HOW AR+AI COULD TRANSFORM THE FUTURE OF PERSONAL COMPUTING

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EVOLUTION OF GENERAL-PURPOSE COMPUTING

IBM

The Guardian

Wikipedia

eBay

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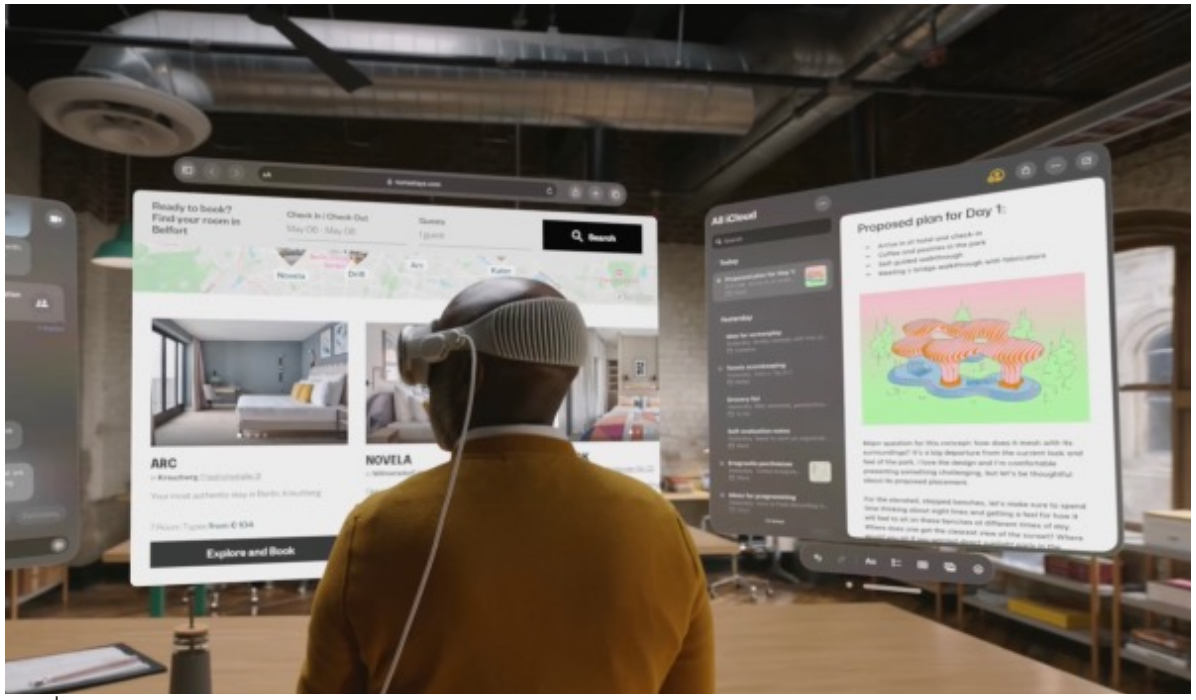
Time



apple.com

WHY WILL AR GLASSES BE THE NEXT STEP?

Extremely *personal* (worn on your face, no one else can see display)

Fully *portable* (can be used anywhere eyeglasses can be worn)

Highly *convenient* (always available and in view)

Unconstrained interface (display(s) can be any size/shape/location)

- Note: Google Glass and other "smart glasses" can't do this – need "real AR"

CURRENT AR TECHNOLOGY

Microsoft HoloLens2
Microsoft

Apple Vision Pro
Apple

Varjo XR-3
Varjo

EVERYDAY AR

Everyday AR envisions a world in which:

- Virtual displays are available all the time, anywhere
- Virtual displays contain information and applications that users may need anytime
- Users interact with virtual displays for all general-purpose computing needs
- Virtual displays are registered in the three-dimensional physical world

A **virtual display** can be:

- A simulated physical display (virtual monitor, virtual smartphone)
- An application, window, or document
- A 3D object or scene

The Everyday AR vision requires **all-day AR glasses.**

windowscentral.com

ALL-DAY AR GLASSES REQUIREMENTS

Lightweight

Eyeglasses (or contact lens) form factor

All-day battery

No cables

Wide FOV

High resolution

Eye tracking

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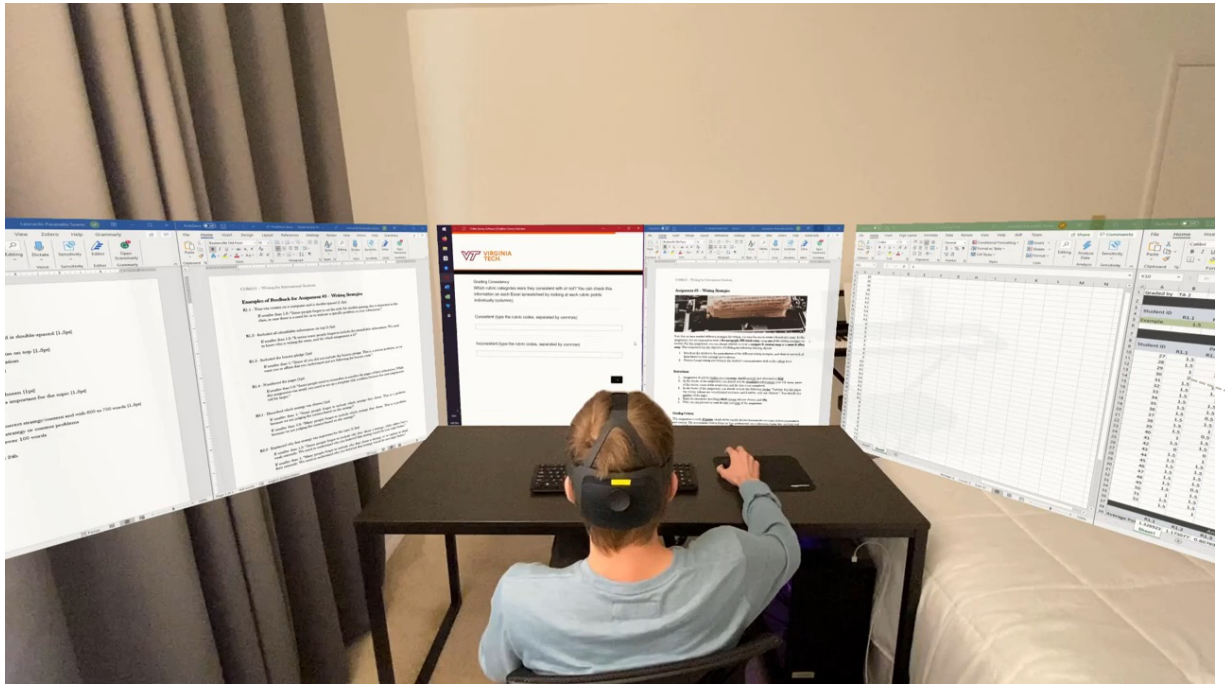
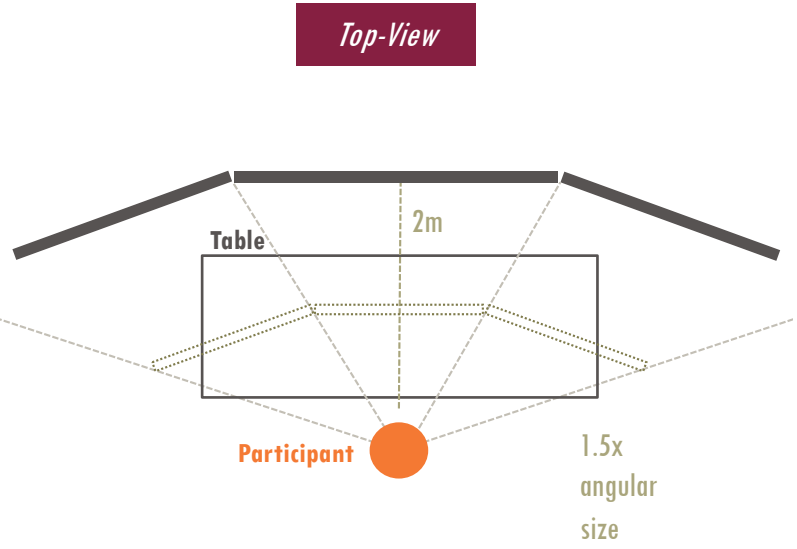
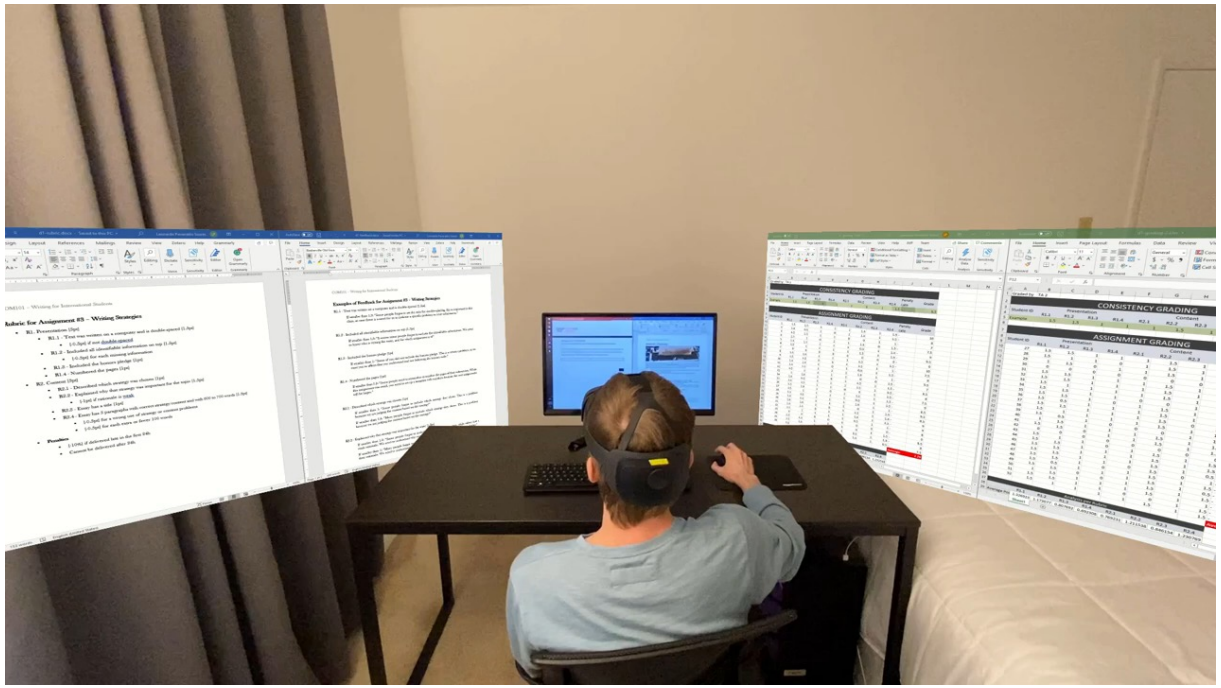
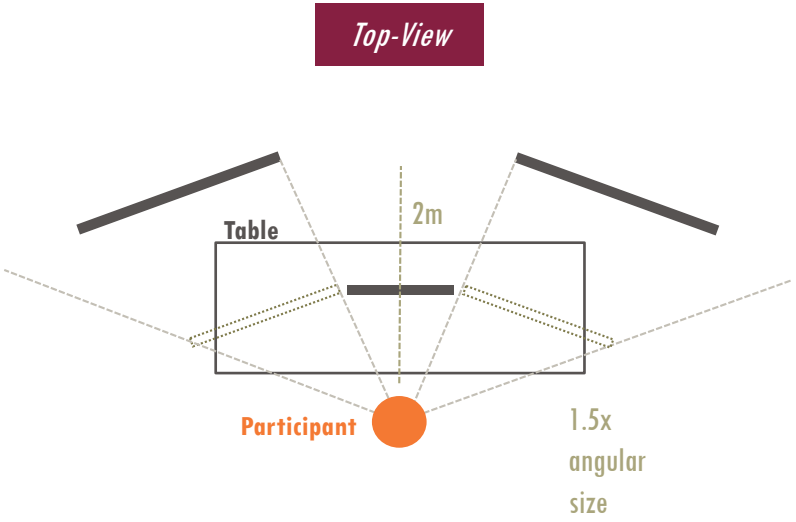
HOLOLENS2 PROTOTYPE – VIRTUAL MULTI-MON



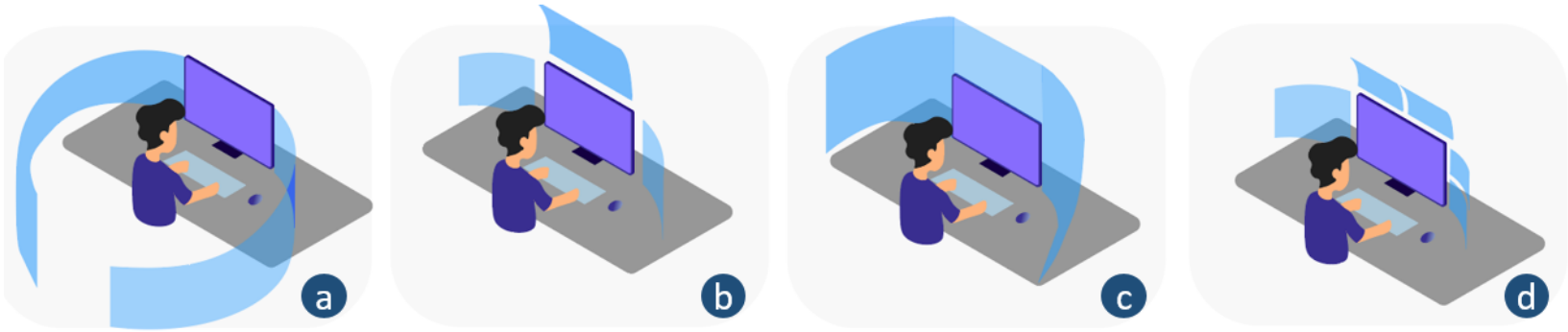


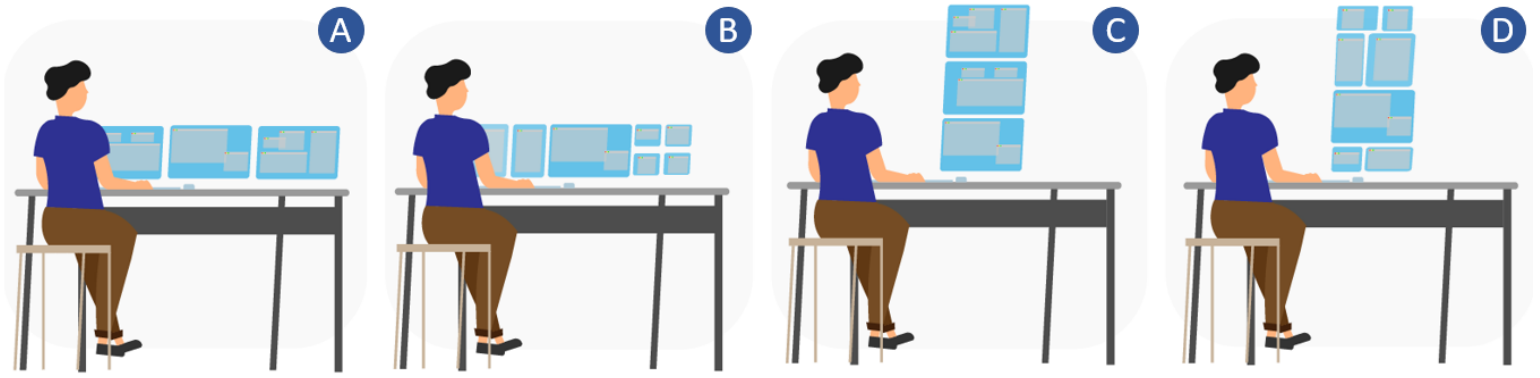
HOLOLENS2 PROTOTYPE – HYBRID MULTI-MON





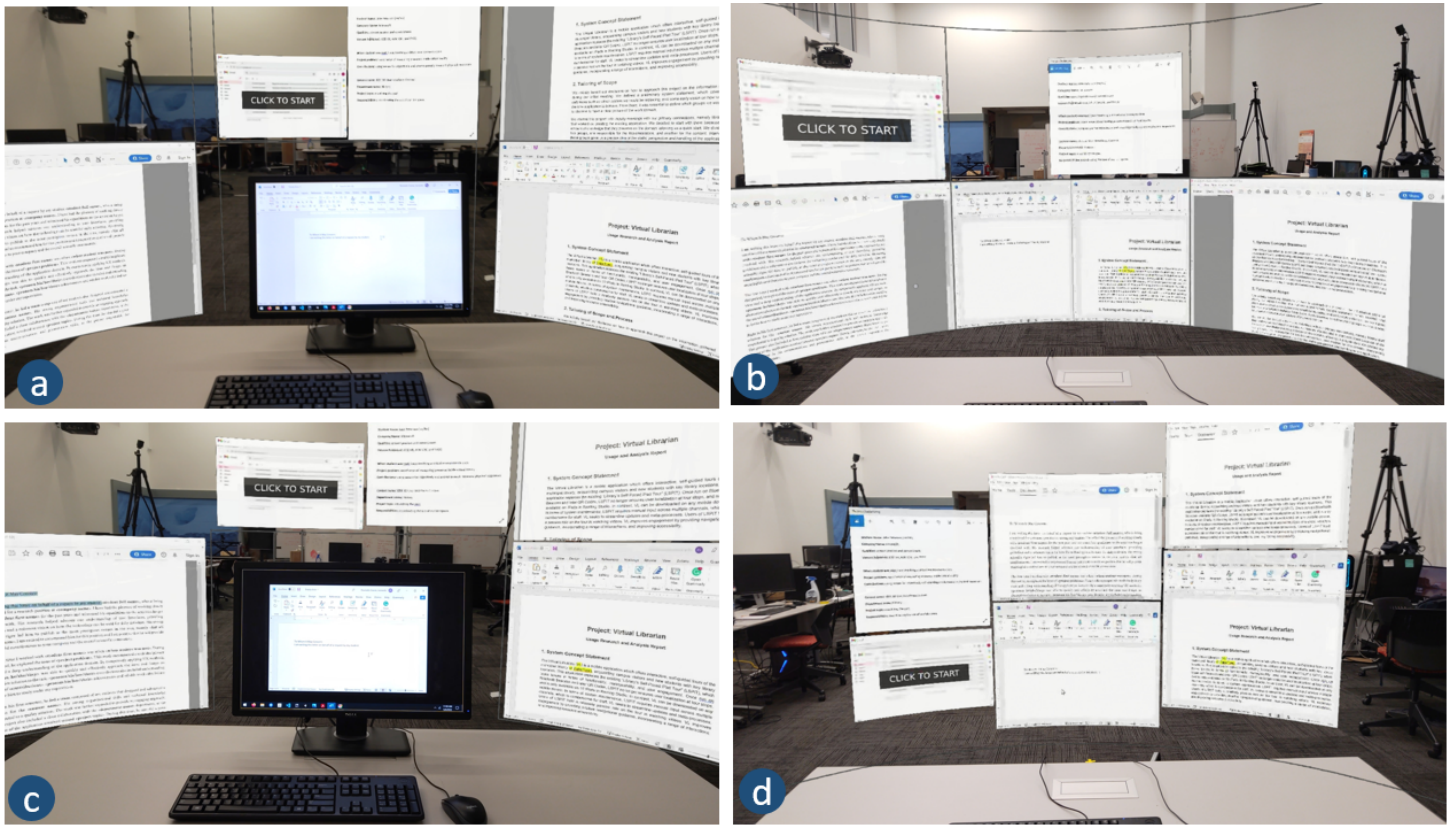
MORE FLEXIBLE SPACE





Illustrations by Feiyu Lu and Lei Zhang

MORE FLEXIBLE SPACE



AR VIRTUAL DISPLAYS ON THE GO

"Glanceable AR"

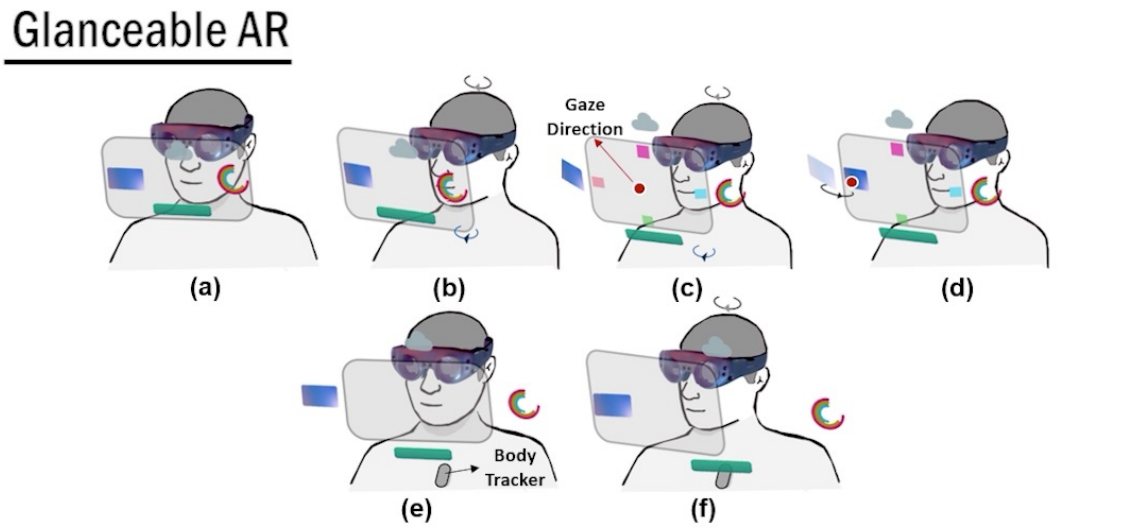
- Information/apps that follow you
- Rapid access to information/apps
- But also unobtrusive, non-distracting, non-occluding

Approach

- Body-fixed content that normally resides outside the field of view

Illustration by Lei Zhang

GLANCEABLE AR

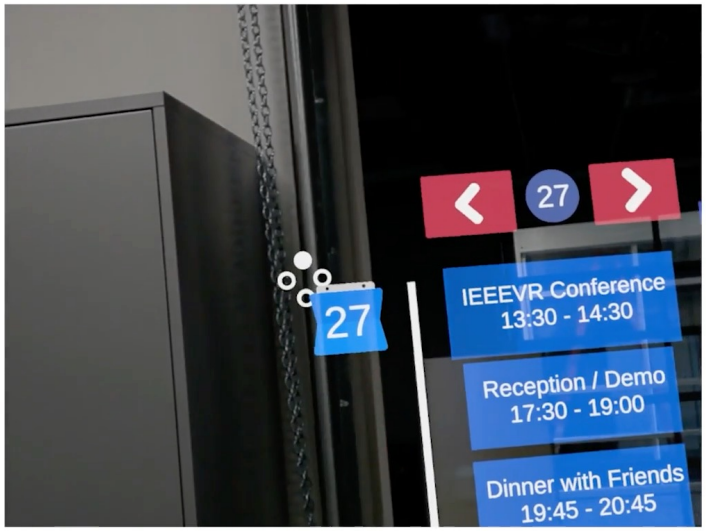


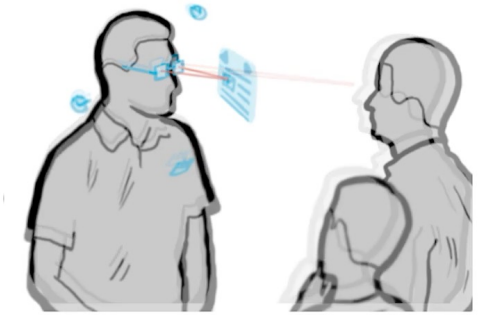
In this research, we propose Glanceable AR, an interaction paradigm for accessing information in AR HWDs.

Lu, F. et al., IEEE VR 2020

GLANCEABLE AR

System Design





and can be accessed by verging one's gaze at the depth of the icon.

Lu, F. et al., ACM SUI 2023

GLANCEABLE AR FINDINGS

Users prefer to see only the real world by default.

People are willing to use Glanceable AR in authentic scenarios and find it less distracting than using a smartphone.

Information access in Glanceable AR is faster than using a smartphone.

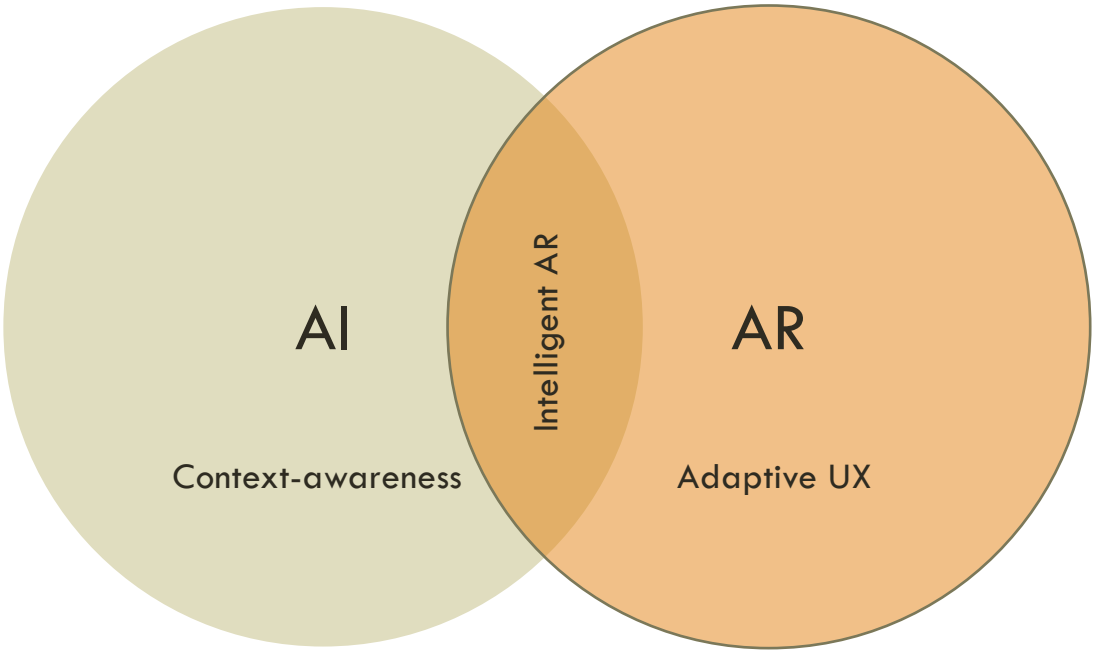
Moving information to the periphery or minimizing it visually is effective for reducing occlusion of the real world.

SO WHY DO WE NEED AI?

AR glasses should not require users to manually change **settings** for the multitude of **contexts** in which they'll be used.

AR glasses should not require users to manually search/browse the multitude of **apps/documents** for one that is relevant to their current **context.**

INTELLIGENT AR



Sense contextual data

- Cameras, depth cameras
- Eye trackers
- Microphones
- Databases

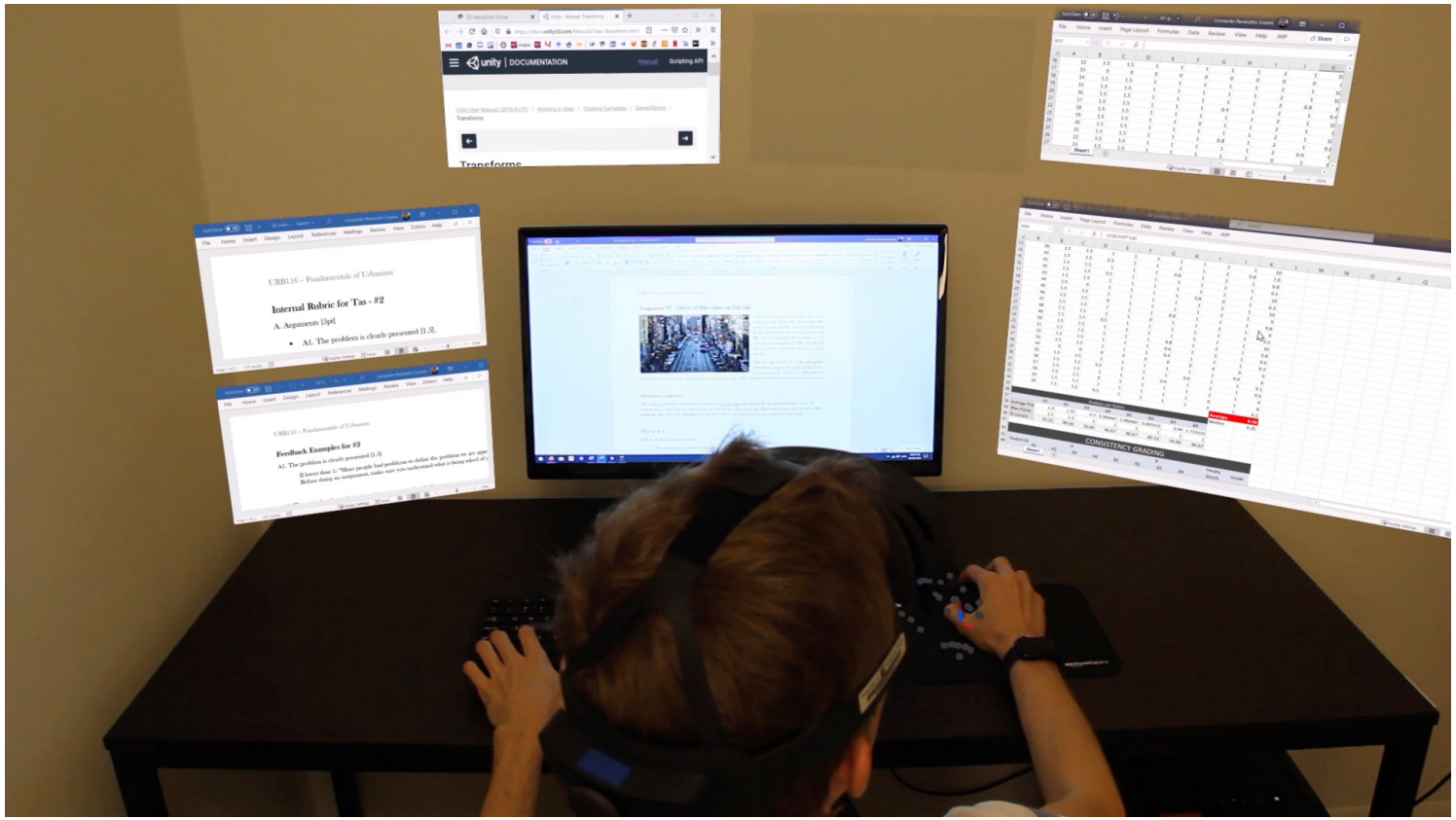
Infer the context (environment, task, and user)

- Computer Vision
- Machine Learning

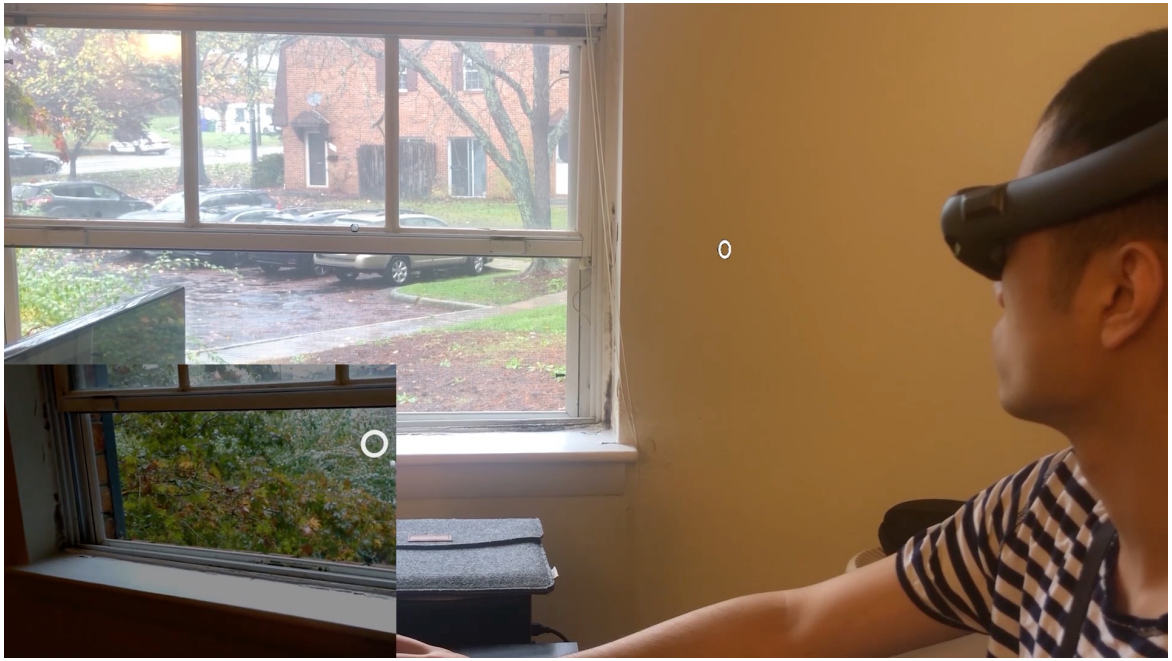
Adapt the interface

Predict the user's information needs

ADAPTIVE USE OF SPACE



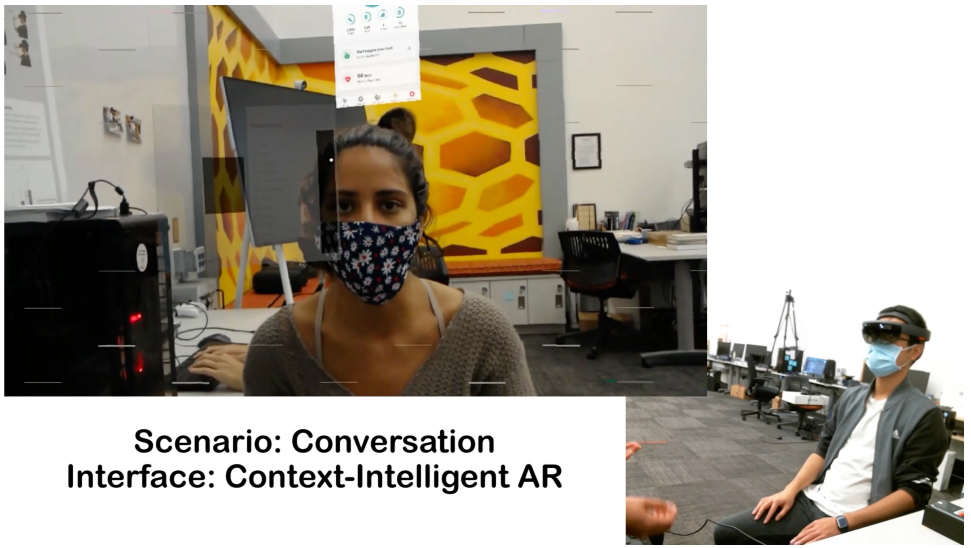
ADAPTIVE INFORMATION DISPLAY



Lu, F. et al., ACM SUI 2021

ADAPTIVE INFORMATION DISPLAY

Illustration by Lei Zhang



Scenario: Conversation
Interface: Context-Intelligent AR

Davari et al., IEEE VR 2022

FUTURE INTELLIGENT AR EXAMPLES

Predicts that you'll use the Netflix app in the living room but the shopping list app in the kitchen.

Displays information using text when you are stationary but using audio when you're moving.

Switches from gesture to voice input when you're doing a real-world task that involves both your hands.

Automatically opens the meeting agenda document when you go to the conference room at the scheduled meeting time, shares it with the other AR glasses in the room, and places it on the wall so that everyone can view it comfortably.

AR+AI TO ENABLE FUTURE PERSONAL COMPUTING

Goal: Use AR to work within real-world contexts without unnecessary clutter or distraction

Approach: Design AR interfaces to allow rapid access and automatically keep content out of the way

Goal: Assist the user by providing the right information, at the right time, in the right way

Approach: Provide context-awareness and intelligent adaptation

Goal: Improve upon current computing experiences

Approach: Take advantage of the ultimate flexibility of AR virtual displays

INTERDISCIPLINARY VISION

This vision requires the work of

- Artists
- Designers
- Technologists
- Engineers
- User Experience experts
- Human Factors experts

ACKNOWLEDGEMENTS

Students/alumni

Leonardo Pavanatto

Feiyu Lu

Shakiba Davari

Cory Ilo

Collaborators

Chris North

Rich Stoakley

Carmen Badea

Tobias Höllerer

Wallace Lages

Joe Gabbard

Nazila Roofigari-Esfahan

Funding

Microsoft Research

Google

Office of Naval Research

Institute for Creativity, Arts, and Technology

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