

# Virtual Reality VR/AR/MR/XR

05-499/899 Fall 2024

Celebrating Accessibility

<https://cmu-05-499.github.io>

Andrew Begel and Patrick Carrington

# Administrivia

- Guest Speaker: Dr. Atieh Taheri around 11:30 am

# What is XR?

Virtual Reality?

Augmented Reality?

Mixed Reality?

# What is VR/AR/MR?



AR



MR



VR



# VR Games





# VR for Training



Conversational Training



Construction Equipment



Flight Simulator

# Social VR

Digitize yourself and interact with friends



Rec Room



Alcove - A family space



Meta Horizon

# Participation Activity

- Pair up with a neighbor and write your names and the date on a piece of paper.
- Think about and discuss any experiences that you've had with a VR/AR/XR system.
  - Why did you use it? What did this experience involve for you? What did you do?
  - What devices did you use? How did you interact with the devices? Did you use your hands/controllers/smartphone/whole body?
  - What did you see? What did you hear?
- On your paper please write:
  - **2 potential accessibility barriers** based on the experience you discussed
  - **2 possible solutions** to overcome those barriers or modify the experience to remove the barriers entirely
- We will discuss. Turn in your papers at the end of class



# Ways to Improve Access in XR

Audio Descriptions for Visual Elements (Text, Environments)

Color Contrast

Image Magnification

Voice Controlled Interfaces

Alternative Physical Controls

Sonification/Audio AR/VR

# From the Readings

# VR and Mobility

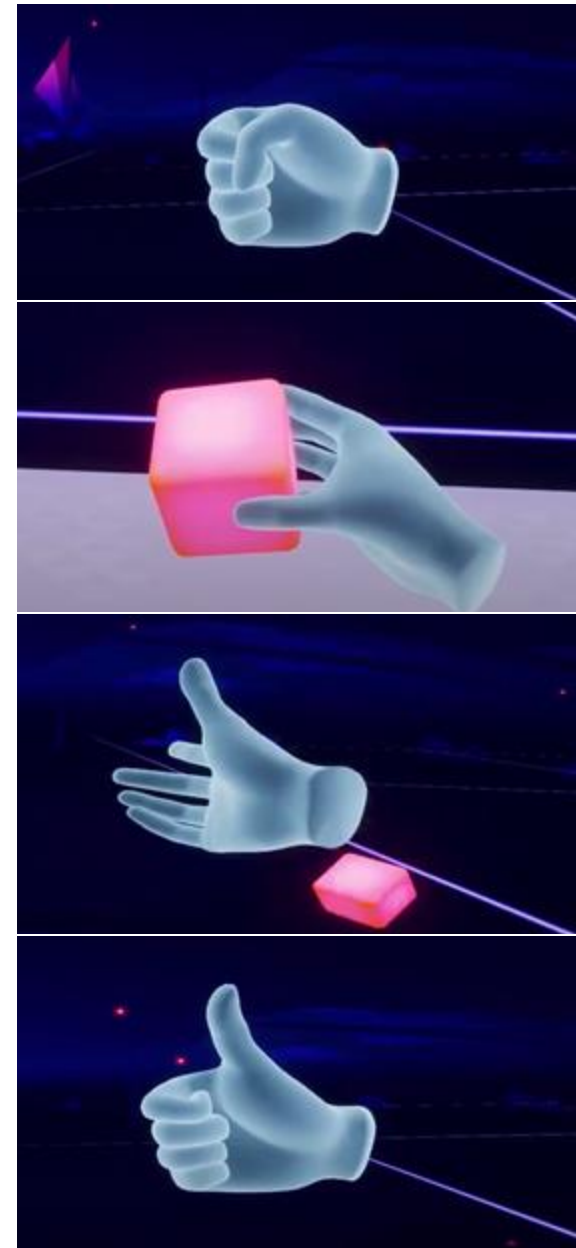
## Physical Device Barriers - Mott et al. 2020

- Putting on, Securing, and Taking off devices
- Interacting with required controller(s)
- Maintaining Postures and relative positions of the body and controls

Interaction Barriers - How to make complex gestures and actions using simple or alternative controls?



Created by Maximilian Becker  
from Noun Project



# AT in VR for Low-Vision

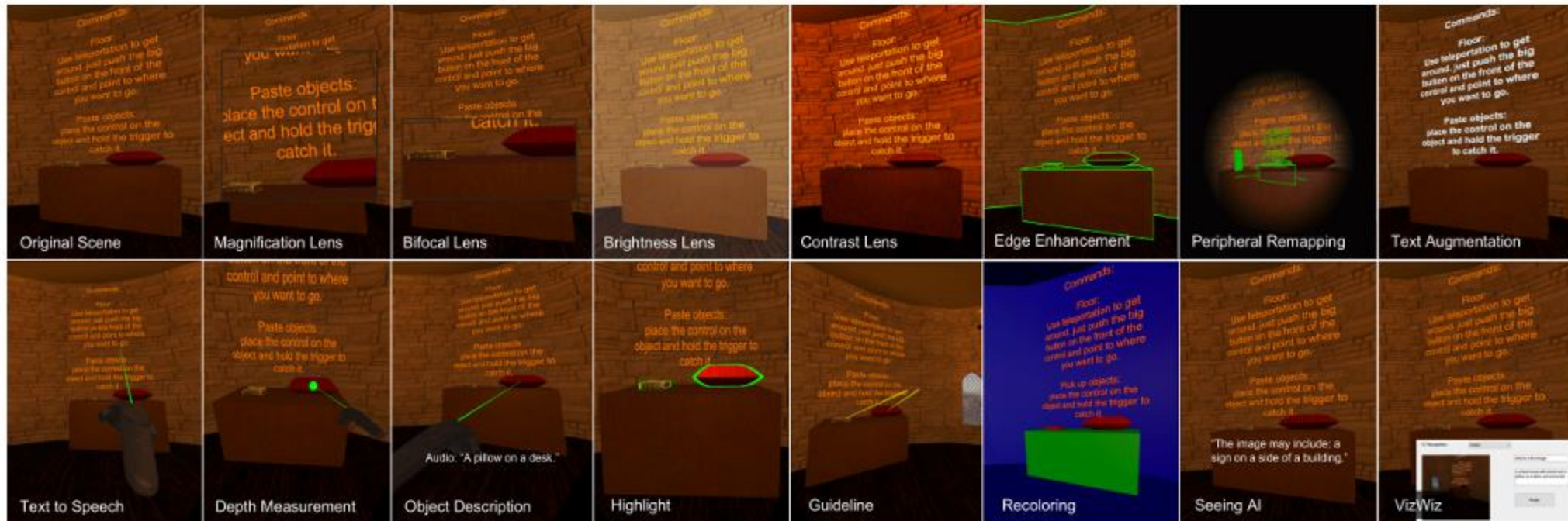


Figure 2: SeeingVR's 14 low vision tools. Tunnel vision in 'Peripheral Remapping' is simulated. The quote in 'Object Description' shows the read-aloud audio description. The quote in 'Seeing AI' shows the read-aloud audio description from the recognition API. The inset in 'VizWiz' shows a screenshot of the question received and the response provided by the human worker.

SeeingVR CHI 2019

# Low-Vision AR



Yuhang Zhao et al. 2019. Designing AR Visualizations to Facilitate Stair Navigation for People with Low Vision. In Proceedings of the 32nd Annual ACM Symposium on User Interface Software and Technology (UIST '19).  
<https://doi.org/10.1145/3332165.3347906>



# Guest Speaker: Dr. Atieh Taheri

Presidential Postdoctoral Fellow in the Human-Computer Interaction Institute (HCII) at Carnegie Mellon University.

Her research intersects Human-Computer Interaction (HCI) and Accessibility, aiming to create meaningful technological solutions that improve the lives of individuals with disabilities. With a focus on participatory design, I'm dedicated to developing solutions that not only fulfill functional needs but also enhance the quality of life and user experience for those with disabilities, an area that has historically received less attention in Assistive Technology design research.

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