

Social VR Accessibility & Inclusion

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Social VR refers to VR platforms where people communicate and socialize in the form of **avatars**.



Social VR is challenging to people with visual impairments



- Enhancing disability representation in social VR
- Making Social VR techniques accessible to people with disabilities
- Incorporating accessibility techniques into mainstream VR applications

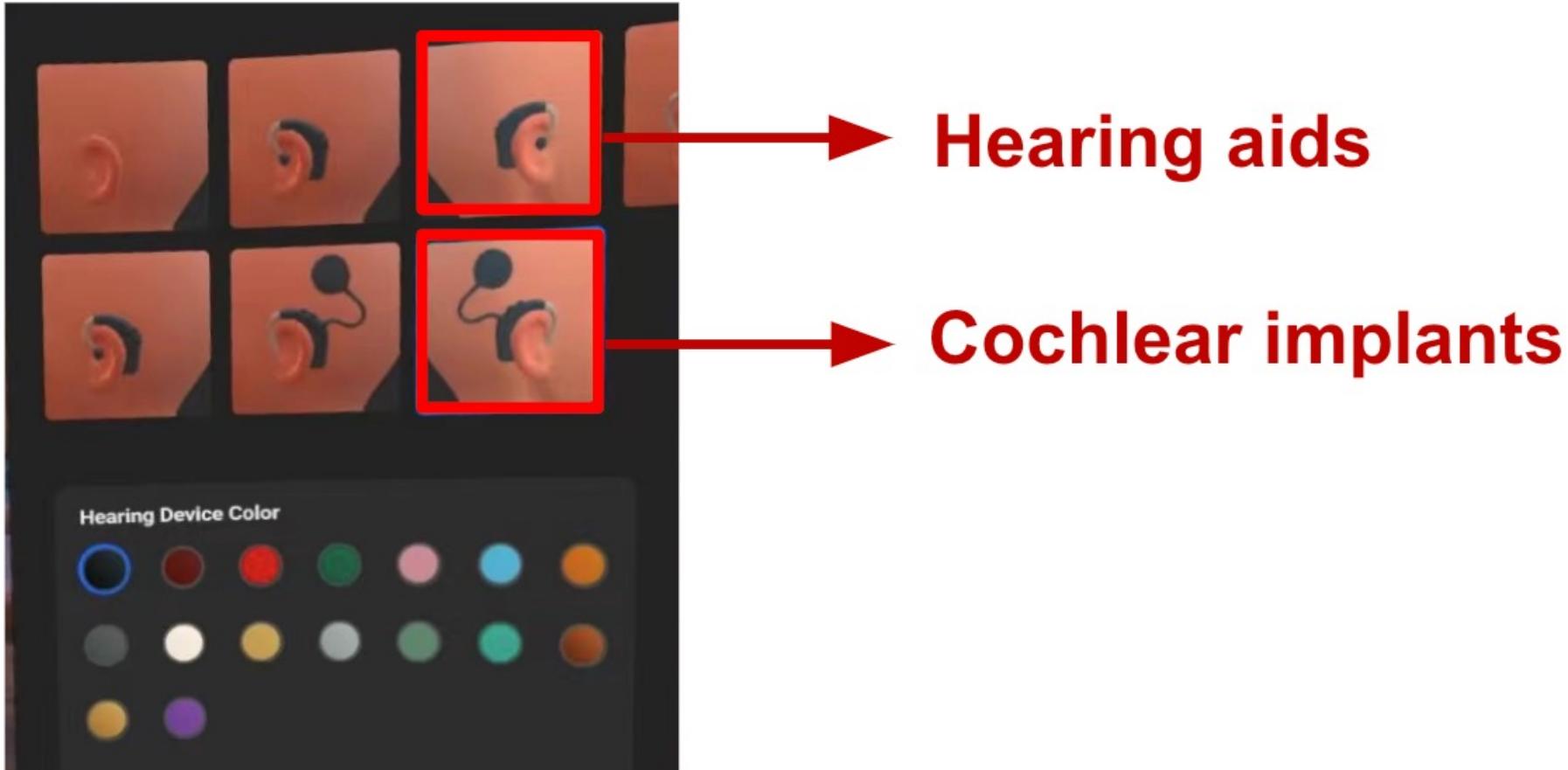
“It’s Just Part of Me:” Understanding Avatar Diversity and Self-presentation of People with Disabilities in Social Virtual Reality



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Disability signifiers in social VR



Research Questions

RQ1: Whether and how is avatar diversity supported on the mainstream commercial social VR platforms?

RQ2: Whether and how do people with disabilities disclose their disabilities when presenting themselves via avatars?

RQ3: What challenges do PWD face during the avatar design and creation process?

Research Questions

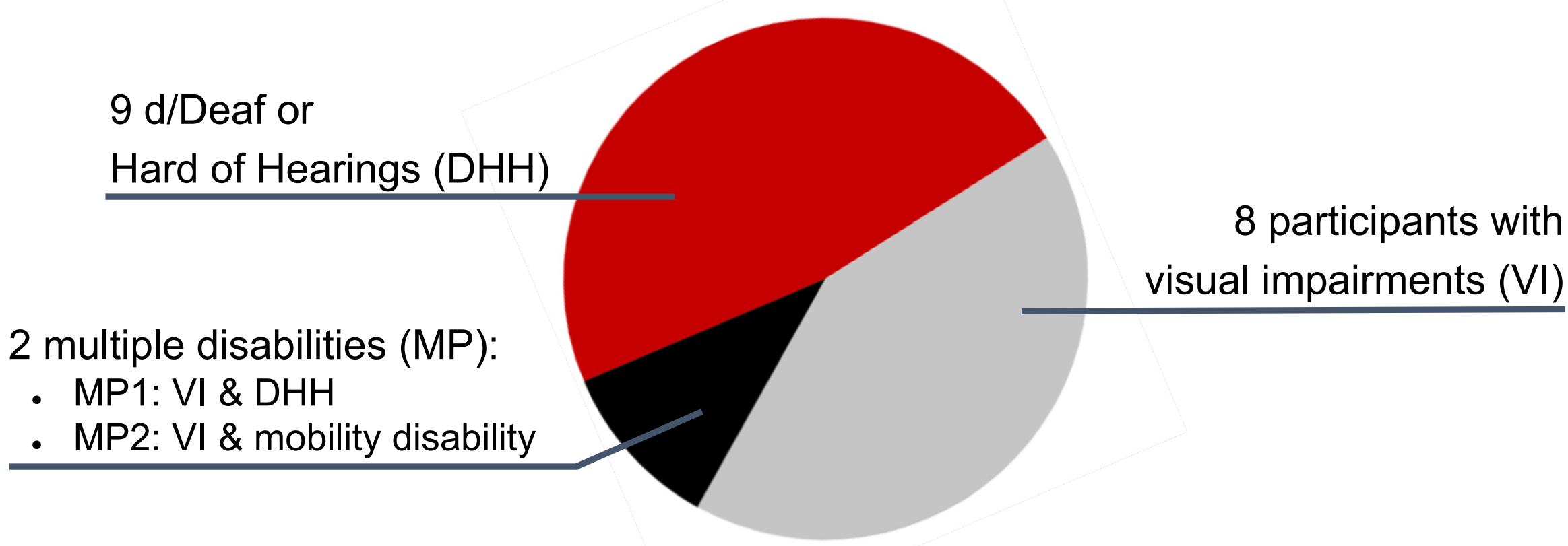
RQ1: Whether and how is avatar diversity supported on the mainstream commercial social VR platforms?

RQ2: Whether and how do people with disabilities (PWD) disclose their disabilities when presenting themselves via avatars?

RQ3: What challenges do PWD face during the avatar design and creation process?

Method: Semi-structured Interview

- 19 Participants with disabilities
 - 11 female, 7 male, 1 transgender; age 20-58
 - Disability types

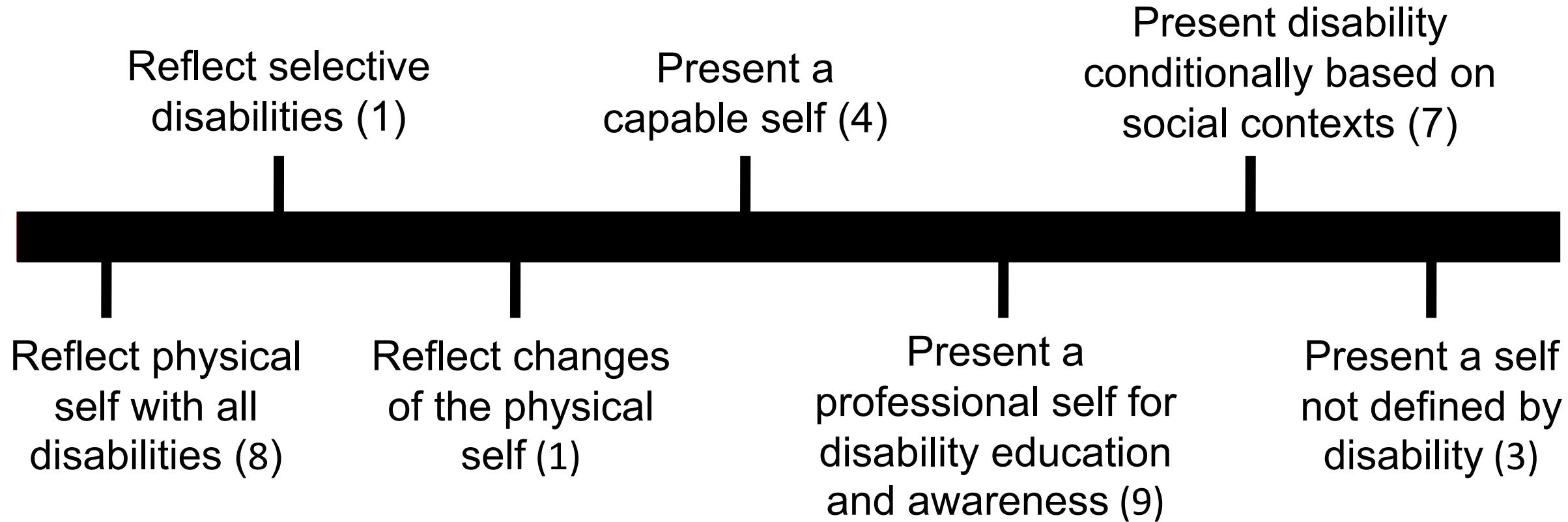


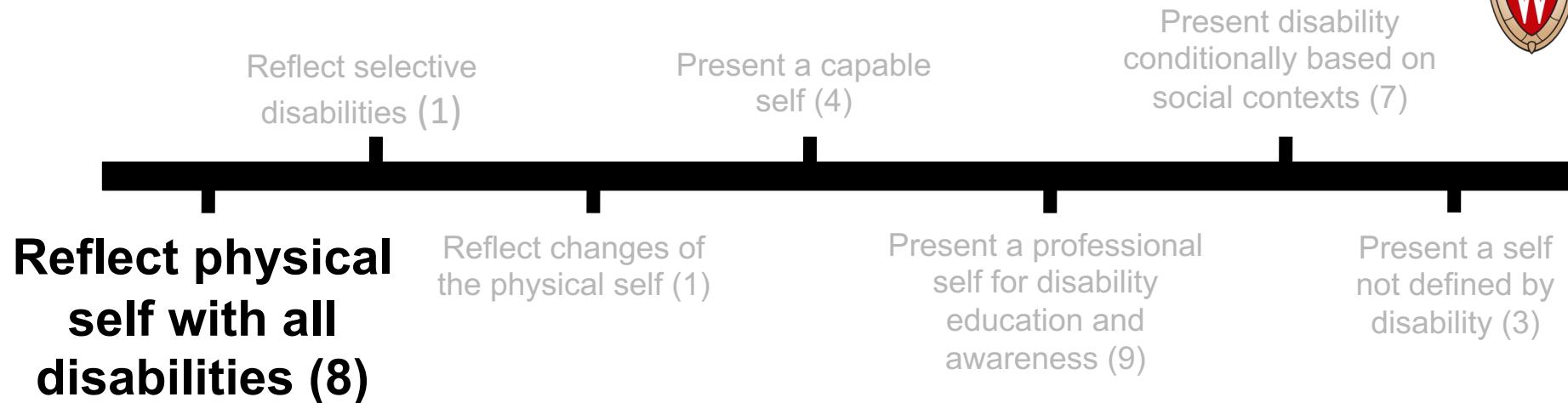


Findings:

How PWD **disclose** their disabilities via avatar? (RQ2)

PWD use **disability disclosure as strategies** for self-presentation



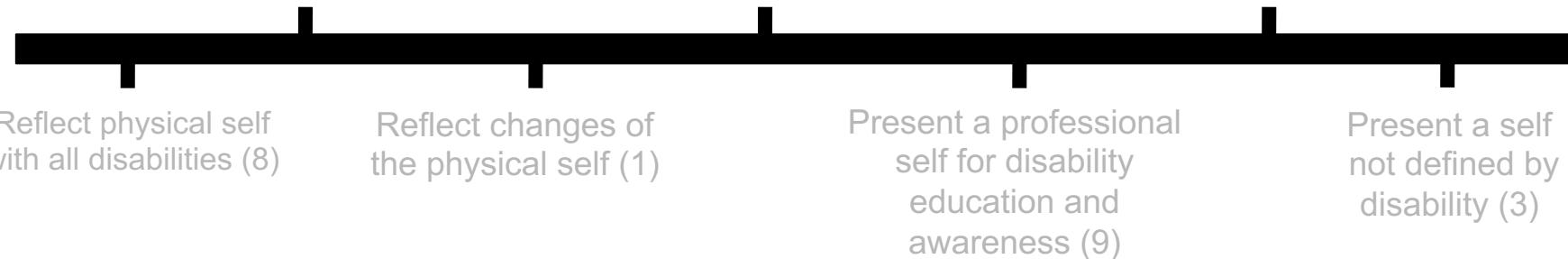


“I have a [cochlear implant] on [my avatar] all the time, just because that’s what I do in real life. I like my avatar to represent me as realistic as possible to myself.

— HP7 (30/M, DHH)



Reflect selective disabilities (1)



Presenting dominant disability:



“I have had the hearing disability for a lot less time than the [blindness], I’ve been blind all my life. I think that maybe if I had grown up hard of hearing or deaf that would be more important to represent for me.”

— MP1 (58/F, VI & DHH)



Reflect selective disabilities (1)

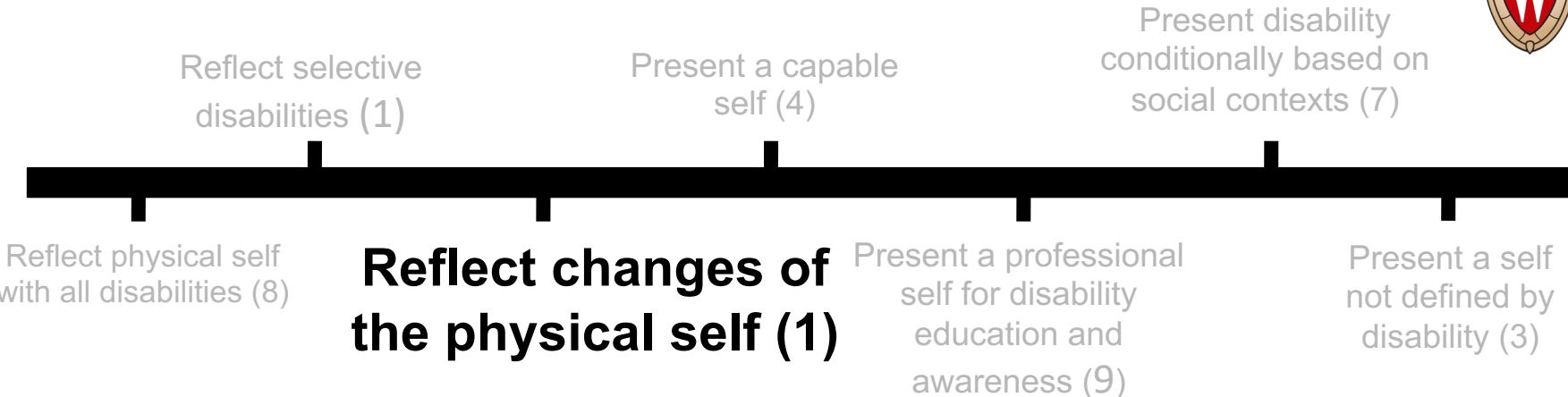


Presenting visible disability:



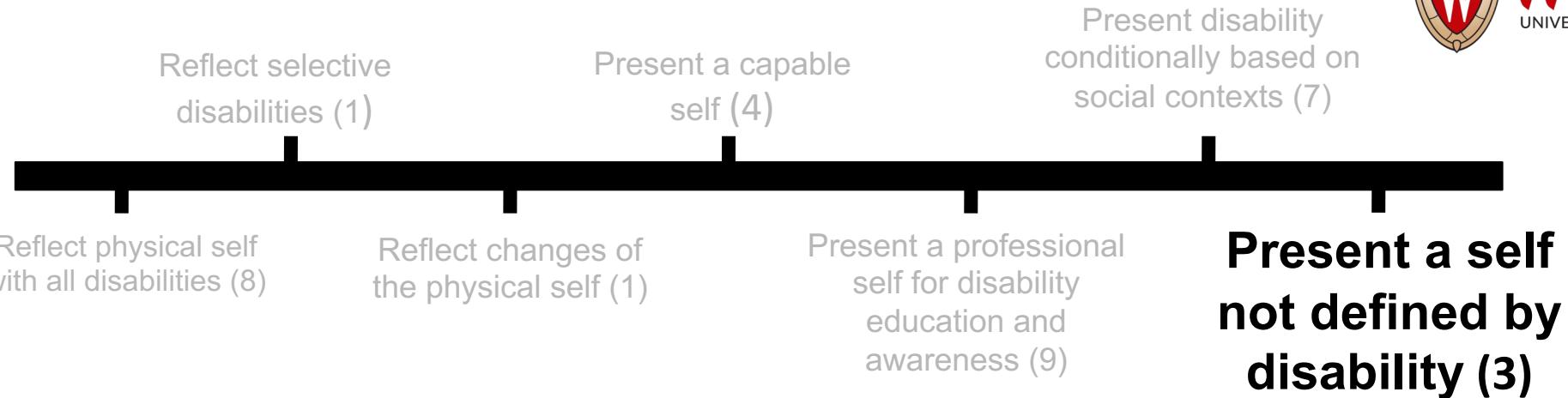
“I do use hearing aids, but I don’t think they are visible ... so I am not going to add hearing aids, because a lot of people probably don’t even know that I use [it]... I don’t think they’re that visible.”

— MP1 (58/F, VI & DHH)



“I'd put hearing aids on avatar [when I get my hearing aids] ... Because people don't know [my acquired disability], especially when [my hearing loss] happens so suddenly to me.”

— HP2 (20/F, DHH)



“*I don't like to disclose [my disability], because I don't want that to be the initial impression people have, that this person is deaf. I just don't want that to be characteristically associated.”*

— HP4 (23/Trans, DHH)

Findings:

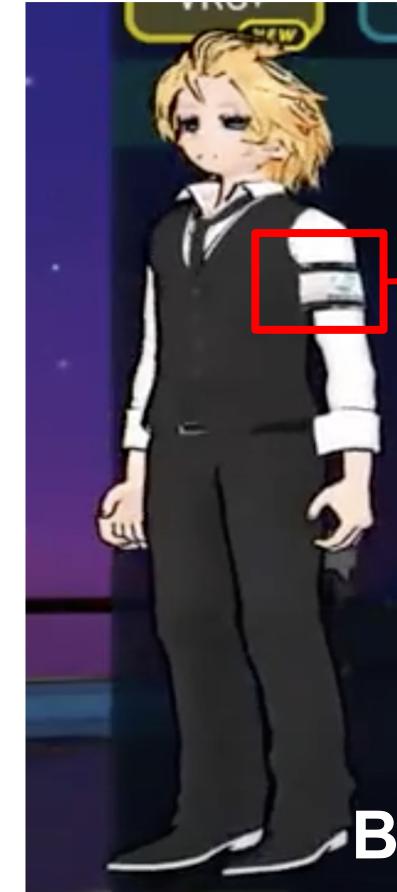
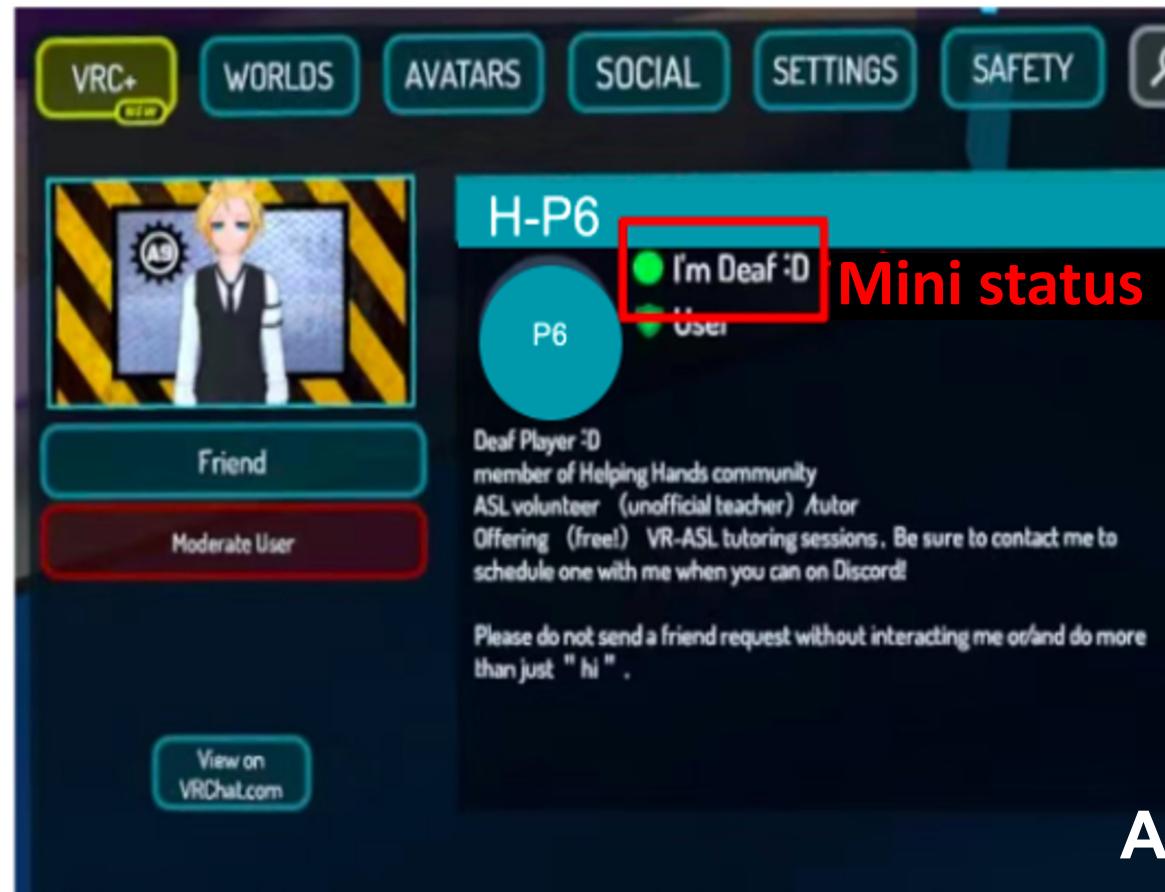
What are the **challenges and strategies** to disclose disability via avatars? (RQ3)

18 out 19 participants complained the
lack of disability representations in avatar design:

“I couldn’t find them as an option.”

Alternative methods to disclose disability

e.g., Mini-status and ID Badge in VRChat



A

B

— HP6 (25/M, DHH)

Specialized sign avatars



Typical Avatars



HP6's Specialized Sign Avatars

**Hands with
black outline**

Discussion:

What would be the best way to **present disability** via avatars?

How to present disability via avatars?

Visible disabilities? Invisible disabilities?



What is the **tradeoff** in presenting disability
on avatars?

Present but also Protect!

VRBubble:

Enhancing Peripheral Awareness of Avatars for People
with Visual Impairments in Social Virtual Reality



Tiger Ji, Brianna Cochran, Yuhang Zhao
University of Wisconsin-Madison

Challenges of Social VR

Perceiving Identity

Avatar Motion and Interactions

Research Goal

Make Social VR an Accessible and Equal Experience
for People with Visual Impairments

Research Goal

Facilitate Peripheral Awareness for People with Visual Impairments

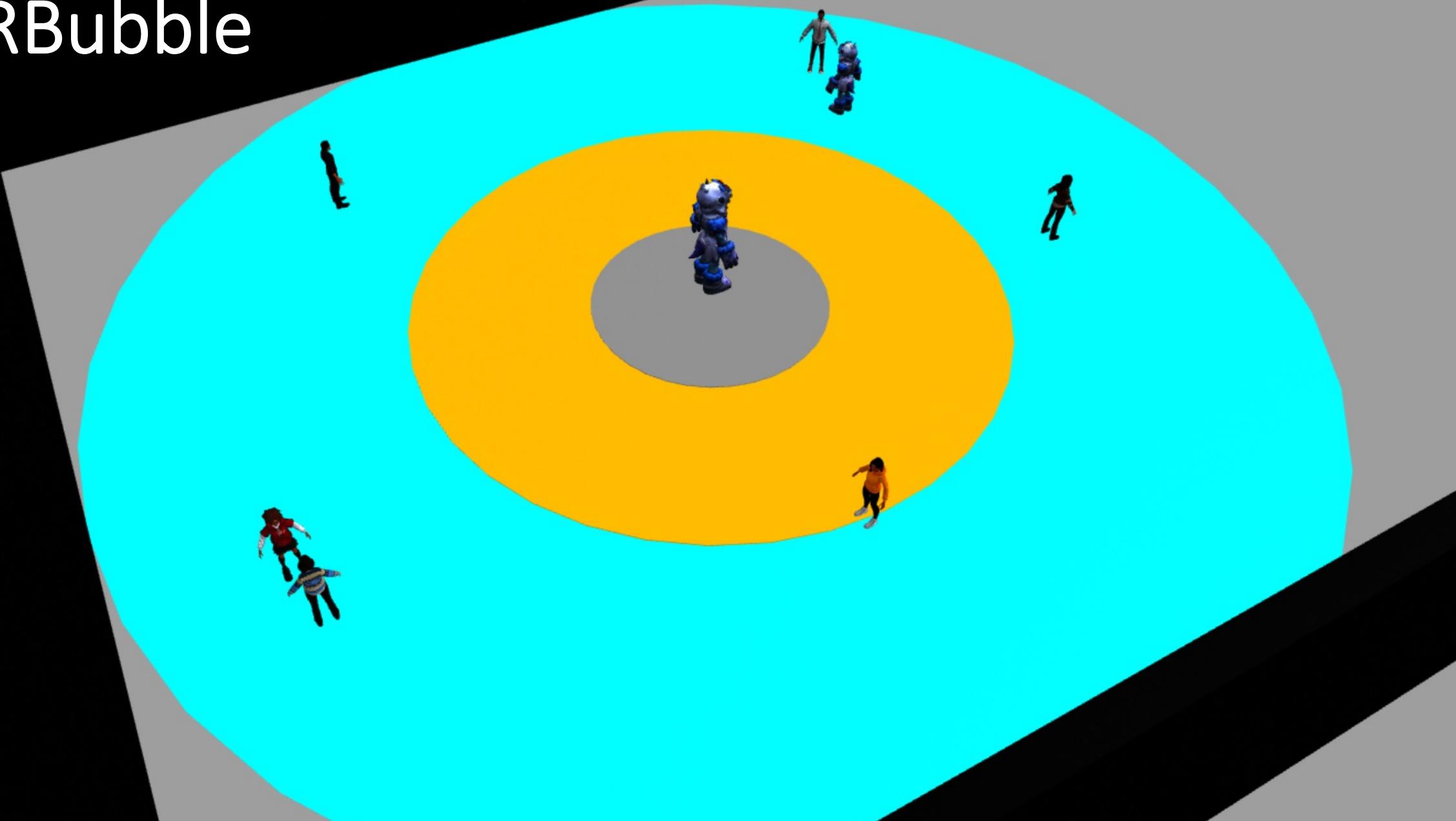
The innate ability to unconsciously maintain a social and physical context

Design Guidelines

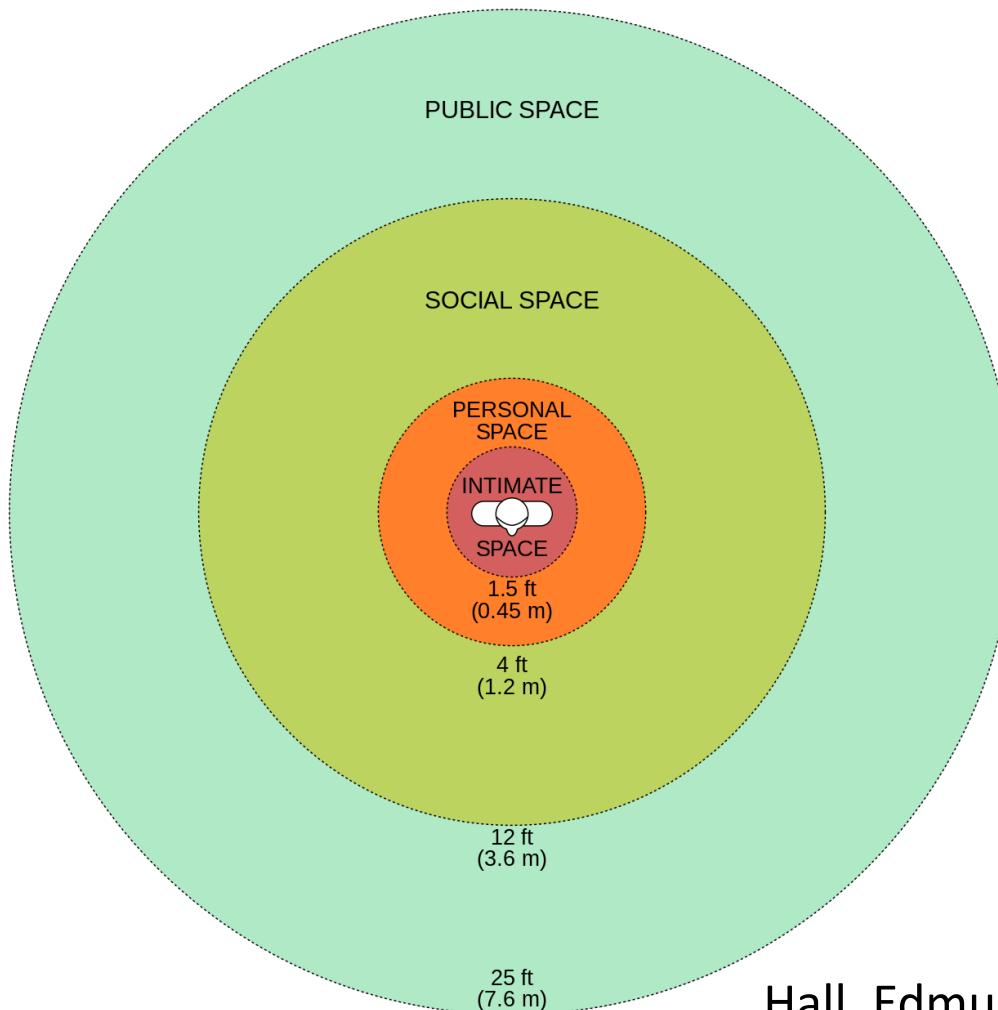
Convey Identity and Location

Minimize Distraction

VRBubble



Hall's Proxemic Theory



Hall, Edmund T., and Edward Twitchell Hall.
The hidden dimension. Vol. 609. Anchor, 1966.

Audio feedback design

- Avatar information to convey
 - Avatar identity: name, relationship (stranger vs friends)
 - Avatar position: entering and leaving bubbles
- Three audio alternatives
 - Earcon
 - Verbal description
 - Real-world sound effect

Earcon

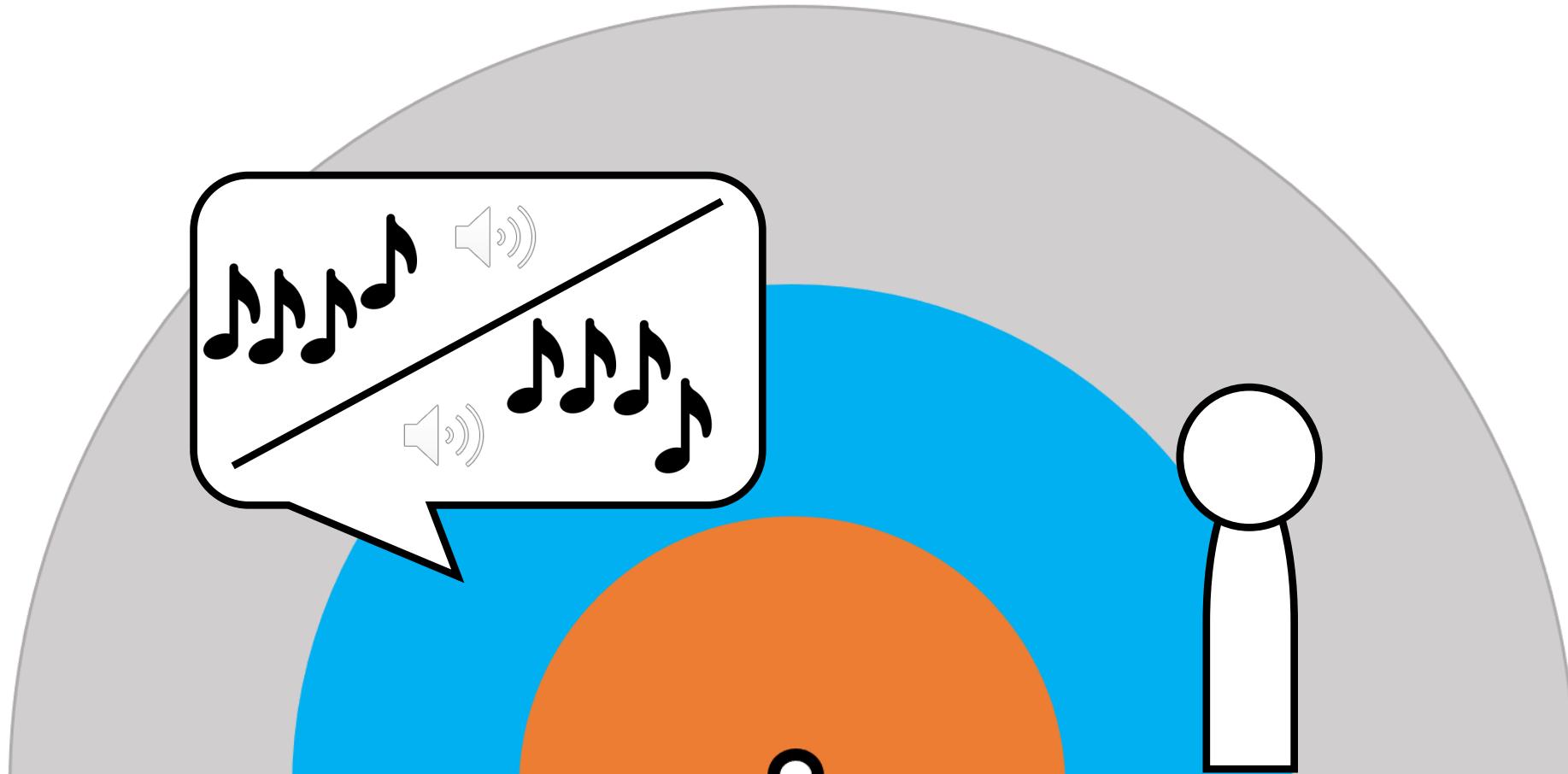
Earcon



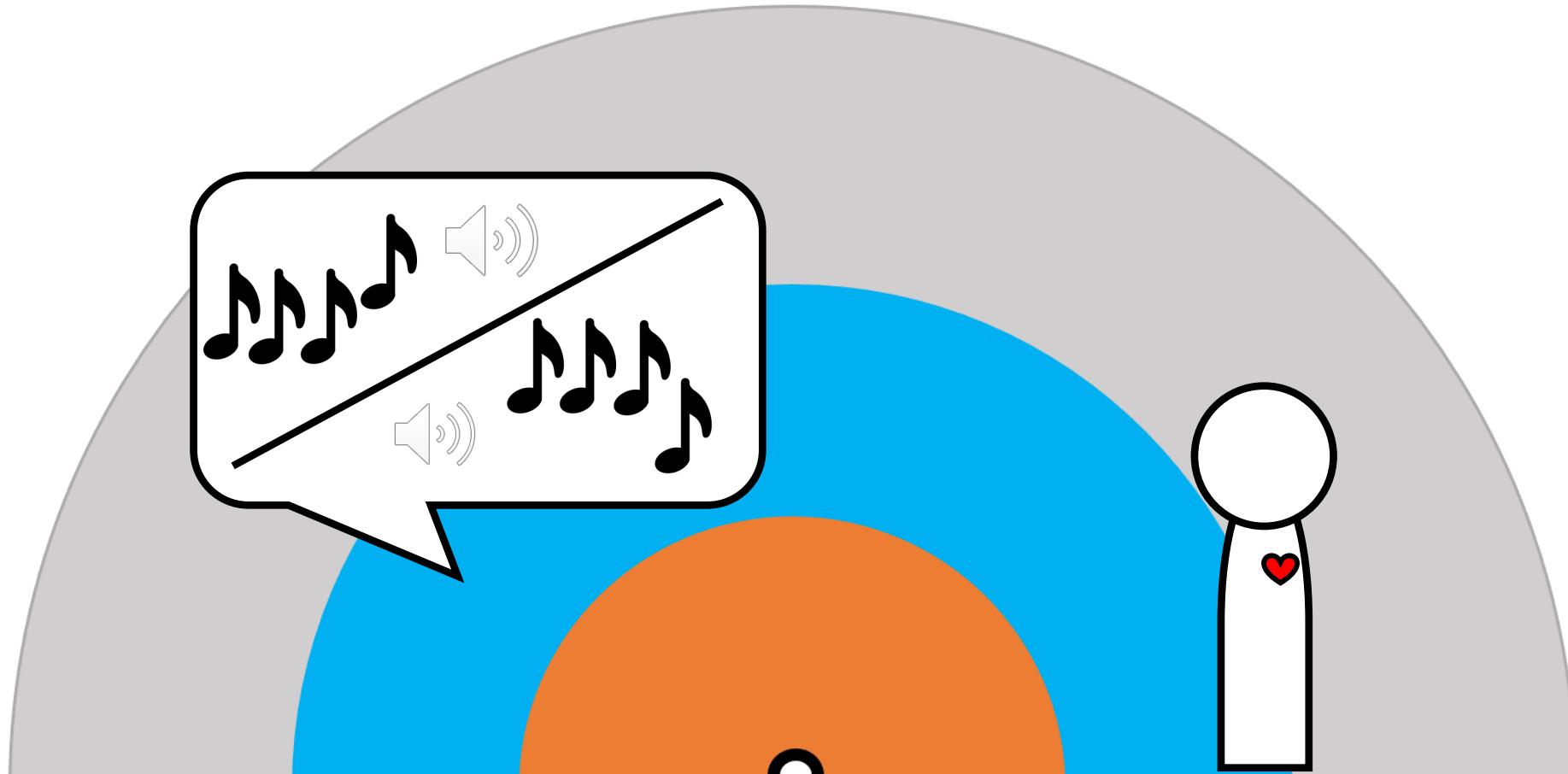
Earcon



Earcon



Earcon

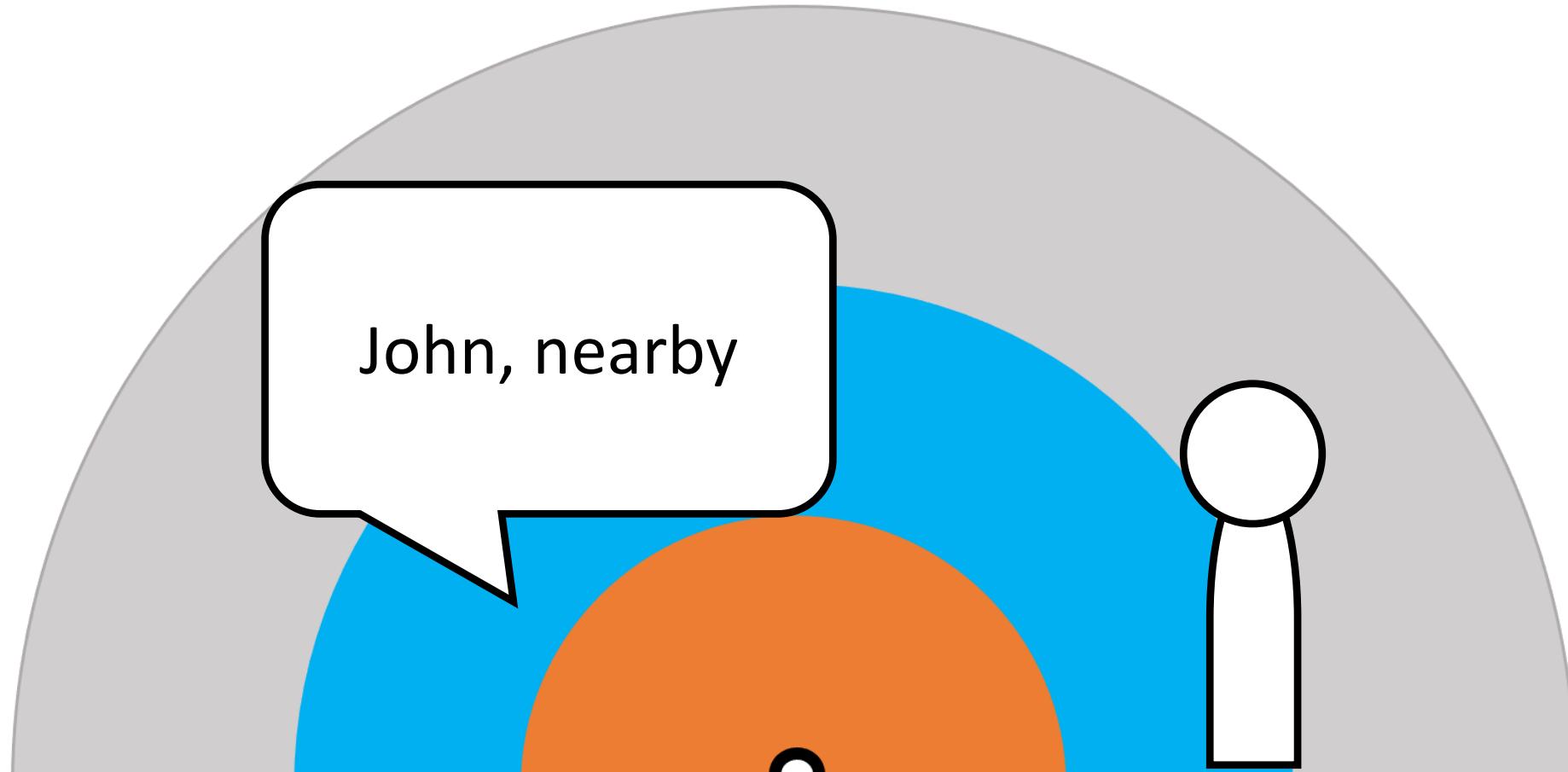


Verbal Description

Verbal Description

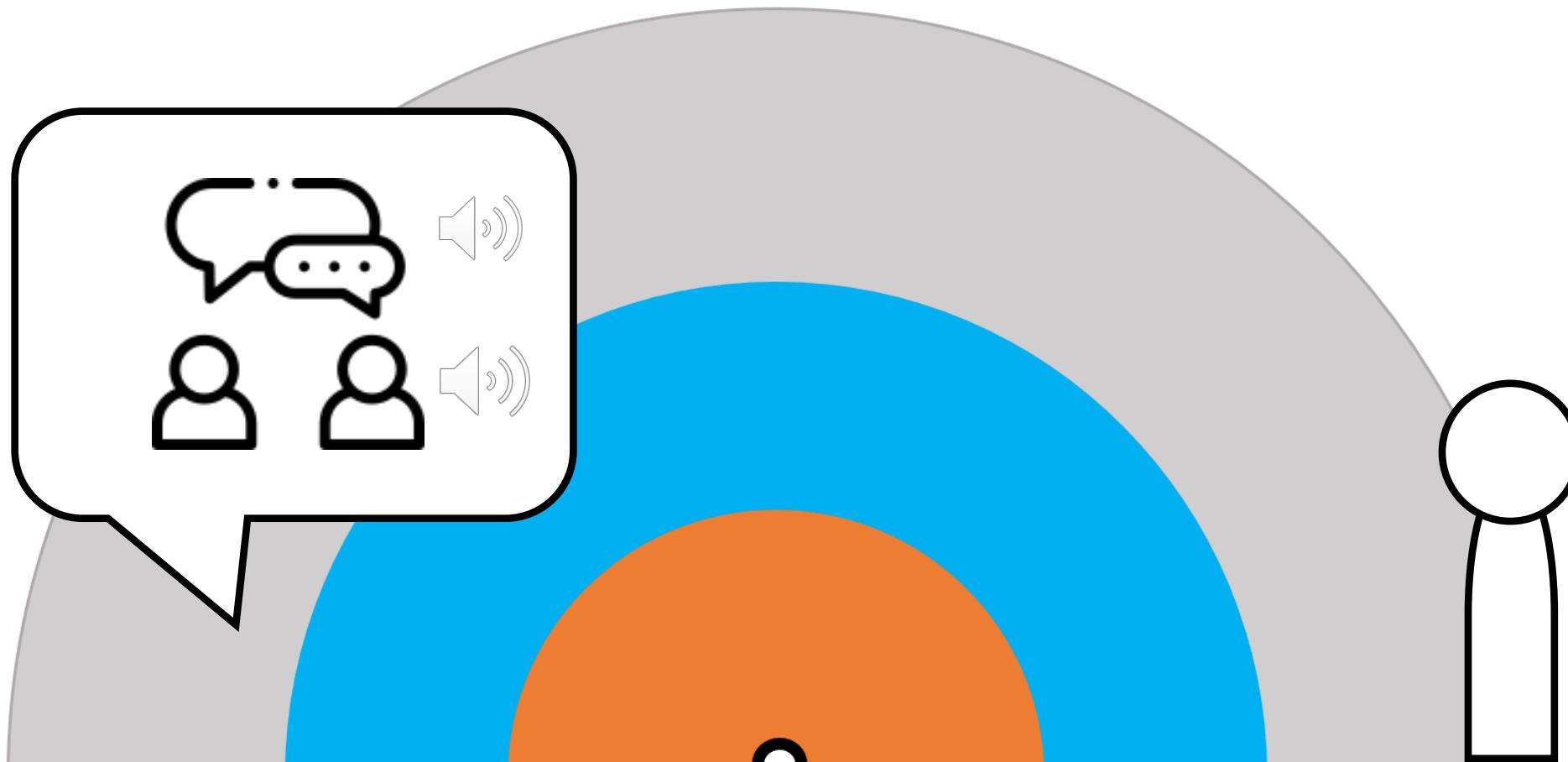


Verbal Description

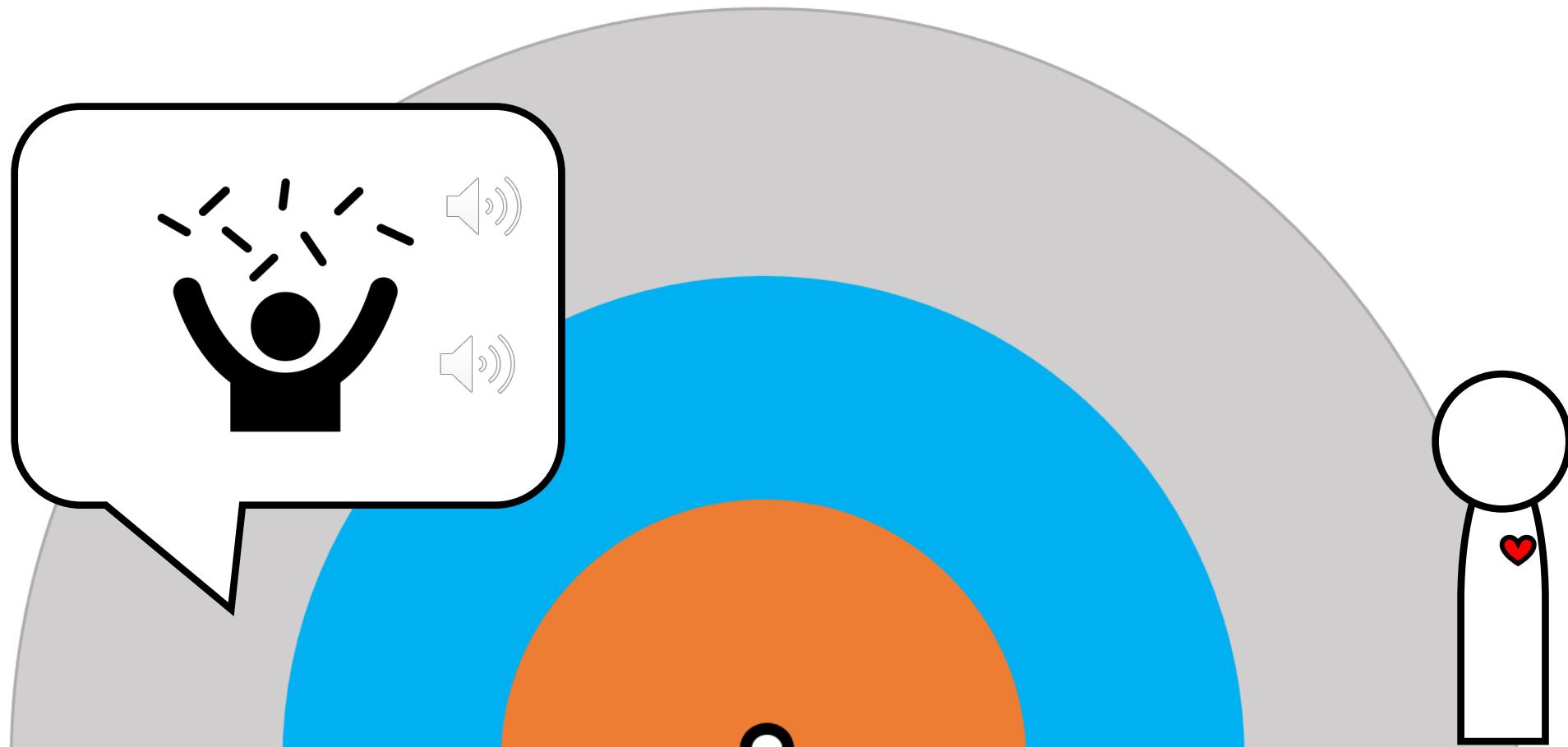


Real-world Sound Effects

Real-world Sound Effects



Real-world Sound Effects



Real-world Sound Effects



Evaluation

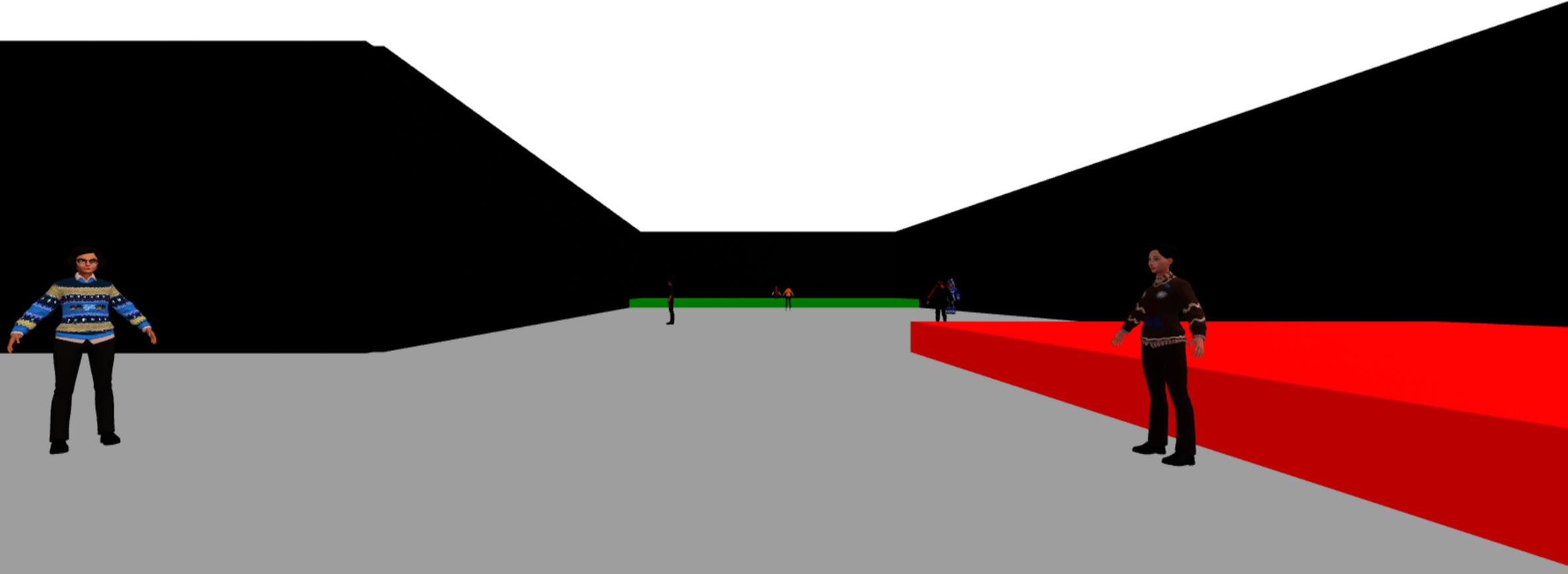
Can avatar presence be conveyed effectively with VRBubble?

How distracting is VRBubble?

Study protocol

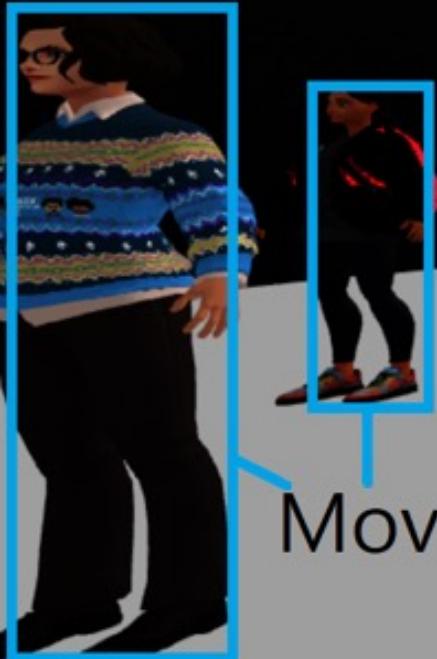
- 12 legally blind participants (7 male, 5 female)
- Two social VR contexts:
 - Navigation
 - Conversation
- Baseline: spatial audio beacon

Navigation task



Conversation task

Speaker



Moving avatars

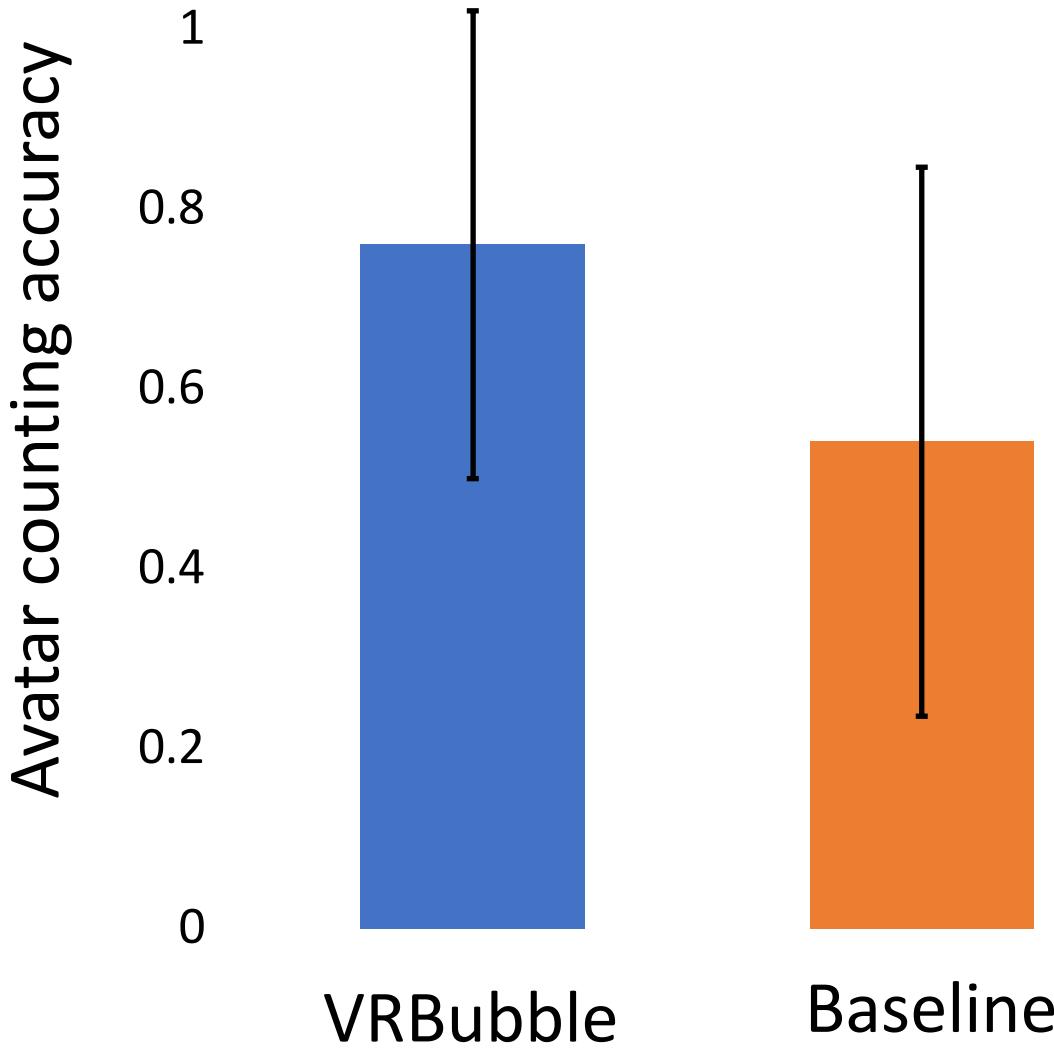


Moving
avatars

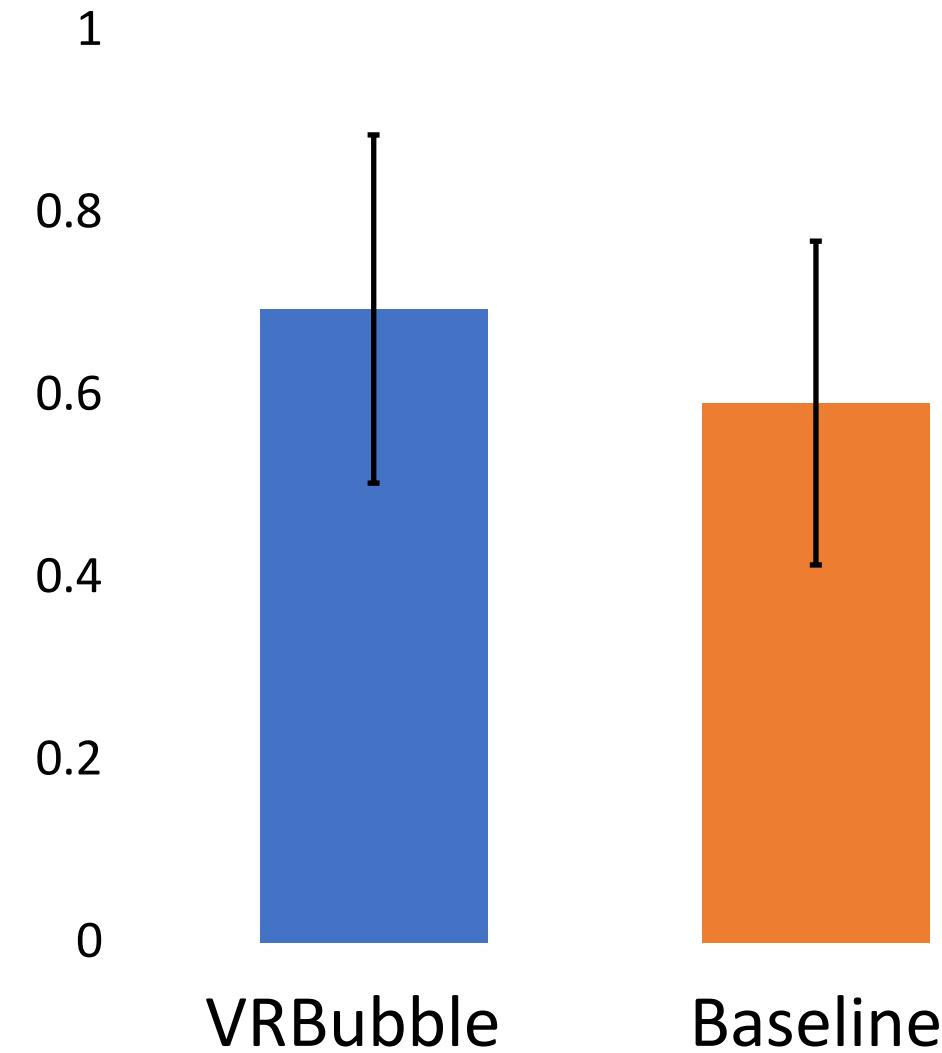


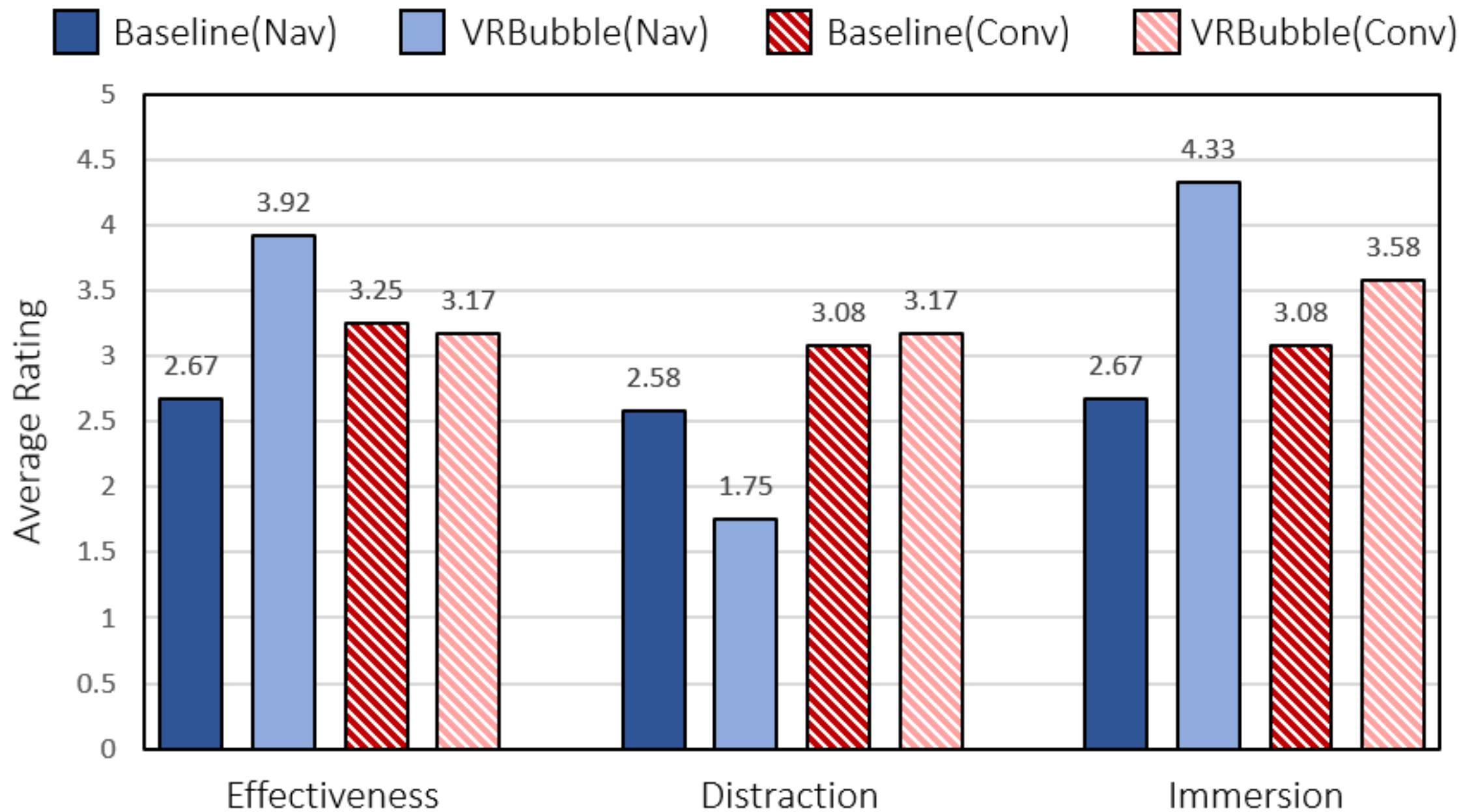
Results

Navigation task



Conversation task





Customization of VRBubble

ID	Navigation Task					Conversation Task				
	Social Friends	Social Strangers	Conversational Friends	Conversational Strangers	Intimate	Social Friends	Social Strangers	Conversational Friends	Conversational Strangers	Intimate
1	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~
2	~~~~~	N/A	~~~~~	~~~~~	~~~~~	~~~~~	N/A	~~~~~	~~~~~	~~~~~
3	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~
4	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~
5	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~
6	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~
7	~~~~~	N/A	~~~~~	~~~~~	~~~~~	N/A	N/A	~~~~~	~~~~~	~~~~~
8	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~
9	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~
10	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~
11	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~
12	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~	~~~~~

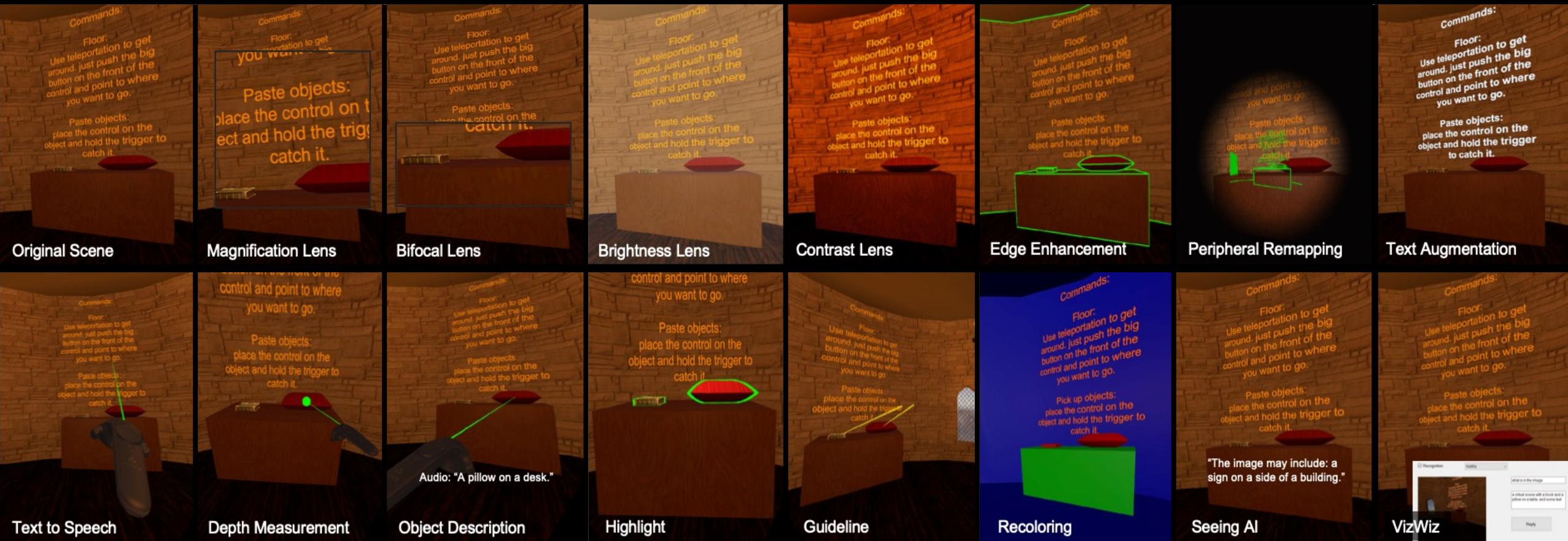
= Earcons
 = Verbal
 = Real-world
 = Changed Customization Between Tasks

Discussion

Peripheral audio needs to be flexible and
context adaptive

Social categorization can improve awareness
without increasing distraction

SeeingVR: 14 low vision tools



[Zhao et al. CHI'19]



HUMAN-COMPUTER INTERACTION
MICROSOFT RESEARCH

Magnification Lens

re is a door
4-digit
should find
pher the
checking
like pillows
e foot of the
on them !!

COMMANDS:

Floor:

Use teleportation to get around. just push the big button on the front of the control and point to where you want to go.

Paste objects:

place the control on the object and hold the trigger to catch it.

Command

Push butt

As for grabbing
place the cont
knob and sque

Open the door
take the edge o
as if it were an
push or pull to

Edge Enhancement



control and point to ...
you want to go.

Paste objects:
place the control on the
object and hold the trigger to
catch it.



Depth Measurement

catch it.

Waltz of the Wizard (Bifocal Lens)



A Plugin: modifying an existing VR app *post hoc*

Object Description

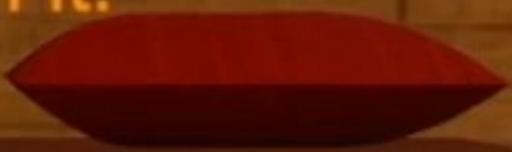
Paste objects:
place the control on the
object and hold the trigger to
catch it.

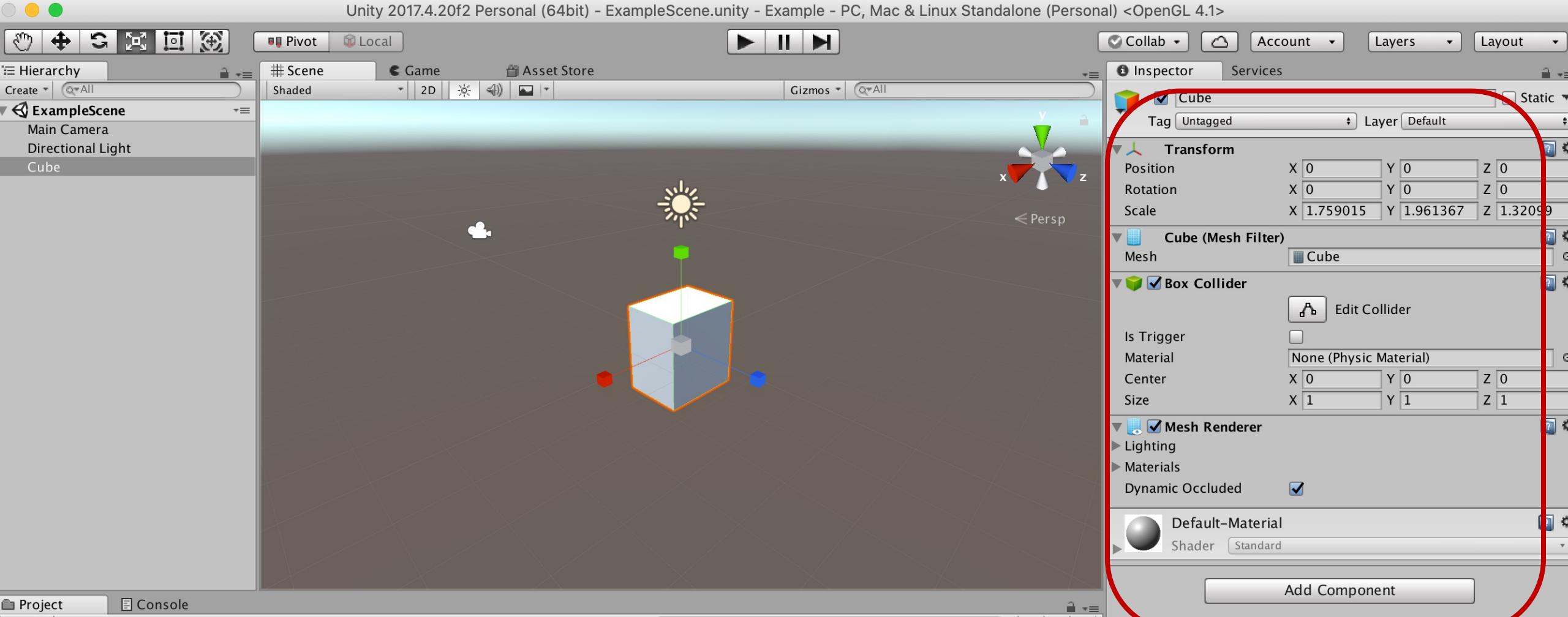


Highlight

you want to go.

Paste objects:
place the control on the
object and hold the trigger to
catch it.





 Unity Developer Toolkit: providing meta input and integrating low vision support during development process

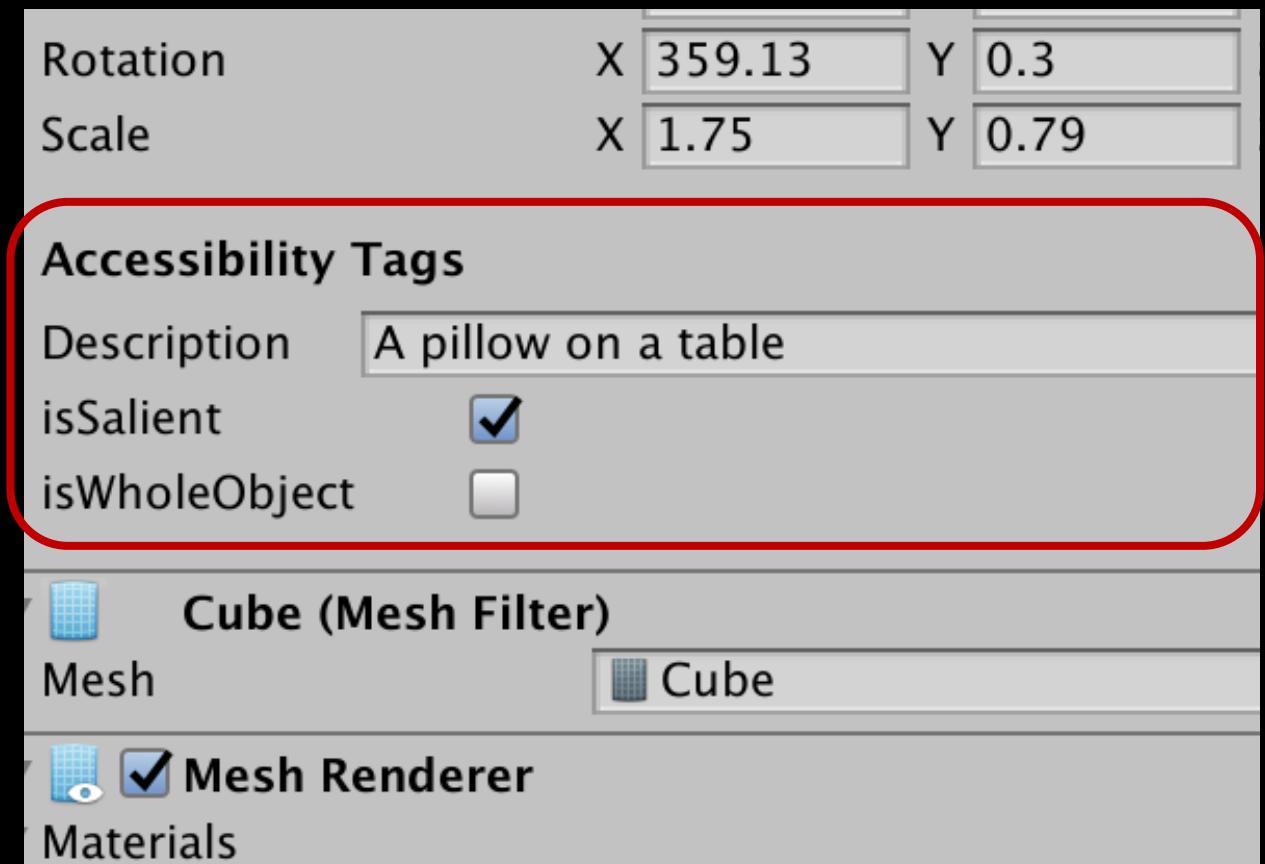
Accessibility features allowing developer input

- *Description:*

Object Description

- *isSalient:*

Highlight



Unity Toolkit

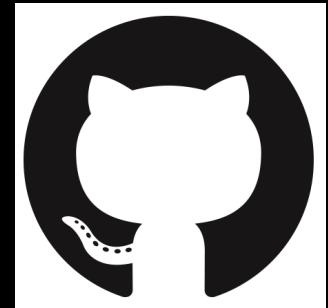
“We sometimes got asked by [the] accessibility team [at our company], ‘You need to be accessible.’ But they don’t really understand what accessibility is in the VR context. You are the first that actually look this deeply into this problem.”

- D1 (31, m)

Bigger Impact

- SeeingVR Unity Toolkit is open source
 - 5 Prefabs
 - 35 C# scripts
 - 12 Shaders

<https://github.com/microsoft/SeeingVRtoolkit>



Summary

- Disability representation in social VR
- VRBubble
- SeeingVR

Mad Ability Lab: <https://www.yuhangz.com/projects>