pro is going to make loneliness worse...

*It encourages users to enter their own virtual world,
removing the need to interact with other...*

The experience looks awfully isolating...

It puts you at the center of your own little screen-filled world

- Fast Company, The Verge

With its wealth of potentials, why is this happening?

**XR should bridge gaps,
not create them!**

Why AI/XR?

To me, my focus in AI/XR is not about how to make AI better, or how to make XR better...

My research question is...

What context makes AI/XR truly useful?

Inclusive Reality Lab

Our vision:

A future where technology seamlessly bridges social and ability gaps, fostering an inclusive prosocial society.

#HCI #cognition #assistance
#augmentation

What is inclusion exactly?

It is about

Acknowledging diversity; everyone thinks and acts differently.

Empowering diversity by bridging gaps.



Understand



Understand



Assist



Augment



Understanding cognition

To promote inclusion, we first need to understand.

How does AI/XR affect our cognitive states?

How does AI/XR affect our emotions?

How does AI/XR affect our behaviour?



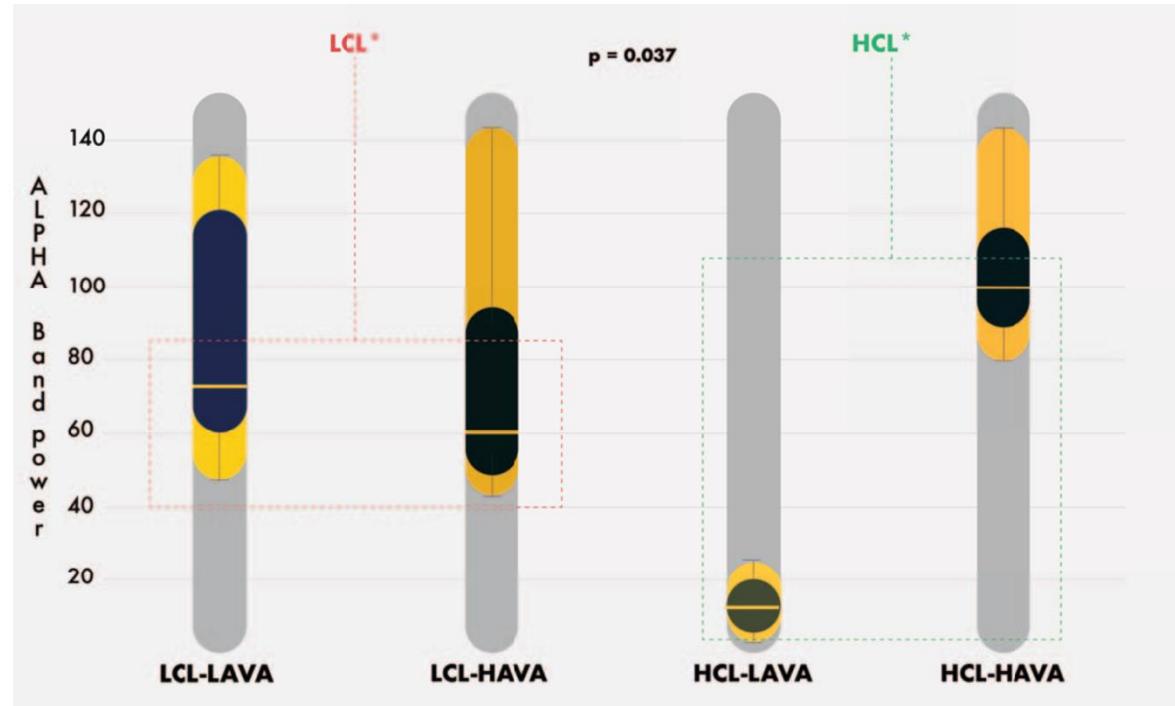
Do we trust AI agents? What happens when we trust/distrust them?

- We designed a task in VR, where an AI assistant helps you to complete it.
- However, it is either 100% accurate, or 50% accurate.
 - Do we trust it?
 - Under different levels of stress, how does our trust towards it change?
 - What happens if we trust it?

Trust in Virtual Agents (IEEEVR 2020)

Trust in Virtual Agents (IEEEVR 2020)

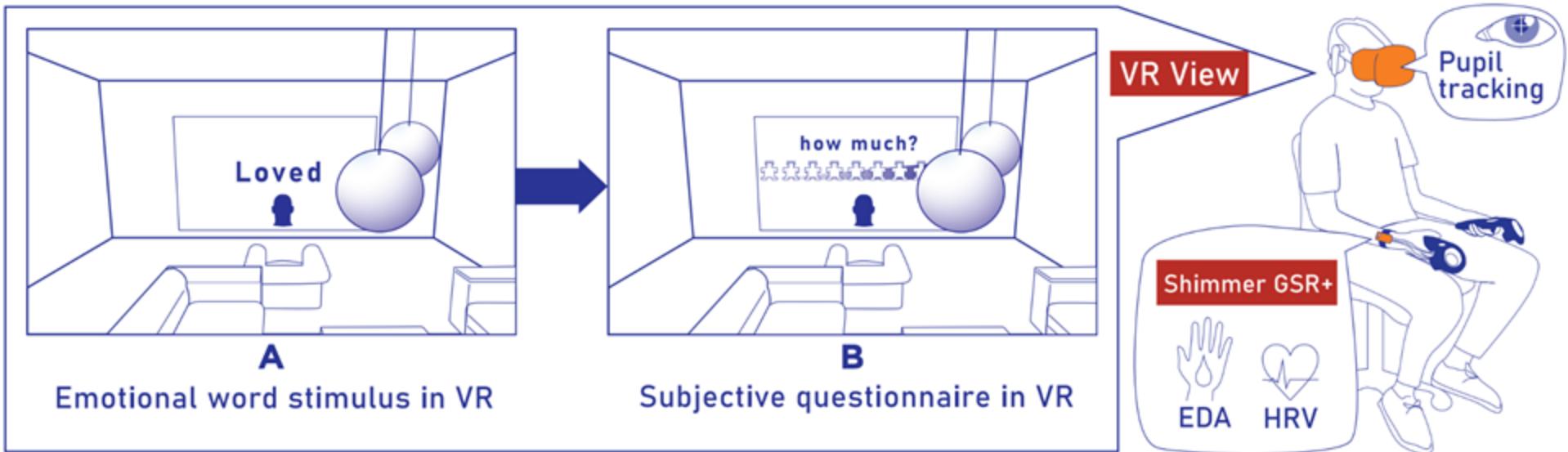
- No significance in head movement behaviour
- Inaccurate agent reduces alpha band power, increasing cognitive load



What is the relation between memory and VR?

- Emotional Autobiographical memory – personal memories linked to specific emotions.
- We designed a task in VR, where a prompt will trigger your memory recall.
 - How can VR help in recalling?
 - What happens when we recall memories?
 - Can we predict memory recall?

Total VRecall (IMWUT 2022)



Total VRecall (IMWUT 2022)

- Significant effect of AM recalls on EDA peaks and blink rate when recalling
- Generalized AM recall accuracy of 77.1% using ensemble classifier
- Personalized AM recall accuracy of 95.1%

Participant ID	AM Detection	
	CV Score (%)	Classifier
1	88.2	EC
2	77.9	EC
3	76.9	KNN
4	93	EC
5	87.6	EC
6	92.1	EC
7	85.4	EC
8	85.5	EC
9	93	RF
10	78.6	RF
11	87.5	EC
12	88.2	EC
13	95.1	EC
14	88.2	EC
15	86	EC
16	84.3	EC
17	87.7	EC
18	89.1	EC
19	87.8	EC
20	86.2	EC
Generalized	77.1	EC

Can we understand a person's emotion just by looking at them?

- We developed an XR experience, where user emotions are reflected virtually in VR and physically as a social robot.
 - How can virtual avatar promote empathy?
 - How can robot movement promote empathy?
 - How does this impact social communication?



Heightened Empathy (Siggraph 2023)

P1

P2

Understand



Assist



Augment



Assisting individuals

Beyond understanding, we need to assist in actionable ways with actionable outcomes.

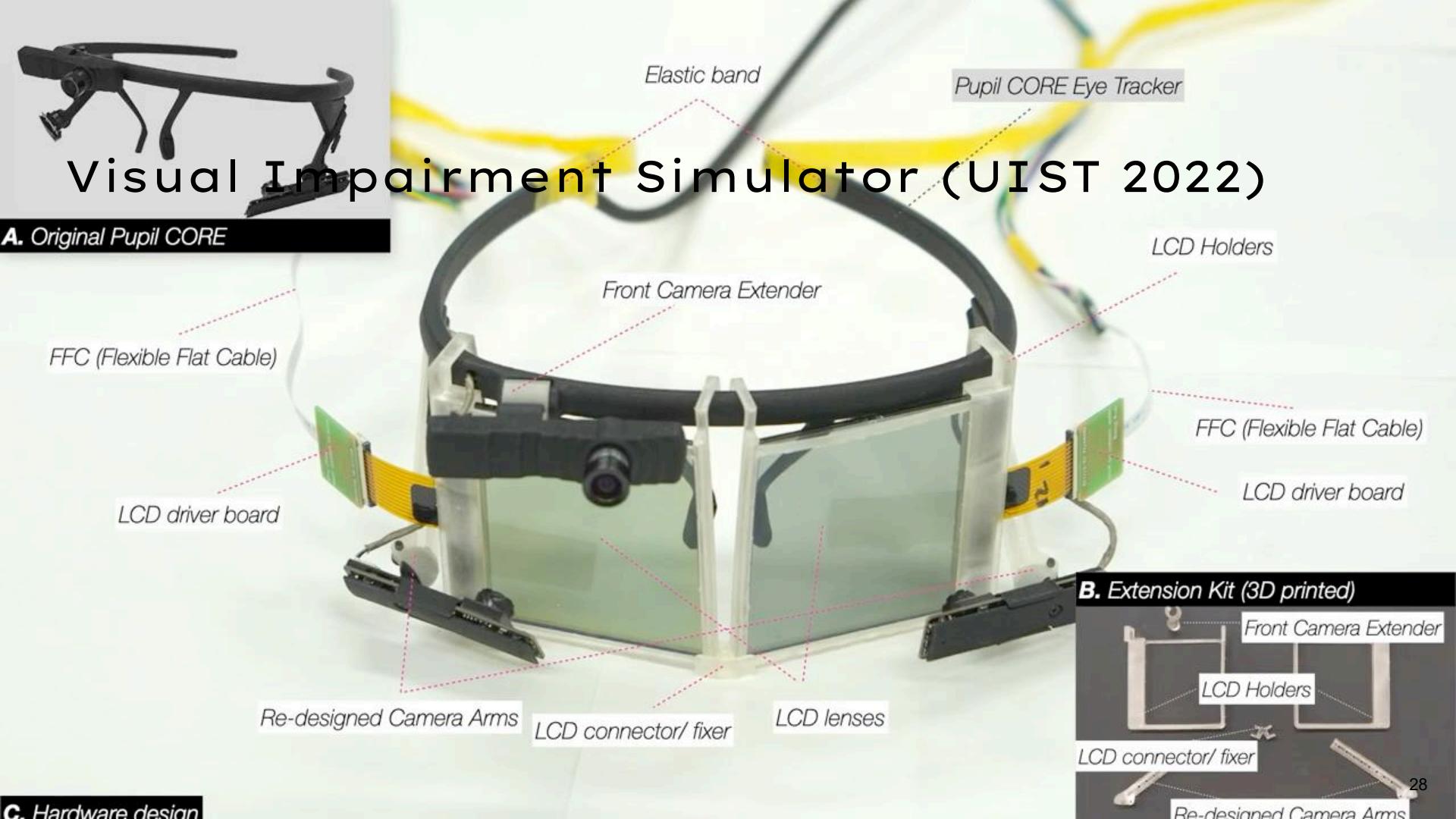
How can AI/XR let us help others?

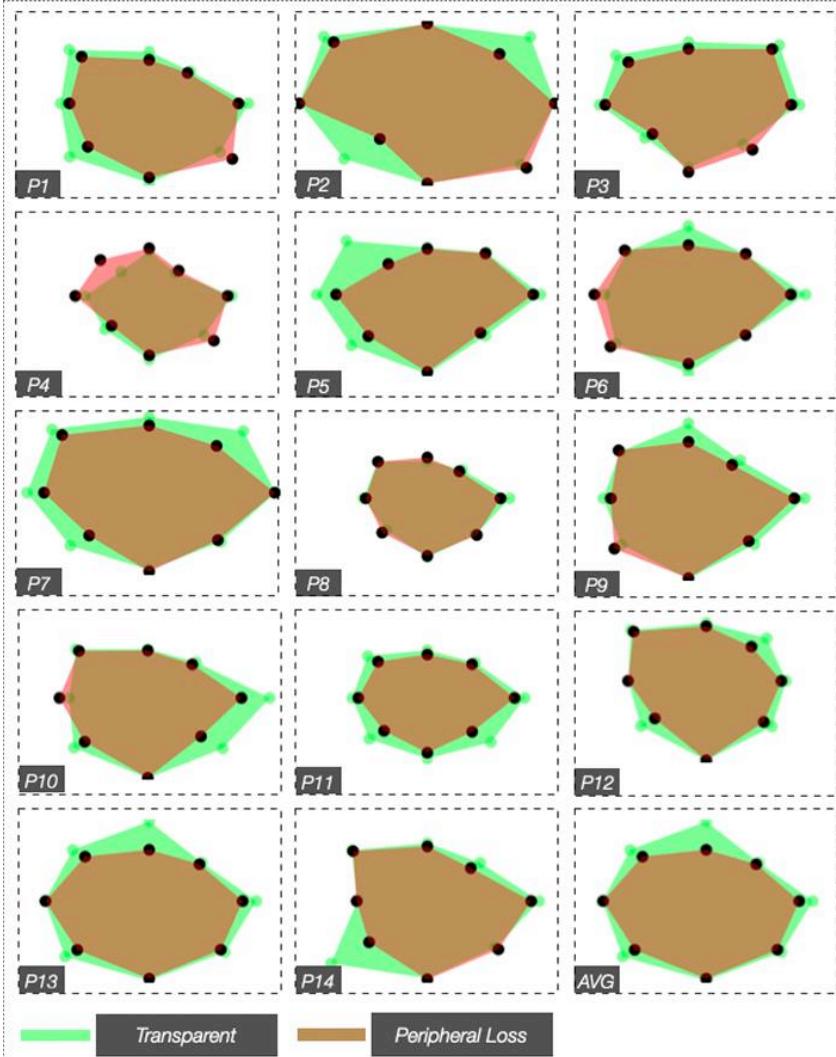
How can AI/XR let us help ourselves?



Can we design an assistive wearable for vision loss?

- We developed a low-cost, light-weight “XR” headset, to specifically simulate peripheral and central vision loss.
 - How to make it low cost?
 - How to make it light weight?
 - How to evaluate its effects?





Can we design an assistive wearable for dementia?

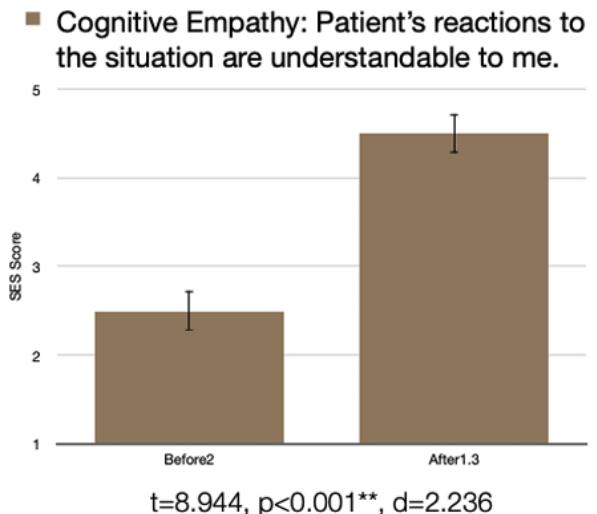
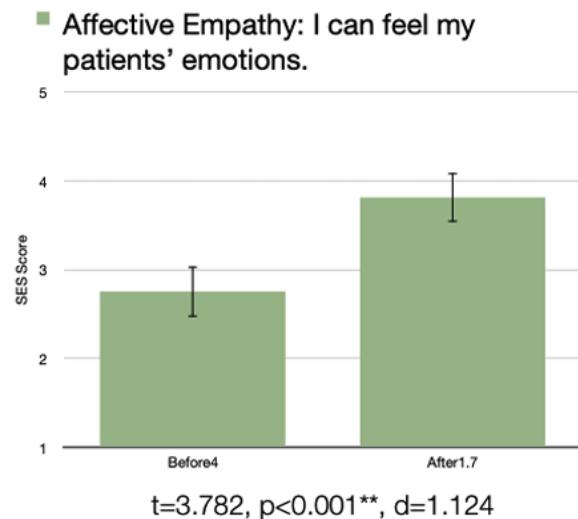
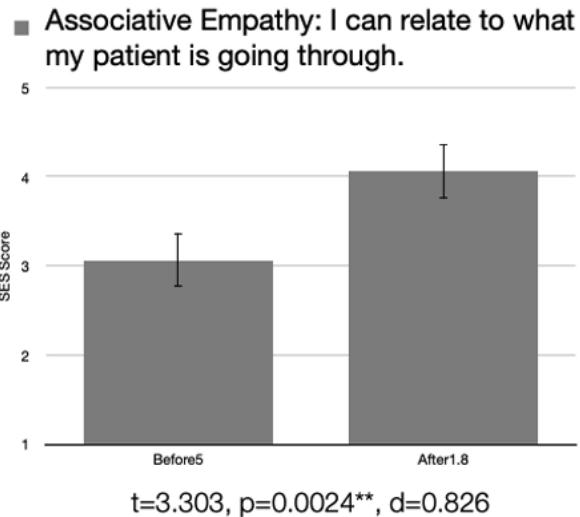
- We developed a low-cost AR system that can simulate how dementia patients visually perceive the world.
 - How do dementia patients see the world?
 - How do we simulate that?
 - How to evaluate its effects?

Dementia Eyes (CHI 2023)



Therefore, we propose Dementia eyes: a mobile AR Experience simulating visual symptoms of senile dementia

Dementia Eyes (CHI 2023)



Can we use VR as a ubiquitous safe room?

- We developed a VR environment specifically for emotional regulation for neurodivergent women and non-binary.
 - How to make a safe room in VR?
 - What are the needs of neurodivergent women/non-binary?
 - How to evaluate its effects?

Portable Silent Room



Final prototype

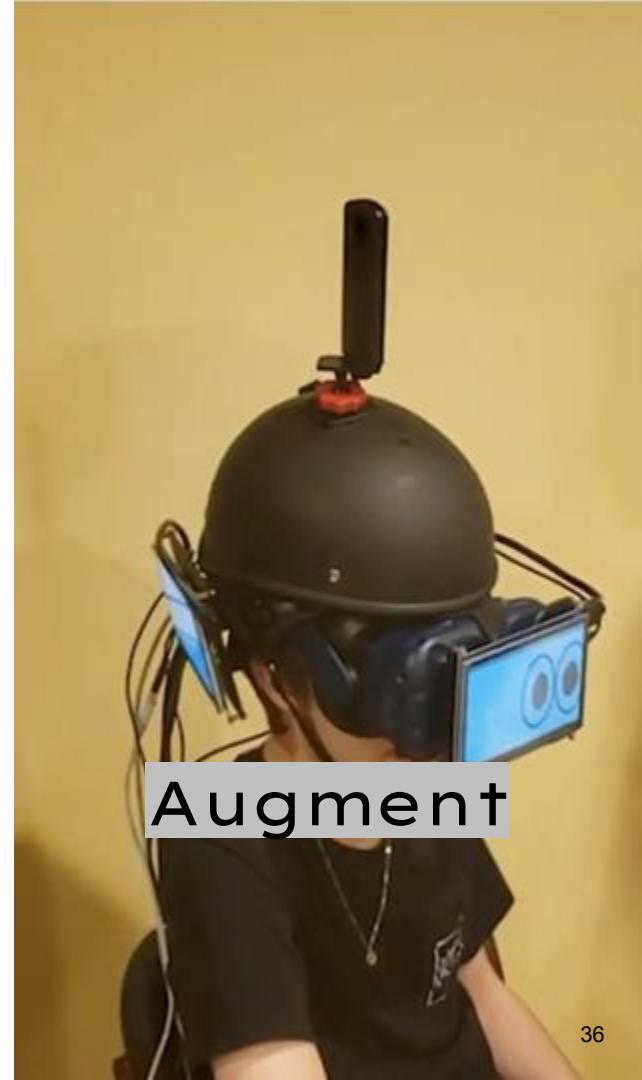
Then created the final version which includes six separate scenes, options for engaging in creative and breathing activities, and a control panel to regulate light, audio and preferred environment.

Portable Silent Room (TBD ISMAR 2025)

- A visual focal point of relaxation
- A space with a sense of safety and security
- Tool for guided breathing
- Natural space for forest bathing
- An area with a sense of freedom and openness
- Adjustable audio stimuli
- Module for creative expression



Understand



Augmenting abilities

The future vision of inclusion, beyond current abilities.

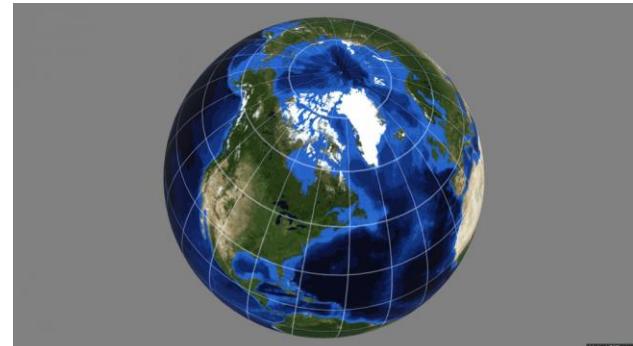
Can technology help us perform beyond our abilities?

Can technology create a new form of perceiving reality?



How can humans have 360 vision?

- Human FOV is approximately 200 degrees horizontally, 135 degrees vertically.
- We developed a usable 360 vision for humans.
 - How can humans possibly see in 360?
 - Is that even usable?

MakeAGif.com

Hardware

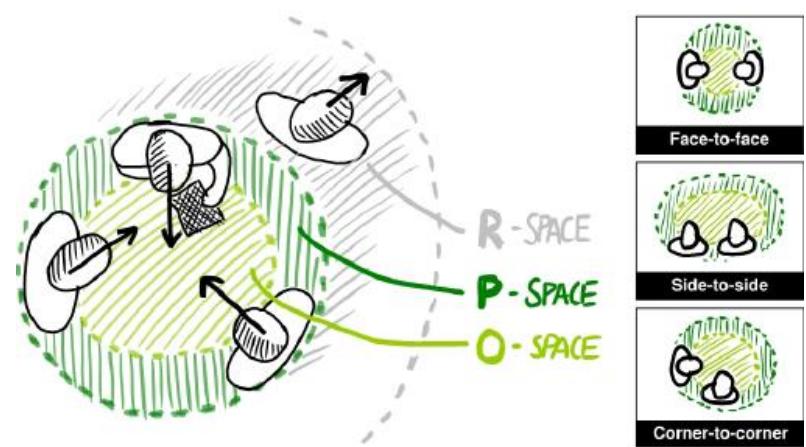
OmniView (Augmented Humans 2020)



We propose OmniView, a system that streams 360° FOV from a 360° camera and uses dynamic distortions to prioritize the direction-of-interest (DOI).

Ok, so humans have 360 vision now...how will this effect social communication?

- Human FOV is approximately 200 degrees horizontally, 135 degrees vertically.
- We developed a usable 360 vision for humans.
 - How can humans possibly see in 360?
 - Is that even usable?



MultiPlex Vision (VRST 2020)



MultiPlex Vision (VRST 2020)

- New paradigms of F-formation.
- No significant differences between users of the system vs non-users of the system, i.e. system was natural enough for communication (disregarding the discomfort of using it).

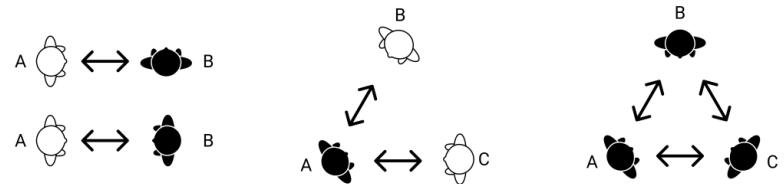


Figure 4: Proposed paradigms for (left) multidirectional one-to-one, (middle) one-to-many with the ability to maintain eye contact two other participants, and (right) many-to-many where all participants are users of MultiPlex Vision.

Inclusion is about recognizing that people are diverse, there are gaps between people, and these gaps can lead to exclusion.

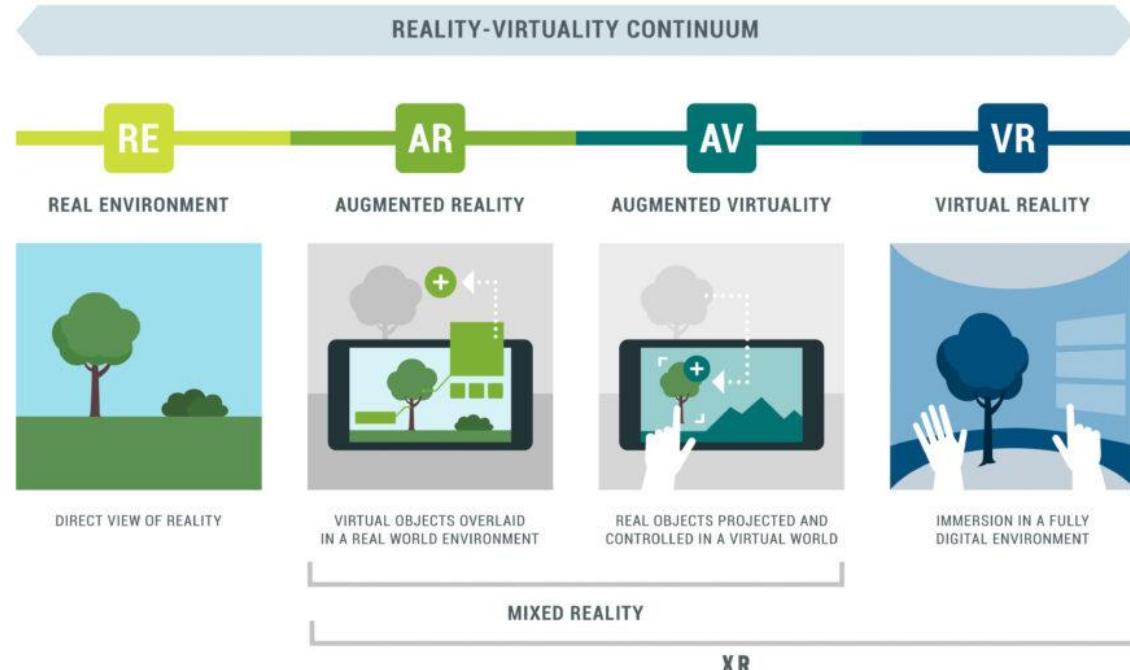
AI/XR has the potential to fill this gap...

1. By understanding how people think, feel and act, we can
2. Assist and help others in more ways than you think, and
3. Push the limits of humanity beyond what it is today.

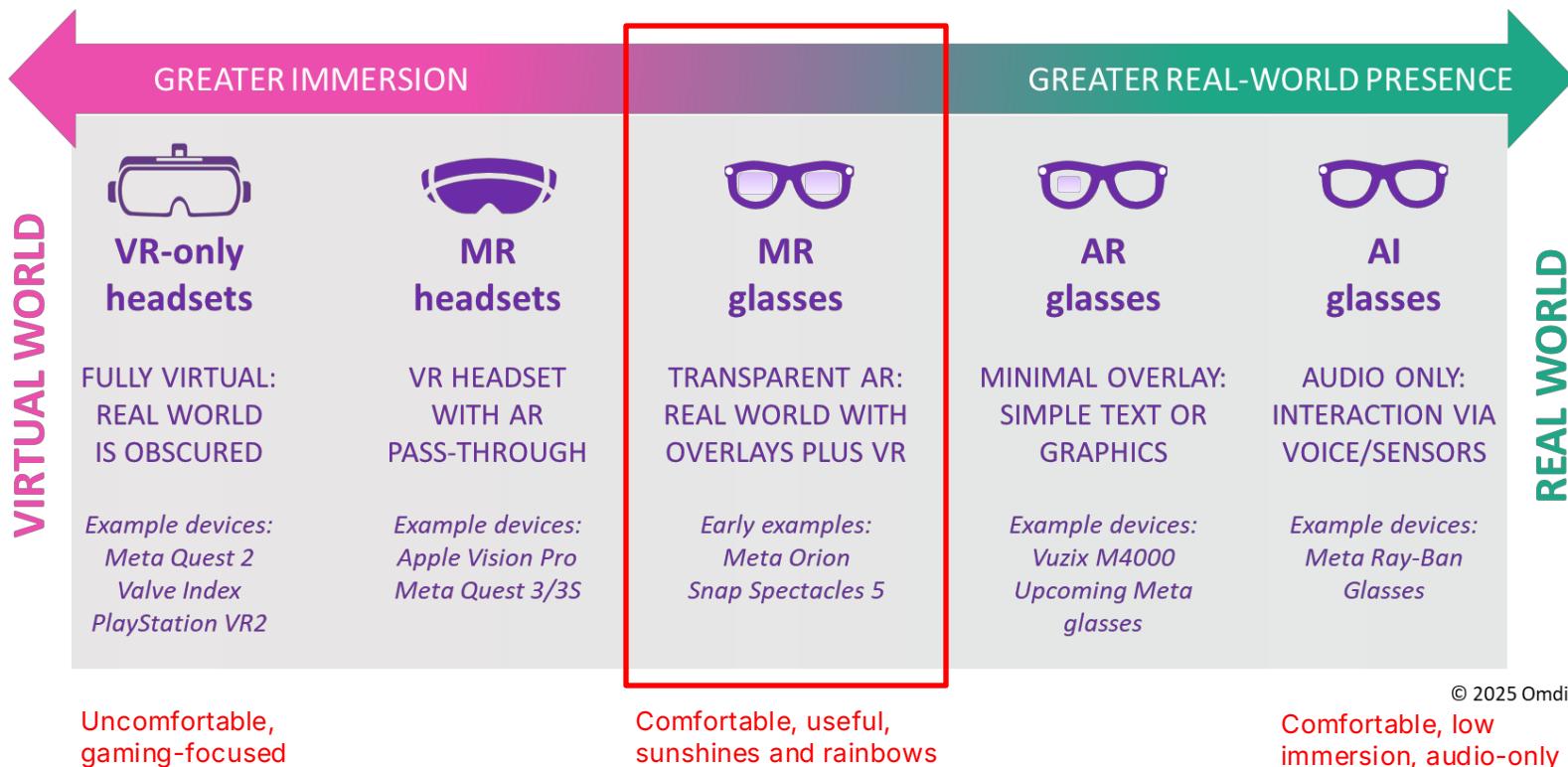
Summary

The AI/XR Continuum

XR Continuum



AI/XR Continuum



The (hidden) cost of AI + XR

The cost of XR

Often, it's a middle ground between "mildly entertaining paperweight" and "mortgage your house".



The environmental cost of AI

AI and its data centers **require freshwater** to cool servers and produce the electricity that powers them. In 2022, Google, Microsoft, and Meta used an estimated **580 billion gallons of water** to provide power and cooling to data centers and AI servers. That's enough water to meet the annual needs of 15 million households.

NEWS

Elon Musk's xAI facility is polluting South Memphis.



According to OpenAI CEO Sam Altman, expressing gratitude to or showing consideration for ChatGPT has cost the company "**tens of millions of dollars**." He shared this in response to a user who pondered: "I wonder how much money OpenAI has lost in electricity costs from people saying 'please' and 'thank you' to their models."

The cognitive cost of AI



GREG ISENBERG
@gregisenberg

Subscribe



...

Just had a fascinating lunch with a 22-year-old Stanford grad. Smart kid. Perfect resume. Something felt off though.

He kept pausing mid-sentence, searching for words. Not complex words - basic ones. Like his brain was buffering.

Finally asked if he was okay. His response floored me.

"Sometimes I forget words now. I'm so used to having ChatGPT complete my thoughts that when it's not there, my brain feels... slower."

He'd been using AI for everything. Writing, thinking, communication. It had become his external brain. And now his internal one was getting weaker.

Made me think about calculators. Remember how teachers said we needed to learn math because "you won't always have a calculator"? They were wrong about that.

“

AI to catalyse, not cannibalize XR growth

“

AI and XR to catalyse people, not cannibalize them.

Not “AI - XR” symbiosis, but

“AI/XR - Human” symbiosis that matters



Huge thanks to

these amazing people!

More details, including other research can be found here:

<https://yunsuenpai.com>

Feel free to contact me via email at:

yun.suen.pai@auckland.ac.nz



Thank you!