

Inclusive Avatar Guidelines for People with Disabilities: Supporting Disability Representation in Social Virtual Reality



Kexin Zhang

Fourth-year PhD Student

Computer Sciences @ UW-Madison

Human-Computer Interaction, Accessibility



WISCONSIN
UNIVERSITY OF WISCONSIN-MADISON

MAD
ABILITY

MadAbility Lab



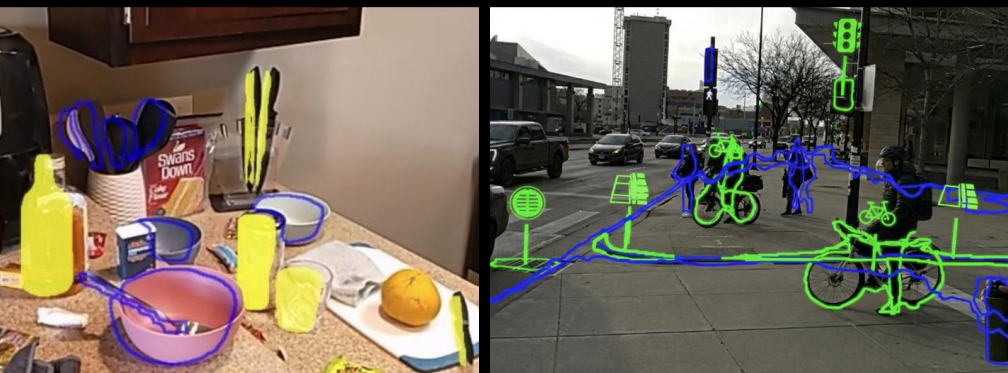
PI: Yuhang Zhao
Assistant Professor
Department of Computer Sciences
yuhang.zhao@cs.wisc.edu



Lab Members, Fall 2025

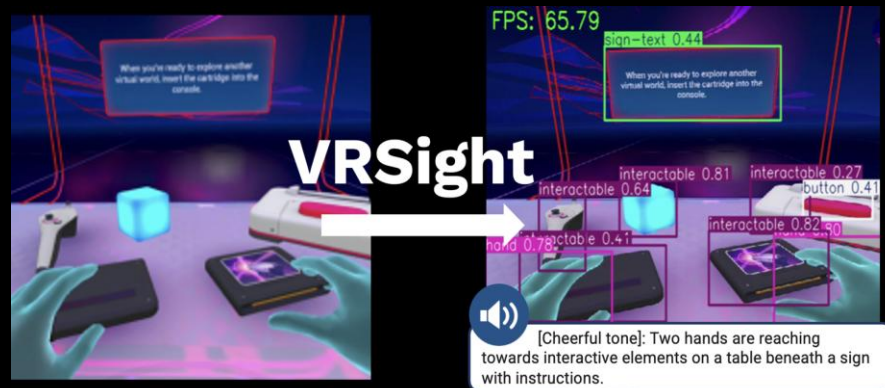
We design and build embodied intelligence for accessibility

Augmented Reality (AR):



E.g., SceneGlance for egocentric daily tasks
(Wu et al., 2026)

Virtual Reality (VR):



VRSight, a VR screen reader
(Killough et al., 2025)

We design and build embodied intelligence for accessibility

Inclusive and Safe Social VR: Zhang et al., 2022-2026



Why avatars matter in social VR?



My Work:



Whether to present disability on avatars? What's the impact? (2022 & 2023)

G3.1. Offer various types of assistive technology to cover a wide range of disabilities (HR).

Avatar interfaces should offer assistive technologies that are commonly used by PWD. According to our large-scale interview data, the most desired types of assistive technologies include: (1) mobility aids (e.g., wheelchair, cane, and crutches); (2) prosthetic limbs; (3) visual aids (e.g., white cane, glasses, and guide dog); (4) hearing aids and cochlear implants; and (5) health monitoring devices (e.g., insulin pumps, ventilator, smart watches).

Practitioners should consider including at least these five categories of assistive technologies in avatar interfaces. In addition, due to people with disabilities' different technology preferences, we encourage practitioners to offer more than one assistive technology option within each category, for example, including guide dog, white cane, and glasses for visual aids.

"For people in wheelchairs, our wheelchair is an extension of our body [...] we view it emotionally as an extension of ourselves, and it gives us our independence."

— a wheelchair user

"I think that the wheelchair would be a good addition to it. Being able to move it in the VR world gives me a sense that I'm a part of this VR world too."

— a wheelchair user

Example: Offer multiple types of mobility aids, such as walking aids and wheelchair.

How to present disabilities on avatars? (2025)

Statement
Evidence & Explanation
Quotes from PWD
Implementation example in UI



How to present disabilities **safely** on avatars? (2026)

My Work: Inclusive Avatar Guidelines



G3.1. Offer various types of assistive technology to cover a wide range of disabilities (HR).

Avatar interfaces should offer assistive technologies that are commonly used by PWD. According to our large-scale interview data, the most desired types of assistive technologies include: (1) mobility aids (e.g., wheelchair, cane, and crutches); (2) prosthetic limbs; (3) visual aids (e.g., white cane, glasses, and guide dog); (4) hearing aids and cochlear implants; and (5) health monitoring devices (e.g., insulin pumps, ventilator, smart watches).

Practitioners should consider including at least these five categories of assistive technologies in avatar interfaces. In addition, due to people with disabilities' different technology preferences, we encourage practitioners to offer more than one assistive technology option within each category, for example, including guide dog, white cane, and glasses for visual aids.

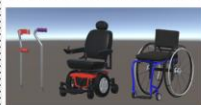
"For people in wheelchairs, our wheelchair is an extension of our body [...] we view it emotionally as an extension of ourselves, and it gives us our independence."

— a wheelchair user

"I think that the wheelchair would be a good addition to it. Being able to move it in the VR world gives me a sense that I'm a part of this VR world too."

— a wheelchair user

Example: Offer multiple types of mobility aids, such as walking aids and wheelchair.



Statement

Evidence & Explanation

Quotes from PWD

Implementation example in Un



Whether to present disability on avatars? What's the impact? (2022 & 2023)

How to present disabilities on avatars? (2025)

How to present disabilities **safely** on avatars? (2026)

**Presenting disabilities via avatars is
particularly challenging**

Challenge 1:

Minimal supports for avatar options that can represent people with disabilities (PWD)



Challenge 2:

Lack of guidance for
developers and designers
to implement in practice

Zhang et al., ASSETS '22
Mack et al., CHI '23
Gualano et al., ASSETS '24



The Gap:

Need a **centralized**, **comprehensive**, and **validated** set of inclusive avatar guidelines that are easy for practitioners to adopt, share, and update

How?

Method

I. Generation

- Literature review on 19 papers
- Interview with **60 PWD**, covering diverse disabilities



II. Evaluation

- Heuristic evaluation with **10 VR experts** in industry



III. Revision

- Refined guidelines to reflect experts feedback

17 guidelines that cover *five design aspects*
of avatars

Five design aspects

G1. Avatar body appearances (4)

G2. Body dynamics (3)

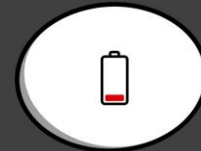
G3. Assistive technology design
(5)

G4. Peripherals around avatar (2)

G5. Avatar control and interface
(3)



[G2.1] Allow simulation or tracking of disability-related behaviors but only based on user preferences.



[G4.2] Leverage spaces beyond the avatar body to present disabilities.

G3.1. Offer various types of assistive technology to cover a wide range of disabilities (HR).

Statement

Avatar interfaces should offer assistive technologies that are commonly used by PWD. According to our large-scale interview data, the most desired types of assistive technologies include: (1) mobility aids (e.g., wheelchair, cane, and crutches); (2) prosthetic limbs; (3) visual aids (e.g., white cane, glasses, and guide dog); (4) hearing aids and cochlear implants; and (5) health monitoring devices (e.g., insulin pumps, ventilator, smart watches).

Practitioners should consider including at least these five categories of assistive technologies in avatar interfaces. In addition, due to people with disabilities' different technology preferences, we encourage practitioners to offer more than one assistive technology option within each category, for example, including guide dog, white cane, and glasses for visual aids.

"For people in wheelchairs, our wheelchair is an extension of our body [...] we view it emotionally as an extension of ourselves, and it gives us our independence."

– a wheelchair user

"I think that the wheelchair would be a good addition to it. Being able to move it in the VR world gives me a sense that I'm a part of this VR world too."

– a wheelchair user

Example: Offer multiple types of mobility aids, such as walking aids and wheelchair.



G3.1. Offer various types of assistive technology to cover a wide range of disabilities (HR).

Avatar interfaces should offer assistive technologies that are commonly used by PWD. According to our large-scale interview data, the most desired types of assistive technologies include: (1) mobility aids (e.g., wheelchair, cane, and crutches); (2) prosthetic limbs; (3) visual aids (e.g., white cane, glasses, and guide dog); (4) hearing aids and cochlear implants; and (5) health monitoring devices (e.g., insulin pumps, ventilator, smart watches).

Practitioners should consider including at least these five categories of assistive technologies in avatar interfaces. In addition, due to people with disabilities' different technology preferences, we encourage practitioners to offer more than one assistive technology option within each category, for example, including guide dog, white cane, and glasses for visual aids.

"For people in wheelchairs, our wheelchair is an extension of our body [...] we view it emotionally as an extension of ourselves, and it gives us our independence."

– a wheelchair user

"I think that the wheelchair would be a good addition to it. Being able to move it in the VR world gives me a sense that I'm a part of this VR world too."

– a wheelchair user

Example: Offer multiple types of mobility aids, such as walking aids and wheelchair.



Statement

Evidence &
Explanation

G3.1. Offer various types of assistive technology to cover a wide range of disabilities (HR).

Avatar interfaces should offer assistive technologies that are commonly used by PWD. According to our large-scale interview data, the most desired types of assistive technologies include: (1) mobility aids (e.g., wheelchair, cane, and crutches); (2) prosthetic limbs; (3) visual aids (e.g., white cane, glasses, and guide dog); (4) hearing aids and cochlear implants; and (5) health monitoring devices (e.g., insulin pumps, ventilator, smart watches).

Practitioners should consider including at least these five categories of assistive technologies in avatar interfaces. In addition, due to people with disabilities' different technology preferences, we encourage practitioners to offer more than one assistive technology option within each category, for example, including guide dog, white cane, and glasses for visual aids.

"For people in wheelchairs, our wheelchair is an extension of our body [...] we view it emotionally as an extension of ourselves, and it gives us our independence."

– a wheelchair user

"I think that the wheelchair would be a good addition to it. Being able to move it in the VR world gives me a sense that I'm a part of this VR world too."

– a wheelchair user

Example: Offer multiple types of mobility aids, such as walking aids and wheelchair.



Statement

Evidence &
Explanation

Quotes
from PWD

G3.1. Offer various types of assistive technology to cover a wide range of disabilities (HR).

Avatar interfaces should offer assistive technologies that are commonly used by PWD. According to our large-scale interview data, the most desired types of assistive technologies include: (1) mobility aids (e.g., wheelchair, cane, and crutches); (2) prosthetic limbs; (3) visual aids (e.g., white cane, glasses, and guide dog); (4) hearing aids and cochlear implants; and (5) health monitoring devices (e.g., insulin pumps, ventilator, smart watches).

Practitioners should consider including at least these five categories of assistive technologies in avatar interfaces. In addition, due to people with disabilities' different technology preferences, we encourage practitioners to offer more than one assistive technology option within each category, for example, including guide dog, white cane, and glasses for visual aids.

"For people in wheelchairs, our wheelchair is an extension of our body [...] we view it emotionally as an extension of ourselves, and it gives us our independence."

– a wheelchair user

"I think that the wheelchair would be a good addition to it. Being able to move it in the VR world gives me a sense that I'm a part of this VR world too."

– a wheelchair user

Example: Offer multiple types of mobility aids, such as walking aids and wheelchair.



Statement

Evidence &
Explanation

Quotes
from PWD

Implementation
example in Unity

G1. Avatar body appearances

[G1.2] Default to full-body avatars

“People can only get my whole disability identity with the full body [avatar].”

– P9



G3. Assistive technology design

[G3.5] Adjustable size of
AT to match with avatar.

“The wheelchair is not the focus of the image. [Instead,] the focus is on the avatar, and that they are having a good time.”

– P39



How to ensure the guidelines are ***validated***?

Practitioner Demographics

- 10 practitioners (age 24 - 52, 9 Male 1 Female)
- Average 4.8 years of VR industry experiences
- XR design engineer, AR/VR developer, XR artists, game designer

Apply each guidelines on one of the five mainstream social VR apps:



Practitioners said...

Guidelines are Great!

Easy to understand,
actionable, and important to
implement



Suggestion 1: Inform Applicable Use Cases

G2.2 Enable expressive facial animations to deliver invisible status

“This guideline is really important in [my use case of] VR therapy and mental health.”

– EP 1 (Lead XR engineer, startup)

Suggestion 1: Inform Applicable Use Cases

G2.2 Enable expressive facial animations to deliver invisible status

“People are not going to stare into the avatar’s eyes to see if it is twitching a little bit more or less.”

– EP 2 (XR developer, big tech)

Suggestion 1: Inform Applicable Use Cases

Revision: Recommendation Levels

G2.2 Enable expressive facial animations to deliver invisible status **(R)**

|

Recommended:

More applicable when representing people with invisible disabilities

G3.1 Offer various types of assistive technology to cover a wide range of disabilities **(HR)**

|

Highly Recommended:

Applicable for all use cases

Suggestion 2: Provide a Concrete Scope

G1.2 Enable flexible customization of body parts as opposed to using non-adjustable avatar templates (HR).

“If I wanted to actually take an action on this guideline, I would need a defined scope that I should try to follow.”

– EP4 (XR developer, mid-size tech co.)

Suggestion 2: Provide a Concrete Scope

Revision: Implementation Scope

G1.2 Enable flexible customization of body parts as opposed to using non-adjustable avatar templates (HR). While the customization spans a wide range, the most commonly mentioned body parts to customize include:

- 1) avatar height**
- 2) body shape**
- 3) limbs**
- 4) facial features.**

Open-source on Github:

<https://github.com/MadisonAbilityLab/Inclusive-Avatar-Guidelines-and-Library>

Contributions



1. A centralized, comprehensive set of inclusive avatar guidelines with concrete evidence and implementation examples;
2. Validate and refined guidelines based on VR practitioners' feedback;
3. Best practices for designing a set of actionable guidelines.



Kexin Zhang
kzhang284@wisc.edu



Scott
Spencer



Abijith
Manikandan



Andric
Li



Ang
Li



Yaxing
yaxingm@vt.edu



Yuhang Zhao
yzhao469@wisc.edu

