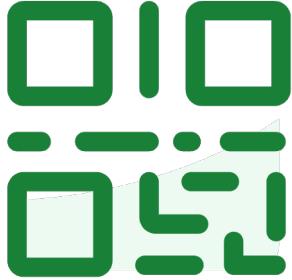


Interaction

Notes for the SIT-DP module: **Developing Immersive Applications**

Created by: Chek Tien TAN





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#week08-interactions**

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Learning Objectives

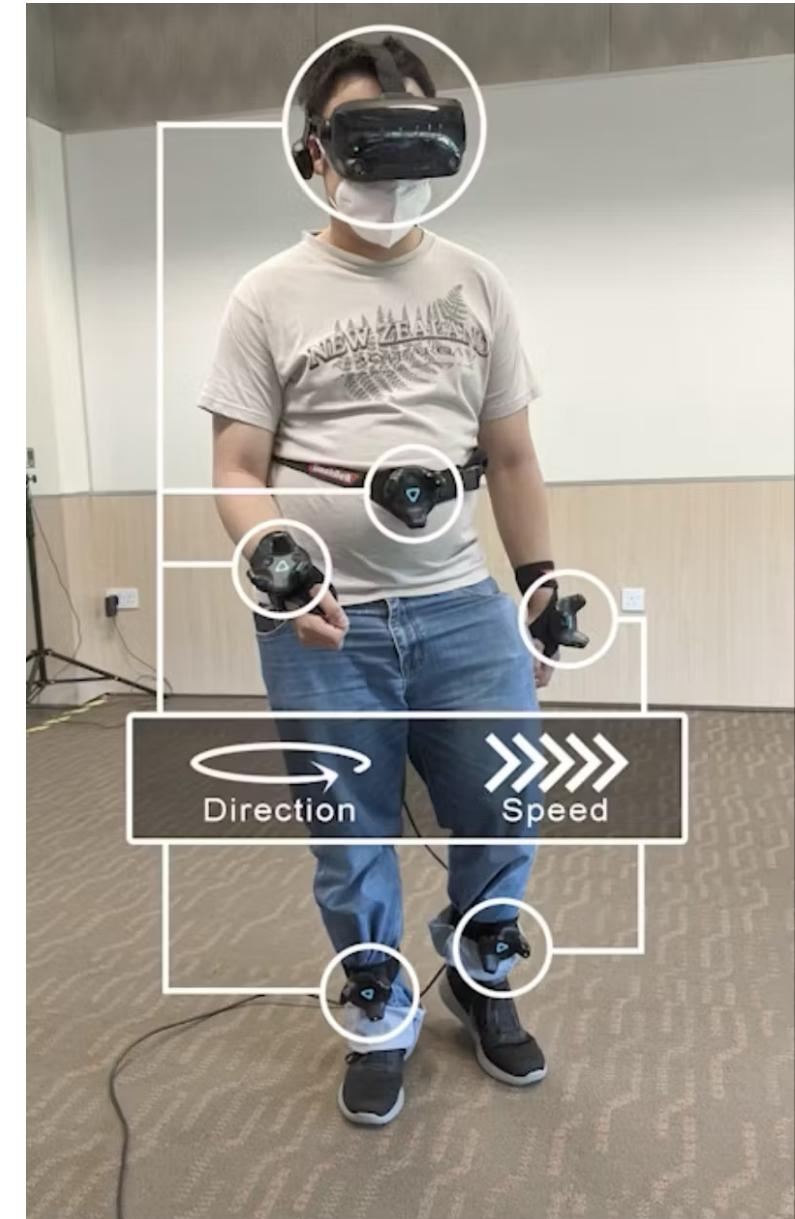
- differentiate common interaction mechanics in immersive applications
- explain how different hardware components implement different interaction mechanics
- differentiate natural and artificial interactions in immersive applications
- apply interaction mechanics and authenticity considerations in designing different interaction use cases

Interaction

- interaction mechanics
- interaction authenticity

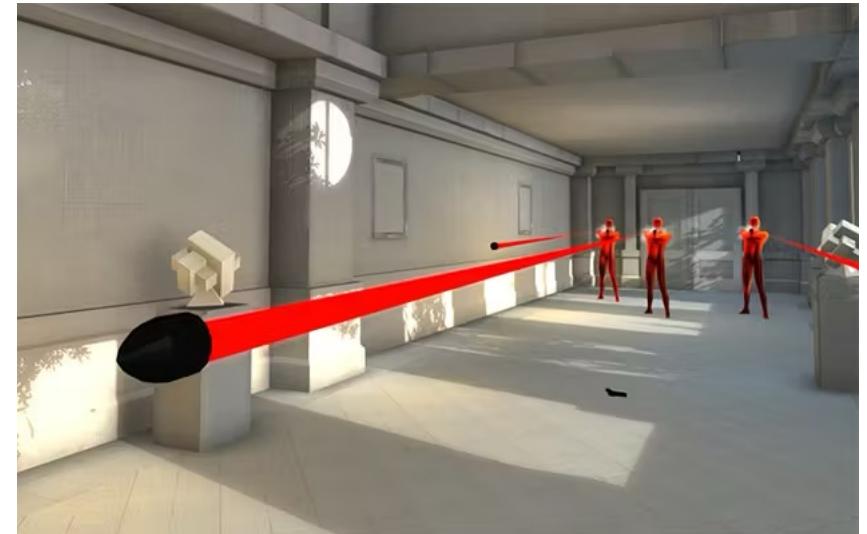
Interaction Mechanics

- viewpoint control
- hand gestures
- body gestures



Interaction Authenticity

- natural interactions
- artificial magical interactions
- artificial augmented natural interactions



<https://www.engadget.com/2014-05-14-superhot-kickstarter.html>



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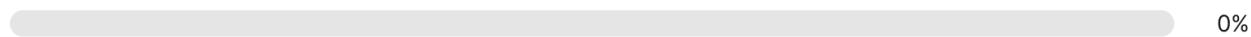


**Which interaction mechanic(s) is commonly
deemed to be the most important in immersive AR,
VR and MR experiences?**

- ① Start presenting to display the poll results on this slide.

Which interaction mechanic(s) is commonly deemed to be the most important in immersive AR, VR and MR experiences?

viewpoint control



0%

hand gestures



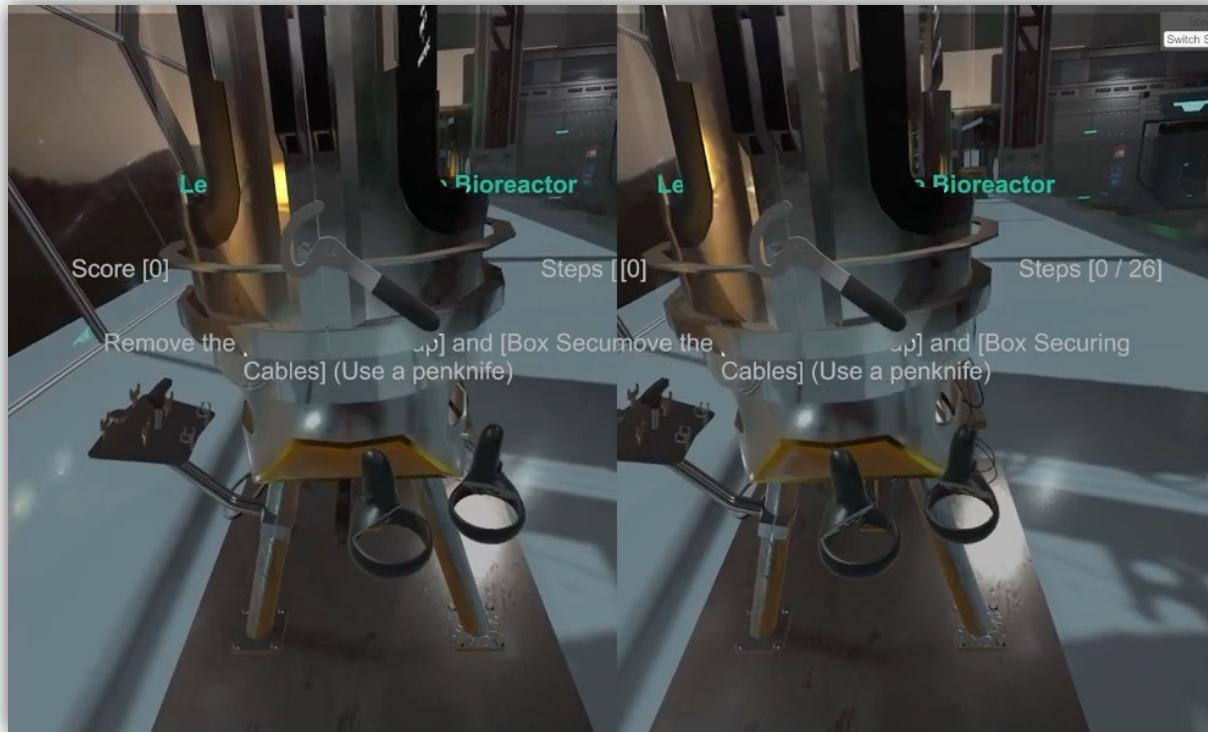
0%

body (excluding hands) gestures



0%

VR Bioreactor Training System



<https://youtu.be/zMEs2bhJOMI>

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**In the VR Bioreactor Training system,
what interaction mechanic(s) were
implemented?**

- ① Start presenting to display the poll results on this slide.

In the VR Bioreactor Training system, what interaction mechanic(s) were implemented?

Show Image

Show poll options

viewpoint control

0%

hand gestures

0%

body (excluding hands) gestures

0%



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In the VR Bioreactor Training system, is viewpoint control a passive or active interaction mechanic?

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In the VR Bioreactor Training system, is viewpoint control a passive or active interaction mechanic?

Passive



Active



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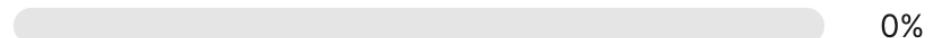


In the VR Bioreactor Training system, are hand gestures a passive or active interaction mechanic?

- ① Start presenting to display the poll results on this slide.

In the VR Bioreactor Training system, are hand gestures a passive or active interaction mechanic?

Passive



Active



360 Video Lecture



<https://youtu.be/2kKcFqSI-Ig>

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In the 360 Video Lecture, what interaction mechanics were implemented?

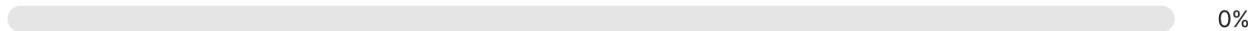
- ① Start presenting to display the poll results on this slide.

In the 360 Video Lecture, what interaction mechanics were implemented?

Show Image

Show poll options

viewpoint control



hand gestures



body (excluding hands) gestures



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In the 360 Video Lecture, is viewpoint control a passive or active interaction mechanic?

ⓘ Start presenting to display the poll results on this slide.

In the 360 Video Lecture, is viewpoint control a passive or active interaction mechanic?

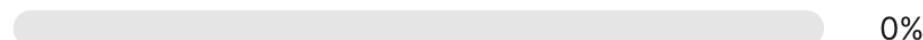
Passive



Active



Both Passive and Active



In the 360 Video Lecture, is viewpoint control a passive or active interaction mechanic?

Gemini Advanced ▾
2.0 Flash

in a google cardboard experience that uses viewpoint control to shoot a laser pointer to select things on the UI, do you think viewpoint control is passive or active...

◆ In a Google Cardboard experience using viewpoint control to shoot a laser pointer for UI selection, it's best described as a **hybrid of passive and active interaction**, leaning more towards **active**. Here's why:

Passive Elements:

- **Viewpoint as Input:**
 - The user's head movements, which are often subtle and somewhat involuntary, are used as the primary input. This can be seen as a passive element, as simply looking around is a natural, often unconscious action.
 - The user is passively providing the direction of the laser pointer.
- **Observation:**
 - The user is primarily observing the UI and the laser pointer's movement, which is a passive form of engagement.

Active Elements:

- **Intentional Selection:**
 - While the viewpoint provides direction, the user must intentionally hold their gaze on a target to trigger a selection. This requires conscious effort and decision-making.
 - The user is actively aiming the laser pointer.
- **Action-Reaction:**
 - The user's actions (gaze control) directly result in a reaction within the VR environment (selection). This action-reaction loop is a hallmark of active interaction.
- **Control:**
 - Even though it is head movement, the user is still in control of where the laser pointer is aiming, and when to select something. This control, is an active mechanic.

Why it leans more towards active:

- The crucial element is the *intentionality* of the selection. It's not just about looking; it's about looking *with purpose*. This intentional action elevates the interaction beyond mere passive observation.

Therefore, while the initial input (head movement) might have passive aspects, the overall interaction, especially the selection process, is definitely active.

+ Ask Gemini



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In the 360 Video Lecture, what form of interaction authenticity is the eye-gaze point-and-click mechanic?

- ① Start presenting to display the poll results on this slide.

In the 360 Video Lecture, what form of interaction authenticity is the eye-gaze point-and-click mechanic?

Show Image

Show poll options

Natural interaction

0%

Artificial magical interaction

0%

Artificial augmented natural interaction

0%

Virtual Embodiment: Effects of the Virtual Hand Representation (Argelaguet et. al.)



<https://youtu.be/oE1XanOoRvw>

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Many users tend to route their hands behind the virtual saw blade when asked to place their hands in the target position. Why is the primary reason?

- ① Start presenting to display the poll results on this slide.

Many users tend to route their hands behind the virtual saw blade when asked to place their hands in the target position. Why is the primary reason?

- Limited field of view in the VR headset affecting depth perception

0%

- The saw blade simply looks hyper-realistic

0%

- High embodiment via realistic hand representation and precise tracking

0%

- Difficulty in accurately perceiving the virtual saw blade's position

0%

Embodiment

- perception that a virtual body is one's own, often correlated to Presence
- improve tracking fidelity
- implement multimodal sensory feedback: visual, auditory, haptic, etc.
- implement personalization: e.g., Meta's mirror



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“The objects in the (virtual) room feels like they are really here. I even bumped into the wall in my real room because I lost track of my actual surroundings.”

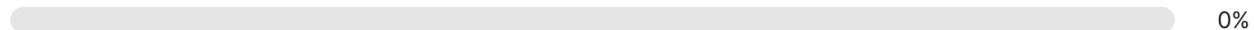
This response is referring to...

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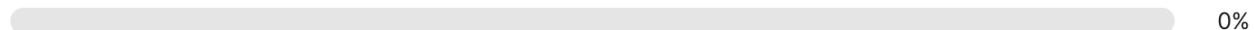
"The objects in the (virtual) room feels like they are really here. I even bumped into the wall in my real room because I lost track of my actual surroundings."

This response is referring to...

Place Illusion



Plausibility Illusion



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“I immediately duck as it really felt like I was in danger when the enemies attacked me, even though I knew it was just a game. I mean the graphics aren't even realistic.”

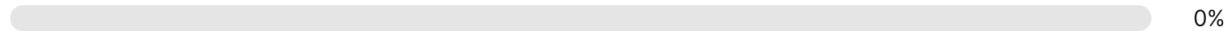
This response is referring to...

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"I immediately duck as it really felt like I was in danger when the enemies attacked me, even though I knew it was just a game. I mean the graphics aren't even realistic."

This response is referring to...

Place illusion



Plausibility illusion



A newer concept of **Presence**

- Place illusion
 - “I am in another place...”
- Plausibility illusion
 - “this (event) is really happening...”

 **frontiers** | Frontiers in *Virtual Reality*

REVIEW
published: 27 June 2022
doi: 10.3389/fvir.2022.914392



A Separate Reality: An Update on Place Illusion and Plausibility in Virtual Reality

Mel Slater^{1,2}, Domna Banakou^{1,2}, Alejandro Beacco¹, Jaime Gallego¹, Francisco Macia-Varela¹ and Ramon Oliva¹*

¹Event Lab, Faculty of Psychology, Universitat de Barcelona, Barcelona, Spain, ²Institute of Neurosciences of the University of Barcelona, Barcelona, Spain

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We review the concept of presence in virtual reality, normally thought of as the sense of “being there” in the virtual world. We argued in a 2009 paper that presence consists of two orthogonal illusions that we refer to as Place Illusion (Pi, the illusion of being in the place depicted by the VR) and Plausibility (Psi, the illusion that the virtual situations and events are really happening). Both are with the proviso that the participant in the virtual reality knows for sure that these are illusions. Presence (Pi and Psi) together with the illusion of ownership over the virtual body that self-represents the participant, are the three key illusions of virtual reality. Copresence, togetherness with others in the virtual world, can be a consequence in the context of interaction between remotely located participants in the same shared virtual environments, or between participants and virtual humans. We then review several different methods of measuring presence: questionnaires, physiological and behavioural measures, breaks in presence, and a psychophysics method based on transitions between different system configurations. Presence is not the only way to assess the responses of people to virtual reality experiences, and we present methods that rely solely on participant preferences, including the use of sentiment analysis that allows participants to express their experience in their own words rather than be required to adopt

<https://doi.org/10.3389/fvir.2022.914392>

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You are tasked to build a VR application to allow kids to learn physics in a classroom. Kids will be able to throw virtual balls to hit cans placed at different distances and heights. What form of interaction authenticity is optimal?

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Show Image

Show poll options

- Natural interaction

0%

- Artificial magical interaction

0%

- Artificial augmented natural interaction

0%

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You are tasked to build an MR application for people to practice taking care of a virtual pet dog in their house, to aid them with the decision of actually getting a real pet dog in the future. What form of interaction authenticity is optimal for this use case?

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Natural interaction



Artificial magical interaction



Artificial augmented natural interaction



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You are tasked to build a VR training system to train aircraft maintenance engineers to repair various aircraft components. If we are aiming for maximum immersion with natural interactions around a huge life-sized aircraft, what device platform is optimal for this use case?

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[Show Image](#)[Show poll options](#)

- Desktop 0%
- Google Cardboard 0%
- Meta Quest 3 (wireless) 0%
- HTC Vive Pro 2 (wired) 0%
- Microsoft Hololens 0%



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You are tasked to build a VR cycling game that can be played on a real bike on a stationary trainer, that places you on equal standing against elite cycling professionals in a virtual Tour de France. If we are aiming for maximum immersion with augmented natural interactions, what device is optimal for this use case (assuming sweat is not a consideration)?

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[Show Image](#)[Show poll options](#)

Desktop

0%

Google Cardboard

0%

Meta Quest 3 (wireless)

0%

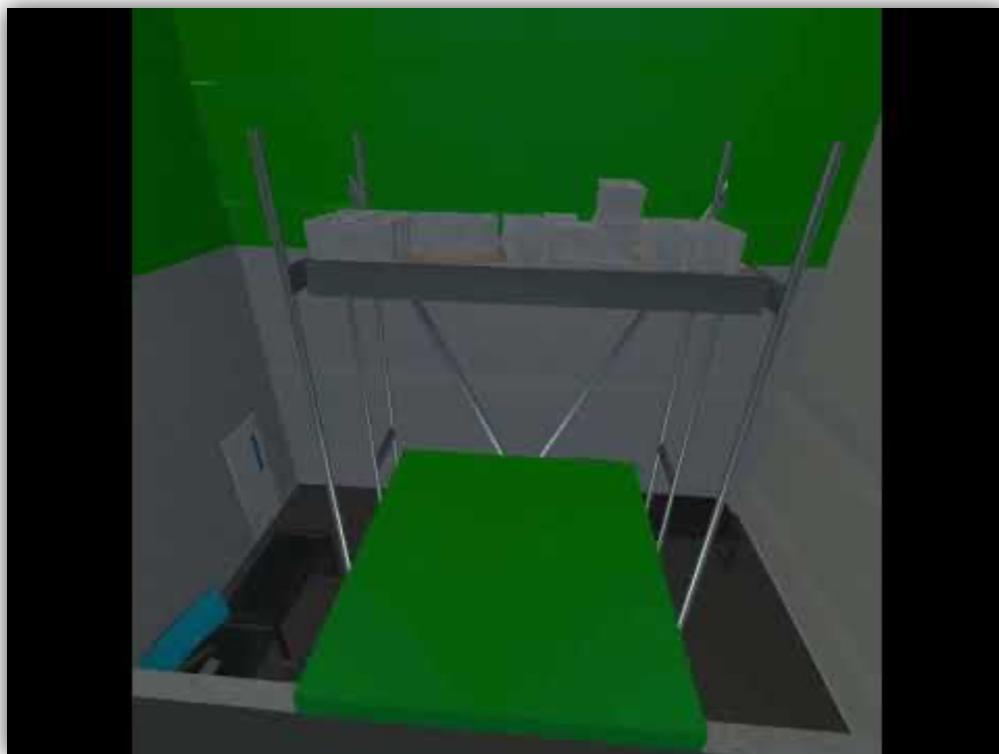
HTC Vive Pro 2 (wired)

0%

Microsoft Hololens

0%

Example of a VR Questionnaire GUI



<https://youtu.be/8gDKu2iyD2g>



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You are tasked to build a VR virtual sightseeing experience for hotel guests and the client wants to obtain feedback after each virtual trips. The client can only provide the users with Google Cardboards. What form of GUI implementation is best suited for this use case?

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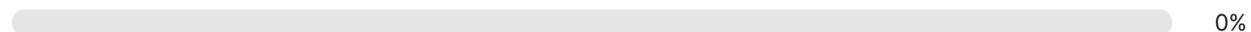
- GUI on a virtual paper (using a virtual pen)



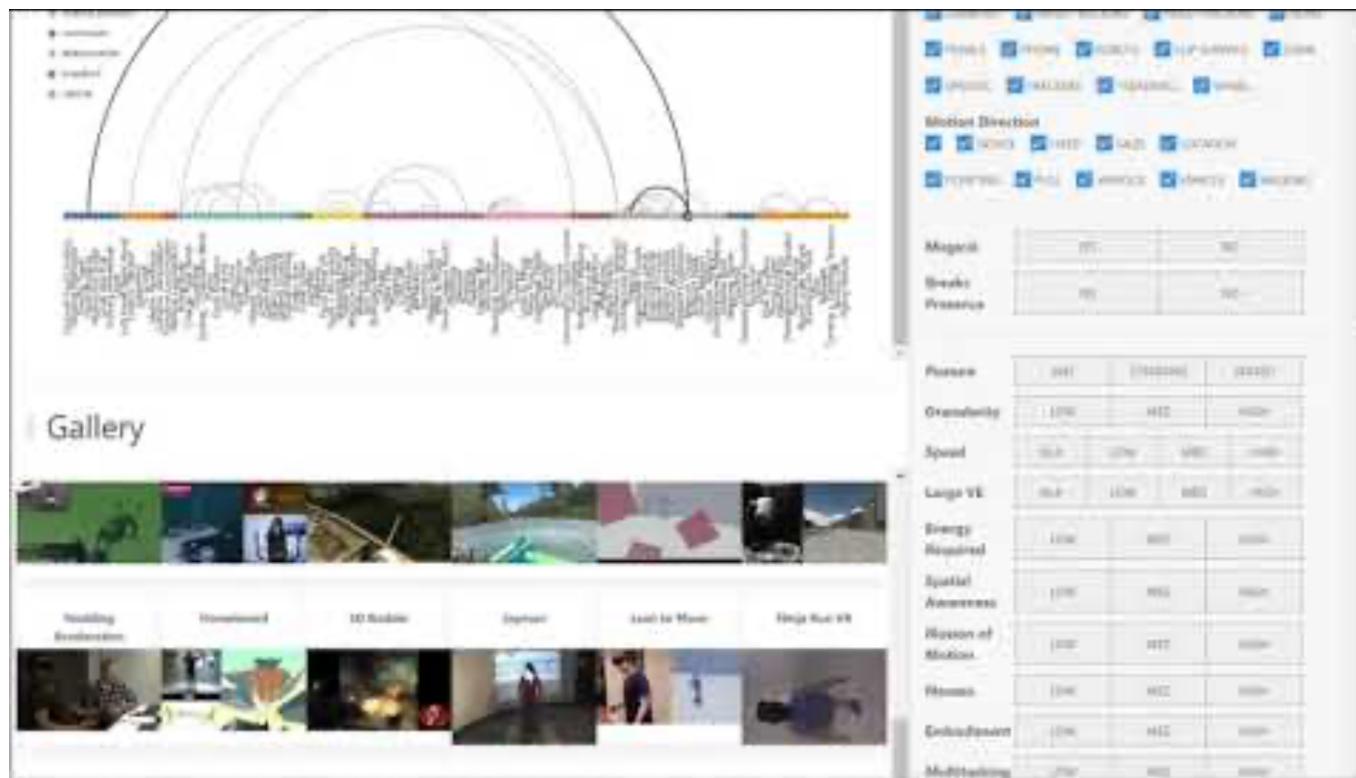
- GUI on a 3D plane anchored in virtual world locations



- Real-world quiz on real paper (take off the HMD when interacting)



The Locomotion Vault



<https://youtu.be/2C4ZBtNZFHw>

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You are tasked to build a VR game for persons on wheelchairs to explore famous mountains in the world. What locomotion technique is best suited for this use case?

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You are tasked to build a VR game for persons on wheelchairs to explore famous mountains in the world. What locomotion technique is best suited for this use case?

 Show Image

 Show poll options

teleportation

0%

joystick-based

0%

walking-in-place (WIP) with KatVR 360 slidemill

0%

walking-in-place (WIP) with HTC Vive HMD and trackers

0%

tracking real movement in physical space

0%

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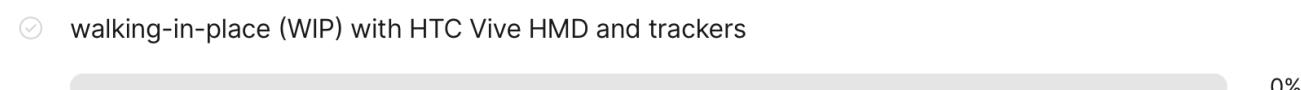
You are tasked to build a VR escape room experience targetted at able-bodied users. Naturally, an escape room experience aims to provide maximum immersion from all aspects. What locomotion technique is best suited for this use case?

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As a lead developer for a new VR action-adventure game, players will engage in a series of quests across varying terrain, from dense forests to steep mountains. Movement in the game needs to be intuitive and contribute to near-realistic interactions with the environment for tasks like trekking and light stealth. To encourage sustained play without causing disorientation, what locomotion technique should you integrate into your game design?

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Audience Q&A

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