

Inclusive Design & Equitable Access in Social AR

Proposal to participate in the October 17-18, 2020 CSCW Workshop

"Social AR: Reimagining and Interrogating the Role of Augmented Reality in Face to Face Social Interactions"

Social AR for people with disabilities and people who are aging or who have temporary challenges

Bill Curtis-Davidson

Senior Consultant – Emerging Technology Accessibility

Partnership on Employment & Accessible Technology (PEAT)

September 24, 2020

Background Questions

How can we ensure equitable access to Social AR devices and applications...

- **... for people with disabilities?** People with more permanent sensory (e.g. vision, hearing), physical (e.g. mobility, dexterity), or cognitive disabilities (e.g. learning, autism, etc.) require equitable access to Social AR devices and apps in order to fully participate in school, the workplace, and society.
- **... in different environments and use cases?** People who are multi-tasking in different environments and industry use cases may experience temporary sensory, physical or cognitive limitations (see slide 7).
- **... for those who are injured or advancing in age?** People experience temporary injuries, and age brings limitations in sensory, physical or cognitive ability.
- **... in current and future workplaces?** Workplaces must provide equitable employment opportunities and provide reasonable accommodations (i.e. adjustments) to people with disabilities by law in most of the developed world.

Participant Profile

- Sr. Consultant, Emerging Tech Accessibility, [PEAT Future of Work Initiative](#). PEAT is funded by the U.S DOL’s Office of Disability Employment Policy, and convenes multiple stakeholders – disability orgs, govt, IT companies, employers, researchers – to advance emerging tech accessibility and increase employment opportunities for people with disabilities.
- Frequent speaker / invited expert – e.g. [A11yVR](#), [AFutureDate](#)
- Served recently as Magic Leap’s first Accessibility Manager
- Founding leader of the [XRAccess.org](#) community initiative
- 20+ years' experience in UX/inclusive product design, ICT accessibility program leadership, assistive tech R&D



Bill Curtis-Davidson

Future of Work
Trends, Technology & Policy



PEAT is funded by the [Office of Disability Employment Policy](#), U.S. Department of Labor. PEAT material does not necessarily reflect the views or policies of the Office of Disability Employment Policy, U.S. Department of Labor, nor does the mention of trade names, commercial products, or organizations imply endorsement by the U.S. Government.



Design Fiction Scenario – User Story

Leading UX researcher who is Deaf presents research findings at a meeting with colleagues after being newly hired in a consulting firm.

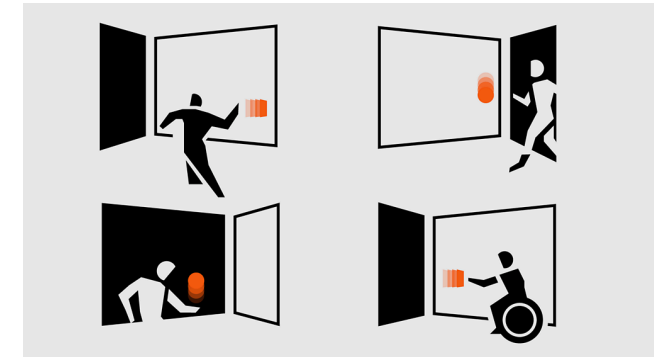
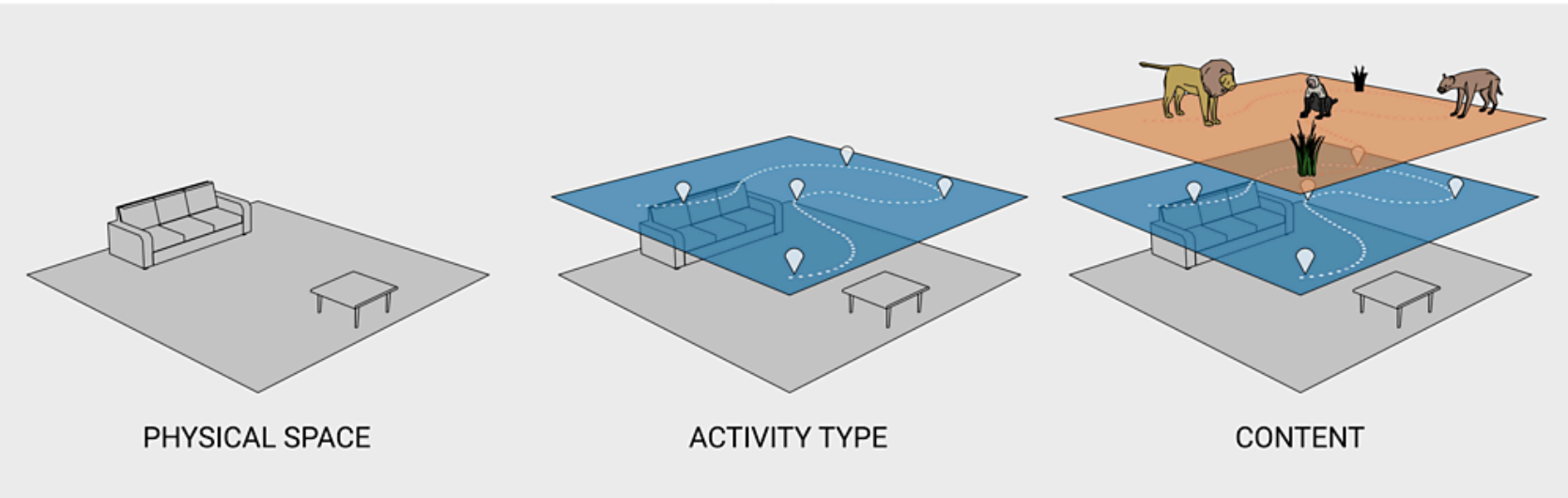
- Wendy is a UX researcher hired by a well-known design firm; After 1 month, she's acclimated to her new role and attends a meeting open to about 25 colleagues to present findings from her first research project.
- Wendy navigates to the meeting location and uses her Social AR app to understand the immediate / ambient environment for the meeting, determine who's in the room, and select a position from which to engage.
- All colleagues attending the meeting are using a Social AR app to communicate and see information being shared by Wendy (virtual presentations embedded in the physical room).
- Wendy, whose native language is American Sign Language (ASL), speaks to the attendees and the Social AR app translates her sign language comments into visual text and text-to-speech in the native languages of her colleagues attending the meeting.
- Her colleagues ask questions and participate in dialogue during the meeting, using their preferred mode of communication (e.g. speech) which is translated in the Social AR app into the preferred communication mode (e.g. audio, gesture, text) and language (e.g. English, Spanish, ASL, etc.) of the receiver.
- This scenario raises issues of fluid switching of communication input/output modes as well as communication languages. Some of the same issues might exist in sharing object, artifacts or documents during the meeting.

Design Fiction Scenario – References

Sampling of industry activities and references related to the User Story



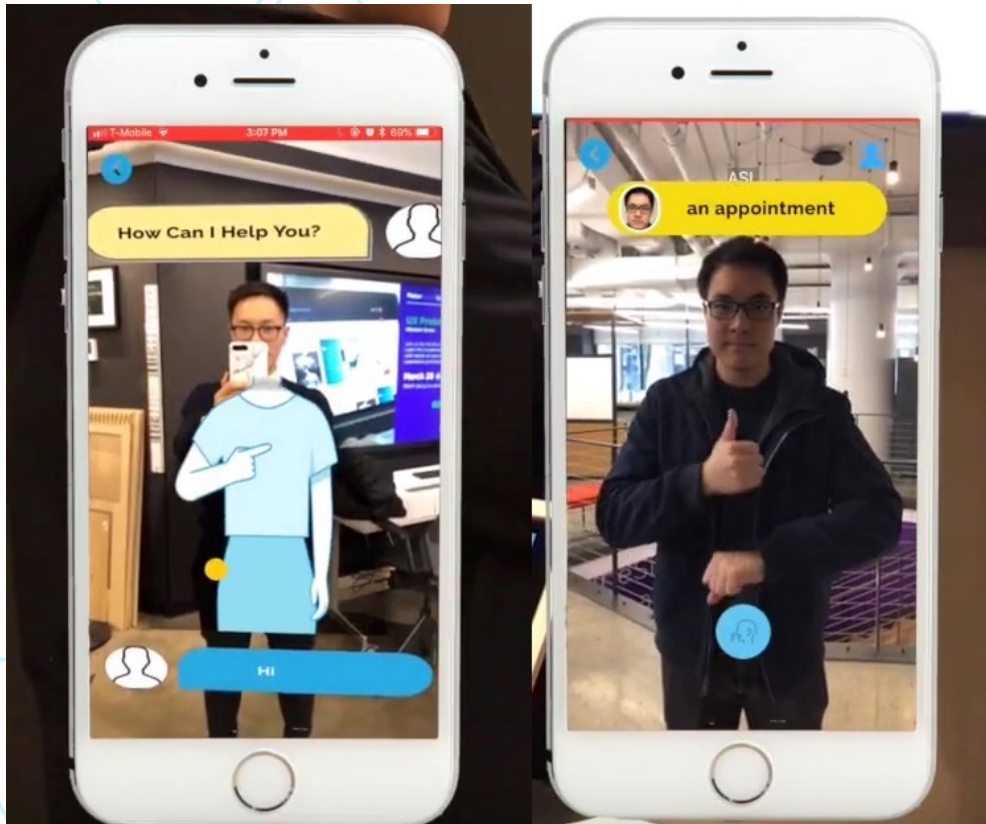
Showing an example of [emerging AR design framework from BBC](#)... including considering persons with disabilities. On the left, symbols for Physical Spaces (square room with sofa and table), Activity Types (e.g. moving around a living room to forage for content) and Content used in various activities (animals sprinkled throughout the square room). On the right, symbols of various users, some standing or peeking through an opening or in a wheelchair, moving through conceptual spaces (represented by two planes).



Source: BBC Global Experience Language (GEL) – [An emergent AR design framework](#), May 2020

Design Fiction Scenario – References (Cont'd)

Sampling of industry activities and references related to the User Story



Source: NYU



Source: XR Access

Showing some ideas from industry activities involving AR social apps to help Deaf and hearing people communicate with each other.

On the left, there are Images of a mobile AR app project from NYU that helps Deaf and hearing people fluidly communicate, translating between speech, American Sign Language and visible text overlaid by speakers.

On the right, a Deaf woman (Wendy Dannels of RIT) wearing a Magic Leap 1 Mixed Reality HMD while communicating via ASL with her interpreter, who then communicates to hearing colleagues.

Design Fiction Scenario – Considerations

Inclusive design of Social AR is prompted by considerations of human abilities, activities and environments.

MOVING & TOUCHING



Using Wheelchair, Cane, Prosthetic

HEARING & SPEAKING



Person who is Deaf or Hard of Hearing

SEEING & OBSERVING



Person who is Blind, or has Low Vision

THINKING & LEARNING



Cognitive or Learning Challenges

PERSON

ACTIVITY

ENVIRONMENT

Stationary or "Hands-Busy"

Smaller or tight physical space

Already Speaking or "Ears Busy"

Quiet or loud environments

"Eyes Busy" or Visual Multitasking

Dark or bright environments

Complex Multitasking

Foreign, new or busy environment

Inclusive design methods draw on the lived experiences of persons with disabilities to develop design considerations, which can also be applied to users who experience sensory, physical or cognitive limitations based on the activities and environments they are using Social AR in.

Design Fiction Scenario – Use Cases

In future workplaces, how can we ensure people with diverse abilities can interact with each other effectively using AR or Mixed Reality Social AR?

- **A blind employee** uses his AR smart glasses to navigate around her workplace, find meeting locations, identify objects and verify which co-workers she is interacting with during her workday. In social situations, her AR device and applications help her see what is happening.
- **A deaf employee** uses his AR smart glasses to detect ambient audio, participate in meetings and casual conversations, and attend on-the-job training with colleagues.
- **An employee who is a military veteran with an amputated or prosthetic limb** uses her AR smart glasses to retrieve digital documents and artifacts and present them to colleagues in meetings.
- **An autistic employee** practices communication, collaboration and presentation skills using their AR device and social applications.
- **An employee participates in a multi-lingual meeting, conference, or event** and uses her AR device and social applications to understand and participate in multilingual discussions in real-time.

Design Fiction Scenario – Key Purposes

Social AR apps will need to support the following key functions / purposes in order to be effectively used by all people, including those with disabilities.

- **Environmental awareness.** Social AR interactions occur in physical environments that affect how people communicate with each other. Social AR devices and apps should help users be more aware of their environment – i.e. size of space, best position for participation, sound levels, ambient vs. immediate environment/context – as well as help them sense the relative position of their body (proprioception).
- **Social participant awareness.** Social AR interactions require participants to understand the human participants and cultural context in face-to-face social situations. Social AR devices and apps should help users understand how many people are involved in the social interaction, who the people are, and understand their relative position to other people in the social space (proprioception).
- **Fluid communication modes.** Social AR interactions require participants to be able to use a fluid mode of communication – i.e. speech, sign language, text – that aligns to their abilities, or the environment or use case. Social AR should allow mixed modes of communications to support participants with different needs.
- **Fluid communication languages.** Social AR should support people choosing to communicate in different spoken languages, as well as signed or symbolic languages.
- **Fluid object sharing modes.** Social AR should support fluid choices for modes of sharing artifacts, objects, documents or other information that is the subject of the Social AR communication and collaboration – i.e. visual, audio, etc.

Design Fiction Scenario – Challenges

This scenario brings up multiple challenges...

- 1. Defining the suite of sensors, displays and other elements required in the hardware used for Social AR.** How can the hardware support key purposes of environment sensing, people sensing (in the social interaction, on periphery or outside social interaction), and support dominant communication modes (i.e. audio-based, visual-based, haptic, etc.)? What operable controls would be required on the hardware and how could they be used by people with disabilities?
- 2. Defining navigation and software interfaces.** How can the user navigate through software interfaces that support the stages of social communication activity including entering a situation, understanding the environment and people involved, communicating and sharing artifacts? How do people navigate and use the software with different kinds of physical, sensory, or cognitive limitations?
- 3. Defining communication interfaces.** Social AR communication will need to support real-time, multi-speaker communication both in terms of modality as well as language. AR Social interfaces will need to ensure participants understand order of speaking, source of speakers, etc. (more important in situations where hearing is limited). Interfaces will likely also need to take into account non-verbal communication.
- 4. Defining custom modes and settings.** People using Social AR may need to select a default mode or setting for their interactions, especially if they have a disability. However, all people would need the same settings on a temporary basis at times... and the Social AR system might also auto-adapt based on context (e.g. environment, use case, etc.)

Design Fiction Scenario – Opportunities

As the challenges previously stated are addressed, new opportunities for innovation in Social AR may be possible...

1. **Hardware** – More flexible hardware to sense environments, people, social situations, communication modalities, and languages with easier-to-use operable controls, displays, and I/O.
2. **Software interfaces.** Easier-to-use software interfaces that support the full stages of social communication activity including planning, setup in physical environment, initiating and conducting social activity, etc.
3. **Communication interfaces.** Ability to use with diversity of people in a variety of environments, and in a plethora of use cases and industry activities.
4. **Dynamic modes and settings.** Having dynamic settings to detect social interaction context as well as optimizing communication mode and language could really help improve the value and adoption of Social AR hardware, apps and services.

Open Questions for Discussion

How can we ensure equitable access to Social AR devices and applications?

- **How do we engage people with more permanent sensory, physical or cognitive disabilities** to co-design so we can provide equitable access to Social AR devices and apps?
- **How do we use the lens of inclusive design to extend the usability of Social AR** to all people who can experience temporary sensory, physical or cognitive limitations? (i.e. design for one, extend to all)
- **What key face-to-face Social AR interactions are imagined in future workplaces,** and how can these be made accessible to everyone?

Resources & Contact Info

- PEAT, [Future of Work – Extended Reality](#)
- PEAT, [Telework & Accessibility Toolkit](#)
- PEAT, [Current virtual meeting platforms accessibility checklist](#)
- Cornell Tech/Verizon, [XR Access Initiative](#)
- XR Collaboration, [Guide - Accessibility](#)
- BBC, Global Experience Language (GEL) – [An emergent AR design framework](#), May 2020
- W3C, [Real-time communication \(RTC\) user requirements](#)



Bill Curtis-Davidson

E: bill.curtis-davidson@wheelhousegroup.com

M: (404) 307-4607

Twitter: [@BCurtisDavidson](https://twitter.com/BCurtisDavidson)

LinkedIn: [BillCurtisDavidson](https://www.linkedin.com/in/BillCurtisDavidson)