2025 XR Access Symposium

3D Diversity

June 26-27, 2025 | New York City, NY

XR Access

Virtual, Augmented, & Mixed Reality for People with Disabilities

Contents

Report authored by Dylan Fox with support from Ria Gualano. Photography by Tim Lee.
AI Disclosure: LLMs were used to generate summaries from transcripts, which were then edited by humans.

Introduction to the 2025 Symposium Report

3D Diversity

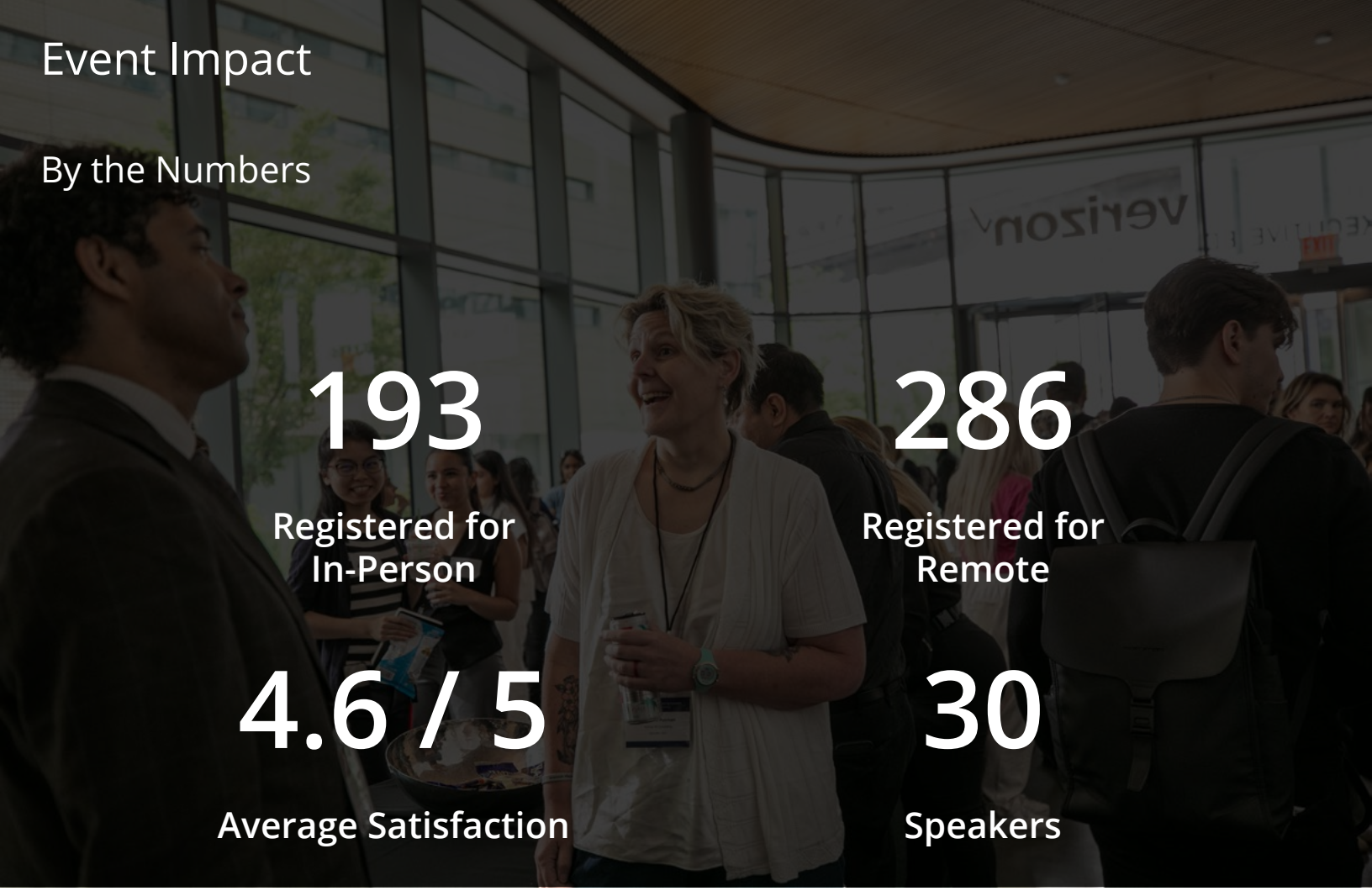
All too often, we hear the same types of voices again and again in technological spaces: the voices of those with ready access to hardware and funding, for whom the technology works simply and smoothly. At this year's XR Access Symposium, held June 26-27, 2025 in New York City, we chose to amplify the voices of people who often struggle to be heard. In addition to the latest technological advances from powerhouses like Meta, we've spotlit artists and academics from the United States and beyond who are challenging the status quo in order to open the power of virtual and augmented reality to everyone, from people with all kinds of disabilities to marginalized people like immigrants and Black women.

In this report, you'll find the best of our photos, summaries, and wisdom from the 2025 Symposium. With 14 plenary sessions, 5 breakouts, and over two dozen exhibits, there was no shortage of wisdom to go around! From talks like "Cripping Up - How We Are Using VR to Challenge Ableism" to demos such as "Echosense: Virtual Navigation through Spatial Audio & Echolocation," the Symposium has once again brough together a smorgasboard of thinkers from all sectors of society.

As you read, we encourage you to think about how the discoveries and experiences here could apply to expanding the impacts of your own work, whether that be in extended reality or beyond. Please join us once again in making XR accessible for all!

Event Impact

By the Numbers



Direct From Our Attendees

"I really appreciated the depth and diversity of material! I don't know that I would aim to improve anything, it was really inspiring and delightful."

"As someone who doesn't have a disability, I learned a lot about the importance of making new technologies accessible to everyone, including people with disabilities. It inspired me to think about how I can incorporate accessibility into my own research and do meaningful work in this area."

"I learned how accessibility and inclusivity can drive innovation in immersive technologies. The emphasis on designing for diverse users, not just ideal cases, shifted my perspective on how XR and AI tools should be developed and evaluated."

"Everyone was very helpful, everyone was so kind and so understanding and knew how to guide those like myself. Very grateful for this experience."

"It was inspiring to see such a diverse community of researchers, creators, and practitioners coming together to shape the future of immersive technologies. The collaborative spirit and openness to new ideas made the Symposium a truly enriching experience. Looking forward to what comes next!"

Sponsors

We'd like to thank our Platinum sponsors Yahoo and the National Science Foundation, as well as our Gold sponsor Meta, for making the 2025 Symposium possible.

Supporting XR Access

XR Access is a research initiative at Cornell University; our mission is to connect and engage stakeholders across the field of XR through events, resource sharing, and other programs. However, we can't do it alone: support from our partners is critical to help us create accessible programming, remain sustainable, and achieve our vision of inclusion.

Industry and academic/non-profit partners who share our mission and goals can help keep XR Access by becoming a research partner or sponsoring next year's Symposium. To learn about becoming a research partner, email info@xraccess.org.

Individuals and organizations can make a one-time or recurring monetary donation of any size to support XR Access's work. Your donation supports XR Access's programs, research, and overall sustainability. One-time or recurring donations can be made via the XR Access website, and are processed by XR Access's parent organization, Cornell University. We also welcome sustaining donations from industry partners.

Acknowledgments

Organizations

We'd like to acknowledge the following for their parts in making the Symposium a success:

- Oxygen Eventworks for providing audio/video support.
- With Direction LLC and 3Play Media for providing disability accommodations.
- Constellation for catering the event.

Conference Chairs

- Dylan Fox, General Chair
- Shiri Azenkot, General Chair
- Ria Gualano, Breakouts Chair
- Ricardo "Ricky" Gonzalez, Exhibit Chair
- Sharon Lin, Volunteer Chair
- Crescentia Jung, Volunteer Chair

Volunteers

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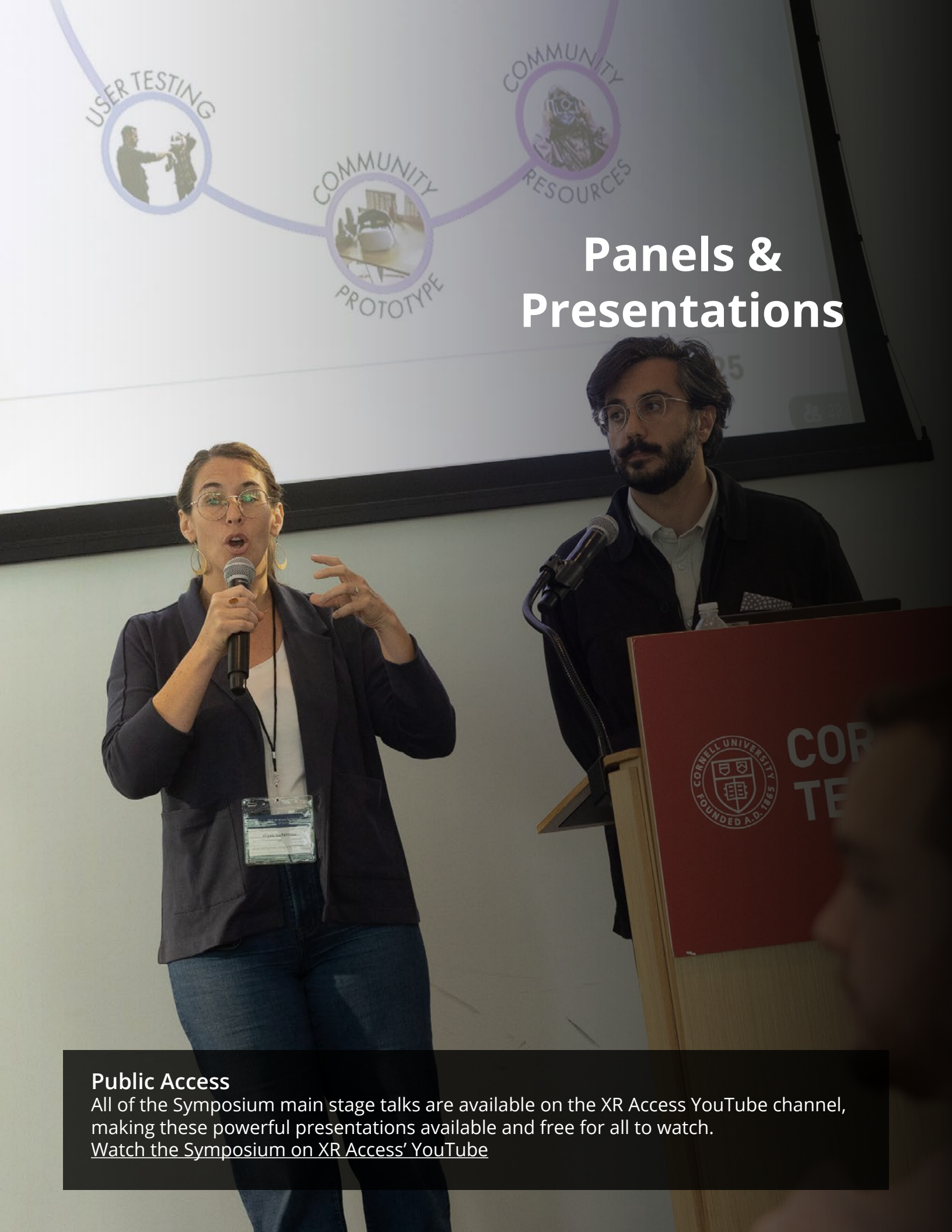


Panels & Presentations

Public Access
All of the Symposium main stage talks are available on the XR Access YouTube channel, making these powerful presentations available and free for all to watch.
Watch the Symposium on XR Access' YouTube

Understanding How Blind and Low Vision Users Relate to and Use An AI-Powered Guide to Enhance VR Accessibility

Jazmin Collins
Cornell University

Virtual reality (VR) environments present a significant visual challenge to individuals who are blind or have low vision (BLV). Collins' research introduces an AI-powered guide designed to enhance VR accessibility, moving beyond mere functionality to foster engaging and even playful user experiences.

Traditionally, sighted human guides have assisted BLV users in visually complex spaces through techniques like "shared movement," where the BLV person physically connects with the guide for navigation and verbal interpretation. However, this approach can lead to feelings of dependence; at least one participant expressed a preference for an AI guide over relying on a person to navigate a virtual space.

To address this, the Cornell team developed an AI guide prototype on Meta Quest 2, creating virtual environments modeled after standard social VR experiences. The system integrates audio input from the user with two screenshots—one from the user's perspective and a bird's-eye view of the environment—to form a query. This query is sent to OpenAI's large language model, which then generates an audio response for the BLV user. The AI guide was given specific guidelines, including describing scenes as if experiencing them from within and adjusting responses based on chosen personas.

Three distinct personas were offered: a warm, professional "human guide," a formal, militaristic "robot guide," and a chatty, eager "guide dog". The AI guide's capabilities included shared movement, following the user, answering visual questions, and adding "audio beacons"—specialized sound effects that help users locate objects by sound. A study with 16 BLV participants revealed that users primarily employed the guide as a background assistant, filling knowledge gaps and facilitating navigation. While the guide's accuracy was around 63.2%, and its usability and usefulness ratings were average, it scored highly for "joy of use" (4.1 out of 5 points).

Crucially, participants became friendlier and more playful with the AI guide in social situations. They used its name, gave it nicknames like "buddy" or "Prince," and even assigned gendered pronouns. Role-playing was particularly prominent with the guide dog persona, with users affectionately referring to it as the "goodest boy" or playfully criticizing it for "going to sleep" or being "on strike and hungry" when it didn't respond as desired.

These findings suggest that future AI accessibility tools should lean into these role-playing behaviors, allowing for more interactive engagements like petting the guide dog or playing fetch. This shift points towards the advantages of embodied accessibility assistants that offer personable interactions, enriching the user experience beyond just providing information. This research highlights the potential for AI to create not just functional, but genuinely enjoyable and engaging accessibility solutions in VR.

Beyond Access: Meaningful Accessibility in Video Games

Brian Smith
Columbia University

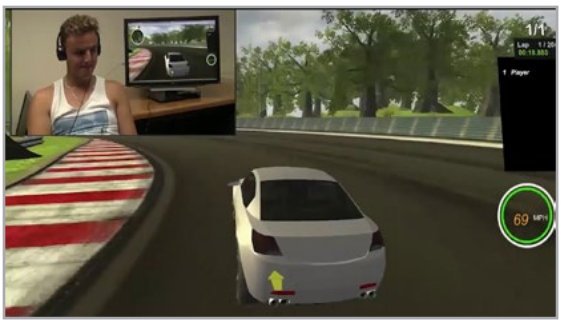
For too long, accessibility in technology, including video games, has focused on simply checking boxes—providing basic functionality without truly enabling an equitable experience. Smith argues that meaningful accessibility is about ensuring people with disabilities can fully partake in experiences that matter, not just access information.

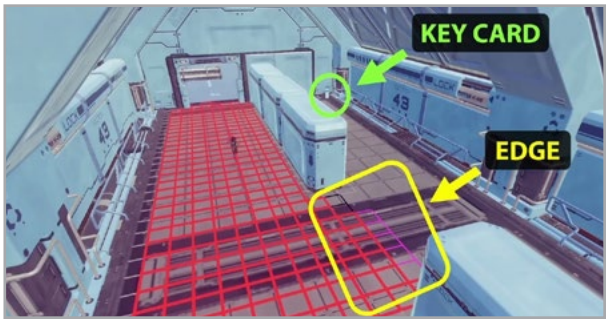
Smith's journey into this philosophy was deeply inspired by Terry Garrett, a blind gamer who, against all odds, mastered "The Legend of Zelda" by creatively leveraging subtle audio cues. This demonstrated that the core elements of gaming—challenge, discovery, and even fellowship in multiplayer—don't inherently require graphics. Yet, traditional accessibility tools often fall short. For instance, adventure games might offer a list of objects, or racing games simply bark "turn left" commands. While informative, these approaches strip away the player's agency and the moment-to-moment choices that define the true gaming experience for sighted players.

To bridge this gap, Smith's Computer-Enabled Abilities Laboratory (CEAL) has developed the Racing Auditory Display (RAD), transforming racing games by providing critical real-time audio cues: a "sound slider" indicating car position and a "turn indicator system" for upcoming curves. While haptic feedback was explored, it often suffered from latency and user confusion, leading their work to lean more heavily on audio cues.

Another groundbreaking project, Project Surveyor, tackles exploration and discovery in 3D game worlds. Instead of a static list of objects, Surveyor empowers players to "look around" virtually using their controller's analog stick, tracking where they've explored and guiding them toward new, undiscovered areas. Both projects have won awards in gaming.

Smith emphasizes that this focus on the "moment-to-moment" experience and player agency evolved through deep engagement with users, including blind individuals who serve as co-designers and co-authors on their research. Ultimately, this research highlights a crucial shift: accessibility isn't just about functional access but about designing for meaningful, engaging experiences that preserve player choice and foster genuine enjoyment. This blueprint extends beyond gaming, offering valuable lessons for any field leveraging XR to create inclusive digital worlds.





VR Interventions for Intersectional Stress Reduction Among Black Women

Dr. Judite Blanc
University of Miami Miller School of Medicine

The complexities of modern life, especially when compounded by systemic inequalities, can create immense stress. For Black women, the cumulative weight of economic hardship, caregiving burdens, racial discrimination, and gender bias contributes to significant mental health challenges and health risks like cardiovascular disease. Dr Blanc's research addresses this need via the use of virtual reality (VR) as an innovative and equitable solution for stress reduction, specifically tailored to the lived experiences and cultural contexts of this population.

Dr. Blanc conducted focus groups and individual interviews with 16 hypertensive and 12 perinatal Black women, exploring their struggles, definitions of resilience, cardiovascular health experiences, and perceptions of immersive technology for self-care. The qualitative findings revealed six major themes, including personal loss and systemic challenges at work and within the current political climate. Crucially, the discussions highlighted the potential role of technology in self-care. While some barriers existed—such as tech literacy, expense, and physical discomfort—many participants expressed openness to VR. A 21-year-old research associate, for instance, saw VR as a valuable "escape" for breaks, allowing her to physically move around and de-stress from demanding studies. Others, like a 20-year-old warehouse worker, were open to VR for meditation, viewing it as a new form of wellness.

A significant advantage identified was the on-demand nature of VR-based interventions. This accessibility is particularly impactful for communities facing transportation challenges, cultural barriers, and the pervasive stigma surrounding mental health services. As one participant noted, the ability to engage with VR programs anytime, even when a child is sleeping or late at night, makes it a "truly available asset" for needed escape.

Dr. Blanc's ongoing work is now using these insights to develop culturally responsive VR prototypes. The goal is to move beyond mere information provision to create immersive experiences that truly transport users away from external stressors, fostering an interactive and engaging path to well-being. This research underscores VR's transformative potential, not just as a tool for therapy, but as a personalized, accessible haven for marginalized communities seeking relief from daily pressures.

Designing Disability-Inclusive Avatars: Representing Chronic Pain Through Social VR Avatar Movement and Appearance

Ria Gualano
Cornell University

In the vibrant, often fantastical landscapes of social virtual reality, our avatars are more than just digital reflections – they are our social proxies, mediating every interaction. Yet, as VR environments become increasingly complex and diverse, a critical question emerges: how inclusive are these digital selves? This challenge is particularly poignant for individuals with invisible disabilities, such as chronic pain conditions. These conditions, which can profoundly impact movement and daily life, are often concealed in the physical world due to stigma and the fear of being perceived as a "burden". But what happens when people want to express this aspect of their identity, or even transcend it, in a virtual space?

Cornell's Ria Gualano research explores how people with chronic pain conditions like arthritis and endometriosis wished to represent their experiences through VR avatar movement and appearance. Through interviews and immersive avatar creation, participants revealed a spectrum of preferences.

A key finding was the profound influence of stigma on pain communication. Many participants desired options to express their pain without explicit disclosure, or even to avoid conversations altogether through a perfectly "put-together" avatar. For some, chronic pain was an integral part of their identity, something to be visibly expressed; for others, it was distinct, and they sought avatars that allowed for escapism or the absence of pain.

The study highlighted temporal motivations for avatar design. Some participants yearned for nostalgia, creating avatars that reflected a past, pre-pain self. Others sought authenticity, representing their current lived experience, while many embraced the opportunity to explore future or alternative selves – taller, older, or entirely free from physical limitations. Some even imagined metaphorical movements for their avatars, like "planking" to represent stomach pain or a "kick to the groin" for sharp discomfort. Some participants desired the translation of physical self-accommodations into the virtual realm, including functional aspects like avoiding certain movements (e.g., jumping) and aesthetic choices, such as clothing options that wouldn't aggravate pain points in the physical world.

The implications for designers are clear: truly inclusive avatar systems must go beyond mere cosmetic customization. They need to offer flexible movement options, allowing users to remap actions or adopt metaphorical expressions of their conditions. Providing diverse clothing styles and textures is essential for comfort and authenticity. Ultimately, empowering users to decide how, and whether, to represent their chronic pain – balancing identity expression with personal safety – is paramount for building truly accessible and meaningful social VR experiences.

Cripping Up – How we are Using VR to Challenge Ableism

Meg Fozzard
Independent

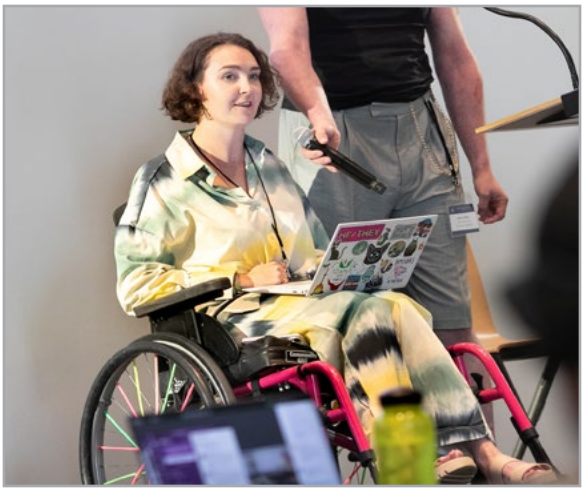
Amy Crighton
Cripping Up

Social virtual reality often promises connection and understanding, but can a digital avatar truly bridge the gap of lived experience? “Cripping Up,” an interactive VR experience, boldly challenges the notion of VR as a simple “empathy machine,” pushing users beyond superficial understanding into a profound confrontation with ableism.

Developed by Meg Fozzard and Amy Crighton, “Cripping Up” invites the audience to embody Meg, a wheelchair user, on what would be a simple journey for an able-bodied person, but for her becomes an odyssey of daily barriers. This isn’t just about seeing through someone else’s eyes; it’s about feeling the friction, the frustration, and the physical exhaustion. The experience recreates moments like getting dressed, catching a bus, and navigating London, punctuated by interactive options. For instance, putting on shoes might trigger the “jerking” movement characteristic of Meg’s limbs, effectively immersing the participant in the bodily reality of her experience.

The project directly critiques the prevalent idea that a brief VR experience can fully convey what it’s like to live with a disability. Fozzard explicitly states her frustration with VR being “touted as an empathy machine” and emphasizes that “just because someone puts on the headset for 20 minutes, does not mean they understand what it is like to be me, day in and day out”. The experience deliberately reminds users of a crucial difference: unlike Meg, they can walk away.

The “Cripping Up” creators hope that participants will recognize some of their own behaviors and feel empowered to take “quiet radical action,” such as moving a bike off a pavement, to foster authentic representation and encourage speaking up. This experience is specifically targeted at individuals who may have general ideas about disability but lack firsthand lived experience, and those who are already politically engaged. By challenging passive empathy and demanding active reflection, “Cripping Up” seeks to spark tangible change in how society perceives and accommodates disability.



Lemmings: Tools For Accessible Gestures

Justin Berry
Yale Center for Immersive Technologies in Pediatrics

In the burgeoning world of XR, intuitive interaction is key, and often, that means gestures. But for many, the intricate hand poses or precise movements typically required can be a significant barrier. Dr. Berry's "Lemmings" project addresses this with an innovative Unity development toolkit, poised to transform how we interact with virtual environments and prioritizing inclusivity from the ground up.

The core problem is that most current XR gesture designs are rigid and difficult to remap. They often rely on specific, high-fidelity configurations of the entire hand, making them inaccessible for individuals with limited mobility or those who simply cannot perform a particular gesture (e.g., someone without a left hand needing to make a left-hand gesture). Furthermore, many solutions are tied to specific hardware, lacking adaptability across different headsets.

"Lemmings" tackles this by fundamentally rethinking gesture design. Instead of focusing on fixed hand shapes, it breaks down complex gestures into a few tracked features and their spatial relationships. Imagine a "thumbs-up" gesture not as a precise finger configuration, but as a relationship between, say, the thumb and the palm. This approach allows users to redefine gestures based on their unique abilities and comfort. A "pinch" could be remapped to a head turn, or an arm stretch to the opening of a palm, offering unparalleled flexibility.

Key innovations include:

- **Hardware Agnostic Design:** Lemmings is built to work with any existing motion tracking system, ensuring broad compatibility.
- **User-Defined Thresholds:** Lemmings allows users to intuitively set minimum and maximum values for gestures by simply performing the movement they are comfortable with and clicking a button. This enables real-time adjustments, crucial for users experiencing fatigue or fluctuating mobility.
- **Low-Fidelity Focus:** The system doesn't demand perfect tracking of every single joint, making it more robust and adaptable to varied body movements.

Berry envisions "Lemmings" being a foundational tool for a wide range of applications, from enabling children with smaller bodies to effectively use full-body VR experiences, to assisting patients in occupational therapy by adapting to their increasing flexibility, and even empowering musicians with injuries to play instruments in new ways. As an open-source project, "Lemmings" invites the entire XR community to collaborate on building a truly accessible future and making XR usable and enjoyable for everyone.

Augmented Reality Navigation System for Wheelchair Users

Anis Idrizović
University of Rochester

Navigating the world, particularly bustling university campuses or urban centers, presents unique challenges for wheelchair users. Despite claims of "fully accessible" spaces, real-world barriers like staircases often confound even advanced mapping tools. This critical gap in accessible navigation software has prompted a team at the University of Rochester to develop a groundbreaking Augmented Reality (AR) Navigation App specifically for wheelchair users.

Md Mamunur Rashid
University of Rochester

Presented by Anis Idrizović, Md Mamunur Rashid, and Huiran Yu, this project tackles the problem head-on. As they discovered, even Google Maps, when asked for a wheelchair-accessible route, can erroneously direct users down stairs. To address this, their team collaborated with LBS tech, a Korean company specializing in location-based services for accessible navigation, to collect crucial accessibility data. This involved gathering information and photographs of various routes, building entrances, and even types of doors and stairs across the University of Rochester campus.

Huiran Yu
University of Rochester

The resulting AR Navigation App is designed to provide optimal user experience, thanks in part to direct feedback from a disability expert. Key features of the app include:

- **Wheelchair-accessible navigation:** Explicitly avoiding stairs and other blockages.
- **Real-time AR visualization:** Presenting clear directions with large banners and arrows overlaid on the physical environment.
- **Estimated travel time and distance:** Incorporating a unique in-house algorithm that calculates travel time specifically for wheelchair users based on geographic conditions.
- **Specific building entrance visualization:** Making it easier to locate final destinations by showing door widths and entrance types.
- **Voice feedback:** Enabling hands-free operation.

Looking ahead, the team has ambitious plans to expand the app's scope beyond their campus, potentially to the entire USA. Future enhancements include adding more voice prompts, integrating with existing wheelchair technologies, and mapping essential features like emergency safe spaces and gender-neutral bathrooms. The project also envisions leveraging AR glasses for an even more immersive experience.

XR for Autistic Inclusion: Balancing Innovation with Ethics

Nigel Newbutt
University of Florida

As XR technologies rapidly advance, ensuring they are ethically designed and truly inclusive for neurodivergent populations like autistic individuals, is a critical and often overlooked challenge. XR ethical practices concerning neurodivergent populations are poorly defined and infrequently enforced. This oversight is particularly concerning given that one in 31 children in the U.S. are diagnosed as autistic and one in 4 are neurodivergent. Current XR designs often cater to neurotypical norms, risking significant harm through sensory overstimulation, emotional discomfort, and data exploitation. Despite nearly three decades of XR research, ethical guidance has not kept pace with the technology's rapid evolution; only one paper (Jones et al, 2023) meaningfully addresses or recognizes ethical risks for autistic users.

To address these "ethical blind spots", Dr. Newbutt proposes a framework encompassing three key areas:

- **Safeguarding:** This includes developing clear, easy-to-understand consent processes for users who may struggle with complex language, recognizing potential platform risks, and ensuring researchers are trained in safeguarding.
- **Accessibility:** It's crucial to adopt co-design methodologies, meaningfully involving neurodivergent individuals at all stages of research and development, and building neurodiverse research teams.
- **Well-being:** Mitigating risks like sensory overload and disorientation requires careful experience design, debriefing, and engaging stakeholders like families and caregivers.

Done properly, XR can support social skill development, navigation & communication, sensory regulation, and skill acquisition for neurodivergent individuals. XR that is customizable, predictable, and low-risk can provide safe spaces for reducing anxiety and mastering new techniques.

Dr. Newbutt emphasizes that inclusive design is not just a technical feature; it's an ethical imperative. Proactively engaging autistic communities and allowing their voices to shape development is essential to ensure XR genuinely benefits, rather than marginalizes, these populations.

AI Advancement in Wearable and MR Technology

The future of accessibility isn't just about specialized tools; it's increasingly woven into the fabric of mainstream technology, particularly in the rapidly evolving world of AI-powered wearables and mixed reality (MR). Meta is at the forefront of this integration, showcasing how AI is being embedded into unobtrusive, stylish hardware. Their Ray-Ban Meta glasses, for instance, now offer Meta AI the ability to provide detailed, real-time descriptions of the environment through voice queries, allowing users to understand what's in front of them without needing to hold a phone. Looking further ahead, Meta's advanced augmented reality glasses, Orion, promise hands-free communication, navigation, and even eye-tracking for interface control, using muscle signals captured by a wristband.

Agustya Mehta, drawing from his personal experience with his mother's guide dog, highlighted the long-standing limitations of traditional assistive solutions, emphasizing that even the best guide dog can't read a sign. This underscores a fundamental shift: from standalone aids to implicitly accessible designs built into devices we use every day.

A cornerstone of this innovation is Project Aria, an open research program accelerating machine perception and contextual AI for future wearable AI glasses. These advanced research glasses, featuring multiple cameras, eye-tracking, and on-board computing, can track user location with millimeter accuracy and even full body pose, demonstrating the potential for truly integrated spatial awareness. In a powerful example, the Envision prototype, running on Aria, enabled LightHouse for the Blind CEO Sharon Giovinazzo to navigate through a grocery store via a spatialized audio beacon and pick out granny smith apples from among a variety.

This push for inclusive design is driven by a core philosophy: "Nothing about us without us". Many impactful features have emerged from bottom-up efforts within Meta, proving that real change can come from anywhere in an organization when diverse voices are centered. As AI and wearable technologies continue to mature, they promise to create not just more functional devices, but experiences that genuinely empower everyone.

Agustya Mehta
Meta Reality Labs

Matthew Bambach
Meta Reality Labs

Prince Gupta
Meta Reality Labs

Aesthetic Access for VR: Centering Disabled Artistry

Kiira Benz
Double Eye Studios

Alice Sheppard
Kinetic Light

Kiira Benz and Alice Sheppard from Double Eye Studios and Kinetic Light offered a compelling vision for integrating accessibility directly into the creative process of virtual reality experiences. Moving beyond traditional after-the-fact accommodations, their work champions the idea that access is not merely a functional add-on, but an inherent part of the art itself. Their project, "territory," serves as a groundbreaking case study.

This PC-VR experience delves into the evocative theme of barbed wire, exploring how it connects and disconnects humans and their environment. What makes "territory" revolutionary is its commitment to equitable accessibility from the ground up, ensuring that disabled audiences receive an artistically equivalent experience.

To achieve this, the team implemented several innovative techniques:

- **Integrated Choreography and Sound:** The visual choreography was intrinsically linked with a sonically compelling score. Rhythmic and light motifs were generated for characters, allowing listeners to track their presence and movement in the 3D space. Sound effects, haptic effects, and visual elements were all meticulously synchronized.
- **Artistic Audio Description:** Unlike standard descriptive tracks, "territory" offers ten different audio description tracks, blended into five selectable options. These descriptions go beyond mere factual narration, incorporating artistic interpretations of visual material, poetry, monologues, and soundscapes to create a rich, equitable audio experience.
- **Advanced Closed Captions:** Two distinct sets of captions were developed. One interprets the musical score and sound effects, while the second set exists within the virtual world itself, following characters and even large props like the barbed wire. These specialized captions employ varying color palettes, sizes, and locations to connect with specific characters or sound effects, functioning as visual leitmotifs.
- **Narrative Haptics:** Leveraging Meta Haptics Studio, "territory" is one of the first PC VR experiences to weave narrative haptics into the experience. These vibrations align with characters, sound effects, and music, transforming tactile feedback from a simple rumble into a storytelling element, creating a truly multi-sensory encounter.

This pioneering approach demonstrates that access is an act of equity that fundamentally transforms and expands how we experience art. For professionals in XR, this work highlights the immense potential of designing for inclusion from the outset, moving beyond basic functionality to craft truly meaningful and immersive experiences for everyone.

Accessibility Innovations for Extended Reality Drama and Documentary

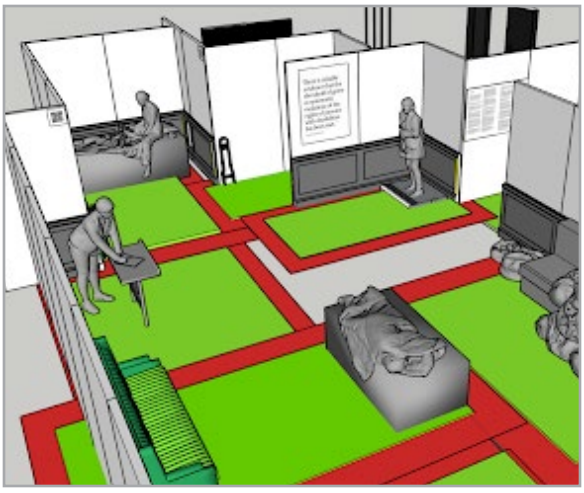
Sacha Wares
Trial and Error Studio

In the rapidly evolving landscape of extended reality, Sacha Wares, founder of Trial and Error Studio, is challenging the traditional "add-on" approach to accessibility. Her presentation revealed how cutting-edge XR projects are weaving accessibility into their very fabric, transforming how we experience art. Wares, a veteran of theater, noted a historical gap: while traditional theater often has dedicated accessibility teams, the burgeoning world of new technologies initially offered little support.

Wares showcased two groundbreaking projects. The first, "Museum of Austerity," is a mixed-reality exhibition exploring the devastating impact of UK benefit system changes on disabled individuals. Experienced via HoloLens headsets, the piece uses sound triggered by audience proximity to holograms, shifting between intimate family testimonies and political rhetoric. Its comprehensive accessibility features include British Sign Language (BSL) onboarding, in-headset captions, audio-described introductions, spatialized audio description, and even options to remove sensitive content. The team learned crucial lessons, such as accounting for wheelchair users who reverse rather than turn, and the unexpected impact of "holographic feet" blocking pathways.

Her second project, "Inside," is a multisensory VR docu-drama about sculptor Judith Scott, who was deaf and had Down's Syndrome. This dialogue-free experience masterfully employs multisensory inputs to guide attention and convey narrative beyond traditional text or audio. Audiences feel the wind from fans, vibrations (like a father sanding wood), and experience shifting sunlight and various scents. This bold use of universal design principles showcases how XR can create rich, inclusive narratives for those who may not engage with conventional language.

Wares' work underscores a critical message for the tech industry: designing for accessibility from the outset not only prevents barriers but unlocks profound new artistic and experiential possibilities. It demands a commitment to testing, diverse teams, and a willingness to learn from every "mistake".



I4AD: Diverse Perspectives from BLV Users on Designing Immersive, Interactive, Intelligent, and Individualized Audio Description Framework for VR Musical Performances

Khang Dang
New Jersey Institute of Technology

Virtual reality musical performances, with their dazzling visuals and immersive soundscapes, often leave a significant audience behind: blind and low-vision (BLV) users. A staggering 68% of BLV individuals surveyed by Khang Dang's team reported never watching an on-screen musical because they couldn't understand the visual elements. To bridge this critical gap, Dang, a PhD candidate at New Jersey Institute of Technology, introduced the I4AD framework: Immersion, Interactivity, Intelligence, and Individualization.

The I4AD framework rethinks audio descriptions (AD) for VR musicals, moving beyond passive narration to create a truly inclusive artistic experience. **Immersion** is enhanced through spatial audio description, where the voice of the narrator moves in 3D space, tracking with performers or objects. This allows listeners to intuitively understand movement and presence in the virtual environment, mimicking how a sighted person would naturally follow action.

Interactivity is built into view-dependent audio description. As users turn their heads, the description shifts to explain what's currently in their view, making the experience dynamic and exploratory rather than a fixed narrative. For moments where traditional descriptions might overlap with fast-paced lyrics or music, the **Intelligence** component introduces an AI guide. This innovative feature allows users to pause the performance and ask questions on-demand for more context about the scene, filling knowledge gaps that standard AD can't address due to time constraints.

Finally, **Individualization** ensures the experience is tailored to each user. The AI learns individual preferences for the level of detail, the type of visualization desired, and even the tone of the AI's voice. This level of personalization, built on feedback from BLV users and professionals, allows for a truly unique and engaging encounter with the art.

The I4AD framework offers a powerful blueprint for designing VR musical experiences that are not just accessible, but profoundly immersive and equitable for all, transforming a typically visual medium into a rich, multi-sensory art form.

Immersive Environments for Resettlement

Milad Mozari
Univeristy of Utah

Krysti Nellermoe
International Rescue Committee

Accessibility comes in many forms, including disability as well as other constraints in accessing content. Nellermoe and Mizari highlight the latter by presenting a compelling initiative that leverages virtual reality to empower refugee and immigrant communities by addressing critical digital literacy gaps and navigation challenges. This project moves beyond conventional VR philanthropy, which often portrays refugees as passive subjects, to actively create tools for their benefit.

Newcomers often face significant stressors, including economic hardship, language barriers, and navigating unfamiliar systems like healthcare and public transportation. The "fishbowl effect"—where external media focuses on despair rather than support—highlights the urgent need for tailored solutions. This initiative tackles this by embedding VR experiences into mandatory cultural orientation courses, making vital information accessible and engaging. The core of their approach is a co-creative process involving newcomers, university students, and service providers. They develop 360° VR videos and an immersive game, "Juniper City," that simulates real-life situations such as taking a bus or visiting a doctor's office. A key innovation is their reliance on visual language to bypass translation barriers inherent in diverse communities.

The benefits are profound:

- **Vicarious Agency:** By embodying real-world scenarios in VR, users gain confidence and practical skills for navigating their new environment, fostering a sense of empowerment.
- **Trauma-Informed Design:** The content is deliberately crafted to be present and future-focused, emphasizing daily tasks and avoiding triggers to ensure a safe and supportive experience.
- **Digital Literacy:** The project makes complex technology approachable, bridging the gap for individuals who may have never used a smartphone or computer.
- **Universal Tool:** Pilot studies have shown wide receptivity, with participants across diverse backgrounds, including older women, appreciating the immersive learning.

This initiative exemplifies how XR can provide an equitable escape and learning environment, offering a scalable model for addressing critical needs in resettlement services and fostering true inclusion. It highlights the power of intentional design and community-led development in making cutting-edge technology a force for social good.

Breakout Sessions

Our Breakout Sessions offered an opportunity for all of the experts and experienced members of our community to come together and brainstorm solutions to the greatest problems in XR accessibility. Each breakout session was a one-hour group discussion, moderated by experienced leaders, to talk about the challenges facing us with regards to XR accessibility and how we can best solve them. There were 5 breakout sessions, held on the afternoon of June 26, 2025; each attendee could choose one to attend.

Full breakout session information

1 Disability, Content Creation and the Arts

Moderators: Steven McCoy, Spoken Heroes; Kiira Benz, Double Eye Studios

When does access begin? It should not start after the experience has been made, but rather at the very beginning, prior to production, and it should involve disabled people at all stages of planning. When creating accessible artistic experiences, it is important to consider everything from choreography and costume alongside access considerations like the color, size and shape of captioning.

How do we encounter space, especially when bringing together the digital and the physical? Perhaps two-dimensional and three-dimensional environments should be considered alternatives that expand access options for neurodiverse audiences. Or perhaps space is where a person can share and collaborate, incorporating their lived experiences. People are experts on their lives, and collaboration can expand who is represented in various spaces.

2 Neurodiversity and XR

Moderators: Nigel Newbutt, University of Florida; Logan Ashbaugh, CSU San Bernardino

What features of XR could be useful for neurodivergent users? What current barriers limit accessibility and neuro-inclusive design? It is essential to design for inclusion from the start using “born accessible” design techniques rather than designing for inclusion as an afterthought. This could manifest in moves toward reducing technical barriers, like complex controls, and integrating intuitive features, such as motion cues.

What strategies can be employed to elevate awareness across XR ecosystem, academia, policy? How can neurodivergent individuals be meaningfully centered in the research of the evaluation of XR systems? At present, there is a disconnect between research, industry, and policy. More awareness, ethical practices, and success stories are needed to drive adoption and funding for accessible XR. Furthermore, inclusion goes beyond consultation. Neurodivergent people should be collaborators or co-authors in XR research and design to ensure these processes reflect real needs.

3 XR/AI Policy & Standards

Moderators: Larry Goldberg, Independent; Michael Bervell, TestParty; Peirce Clark, XR Association

Organizations like XR Access, the XR Association, and the Metaverse Standards Forum are building proactive best practices to address pressing issues in XR and AI, as are disability organizations involved in building AI principles. Many groups are training parents and others to get involved in these discussions directly, especially recognizing potential harms. What are the risks of people with disabilities using AI tools prior to their regulation, especially concerning data security or harmful user experiences? And how do you know if you are using AI for good?

There are concerns spanning aspects of numerous industries, including resumes, healthcare and voting. Further, can AI be used as an accessible web design tool, especially when considering AI models are often built around an "average" person rather than people with disabilities? Perhaps the concept of personalization rather than generalization can make a difference, as well as historical pushes toward legally mandated access requirements for other technologies. Regardless, there is a need for diverse voices in AI policy.

4 Accessible Game Design

Moderator: Brian Smith, Columbia

How can meaningful accessibility be incorporated into game design? Blind and low vision gamers experience the same game differently from sighted gamers, and these experiences can be captured in the game industry's eight types of fun: Sensation, Fantasy, Narrative, Challenge, Fellowship, Discovery, Expression and Submission.

Through an accessible lens, there are numerous considerations, like what kinds of audio descriptions matter the most for blind and low vision players. Other questions surround player experiences of the eight types of fun. Challenge, for example, begs the question: are blind and low vision players losing for the same reasons as sighted players? If not, then they are not accessing the same experience. It is important to incorporate and universalize fun so that everyone can feel good about hitting challenges without feeling othered or disabled by them or the language often used in gaming spaces, such as terms like "handicaps." Customization tends to be the conclusion in gaming, but it can be hard to implement, necessitating a compromise between player customization and designer intention.

5 XR in Healthcare

Moderators: Judite Blanc, University of Miami Miller School of Medicine; Chelsea Twan, NYU Langone Health

What strategies can we use to address intrapersonal, interpersonal and systemic barriers to XR access in healthcare? A key concern is the gap in access within certain communities, particularly related to infrastructure, digital literacy, and necessary technology. In part, this may be due to complex emotions that complicate reception and outreach efforts toward building digital literacy.

Additionally, collaboration between academic institutions and the healthcare industry presents notable difficulties, as these sectors often pursue divergent goals toward “publish or perish” constraints, patient outcomes, or profit at the expense of these outcomes. To improve collaboration among diverse stakeholders, a participatory community approach is essential. Moreover, it is crucial to involve individuals who can effectively bridge the communication gap between patients/users, healthcare professionals, and developers. Establishing advisory boards and conducting user testing are also critical components of ensuring inclusive and meaningful engagement.

Exhibits

Full Exhibit List

Our app demonstrations and poster sessions gave the Symposium audience a look at the latest and greatest in XR accessibility research and projects. Select exhibit materials can be found here.

Demos

1. **Aesthetic Access for VR: Centering Disabled Artistry**
   Kiira Benz & Alice Sheppard, Double Eye Studios & Kinetic Light
   Attendees will step into "territory," an equitably accessible PC-VR experience that pairs narrative haptics (Meta Haptics Studio) with music, audio description, and artistic closed captions, showcasing ground-breaking aesthetic access from pre-production through virtual world-building.
2. **AI Advancement in Wearable and MR Technology**
   Agustya Mehta & Matthew Bambach, Meta
   Attendees will explore Meta prototypes highlighting new AI-powered features in wearables and mixed-reality headsets, illustrating how these advances translate to AR and drive accessible XR.
3. **Customize Accessibility on Apple Vision Pro**
   Rob Dietz, Weill Cornell Medicine
   This demo invites attendees to experiment with Vision Pro voice commands, eye/hand tracking, Siri shortcuts, and head-mounted capture, showing how built-in tools can be pushed further to accomplish complex tasks with simpler input.
4. **Designing for Local Community Issues Using AR Rapid Prototyping and Ideation**
   Daniel Enriquez, Cornell Tech
   An AR application lets attendees freely place sketch-ups over real locations, creating high-contrast navigational cues on the fly and enabling low-vision users to augment physical space without permanent modification.
5. **Echosense: Virtual Navigation through Spatial Audio & Echolocation**
   Connor Pugh, Jake Araujo-Simon, Rajshri Jain, and Rhythm Raghuwanshi, Cornell Tech
   Attendees can navigate a virtual scene as Echosense converts sonar-style scans and geometry processing into rich spatial audio, conveying fundamental geometric information directly via sound.
6. **EnVisionVR: A Scene Interpretation Tool for Visual Accessibility in Virtual Reality**
   Junlong Chen & Vanja Garaj, University of Cambridge / Brunel Design School
   Attendees will use voice input with a Vision Language Model and multimodal feedback to interpret VR scenes and locate virtual objects, demonstrating a novel accessibility pipeline for BLV users.
7. **Exploring VR for Emotional Self-Regulation in a Disabled Community**
   Jesús Eduardo Russián, University of the West of Scotland
   Two side-by-side stations let attendees compare a calming 360° nature video with an interactive VR game, examining how each approach supports emotional self-regulation and accessibility.
8. **Hands-on InclusiveVR@Work: Demonstrating Customizable Virtual Workspaces for Accessibility**
   Julia Anken, Karlsruhe Institute of Technology
   Attendees will build individualized VR workspaces with flexible input, multi-monitor layouts, focus modes, and adjustable color, contrast, magnifier, lighting, and ambience, showcasing collaborative virtual environments tailored to each user.
9. **Inclusive VR Card Deck**
   Shiyun "Joanne" Tang, New York University
   In this interactive card game, attendees draw Accessibility Challenge and AI Tools cards to brainstorm inclusive VR strategies, turning complex 3D ideation into approachable 2D solutions while sparking fresh ideas for inclusive design.

10. **Lemmings: Tools for Accessible Gestures - BEST DEMO**
    Justin Berry, Yale University
    Live Unity scenes show how complex gestures are decomposed into a few tracked features, letting attendees remap actions—like a pinch to a head turn—advancing gesture and motion-powered interaction for accessibility.
11. **MapIO: A Gestural and Conversational Interface for Tactile Maps**
    James M. Coughlan, Smith-Kettlewell Eye Research Institute
    Attendees point to tactile map features and ask verbal questions; a camera tracks finger location, queries an LLM, and provides audio answers plus real-time step-by-step guidance.
12. **Virtual Reality Interventions for Intersectional Stress Reduction Among Black Women**
    Judite Blanc, University of Miami Miller School of Medicine
    Attendees can experience excerpts from NurtureVR™ and First Resort, sampling mindfulness, relaxation, and blood-pressure-management activities designed to address intersectional stressors and highlight VR's escapism benefits
13. **Accessibility Innovations for Extended Reality Drama and Documentary**
    Sacha Wares, Trial and Error Studio
    Museum of Austerity is a mixed reality exhibition exploring links between the deaths of disabled people and changes to the UK benefit system.

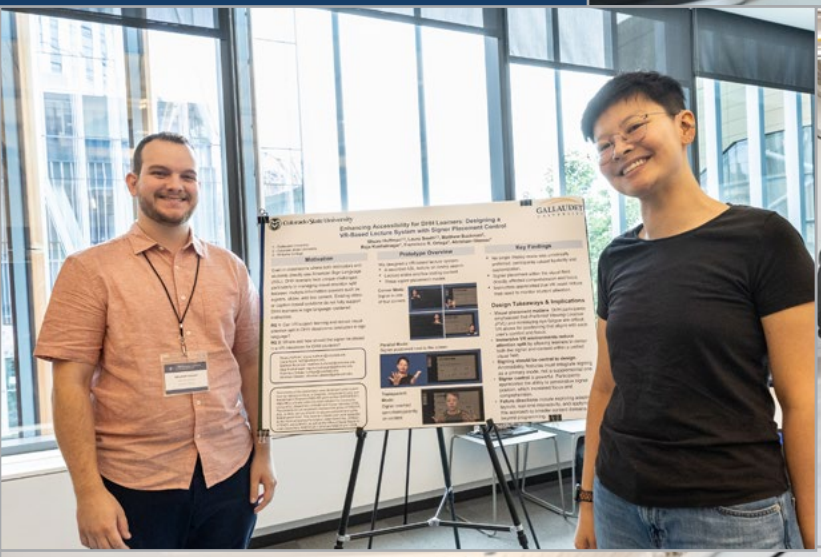
Posters

14. **Accessibility and Neurodiversity in XR**
    Logan Ashbaugh, California State University San Bernardino
    Building on a disability-design literature review, this poster shares collaboratively refined guidelines for creating XR applications that address the needs of neurodivergent users.
15. **Assembly and Expression in XR: Transposing Human Rights Across Realities**
    Emmie Hine, Yale Digital Ethics Center
    Through case studies of virtual protests, art, and public discourse, the poster proposes a rights-protection framework that weighs embodiment levels and public-function doctrine to help platforms uphold assembly and expression for marginalized groups in XR.
16. **Designing AI-Avatars to Support Young Adults in Emotion and Positive Self-talk**
    Ann-Kareen Gedeus, Cornell University & Cornell Tech
    Participatory design sessions with therapists and young adults refine verbal and non-verbal AI-avatar behaviors, laying groundwork for a mobile app that pairs avatars with calming XR scenes to encourage positive self-talk.
17. **Empowering Inclusive Care: An Immersive VR Training Program for Neurodiverse Patient Interactions - BEST POSTER**
    Lynn Xu & Chelsea Twan, NYU Langone Health
    Details a Meta Quest 3 prototype that places clinicians inside sensory-rich exam scenarios co-designed with autistic and ADHD self-advocates. Motion-tracking and haptic cues highlight body language, while pre- and post-surveys chart gains in empathy, bias reduction, and communication confidence.
18. **Enhancing Learning Platforms for Individuals with ADHD in XR Education**
    Veronica Pimenova, Carnegie Mellon University
    Building on a controlled study where segmented videos lowered errors and hesitations, this poster shows how "pause-and-chunk" pacing, micro-goals, and lightweight progress cues can be embedded in XR lessons to tame cognitive load for ADHD learners.

19. **Exploring Reading in Augmented Reality for People with Dementia**
    Rupsha Mutsuddi, York University
    Mixed-reality prototypes add contextual audio prompts and enlarged, glance-able text to everyday reading. This poster shows how field sessions with adults in early-stage dementia surface design rules for cognitively accessible MR, such as limited menus, gentle animations, and easy exits.
20. **Exploring Virtual Reality to Mitigate Visual Split in Computer Science Education for Deaf and Hard of Hearing Classrooms**
    Shuxu Huffman, Gallaudet University
    The poster compares Transparent, Parallel, and Corner signer placements in a 15-minute ASL "binary search" lecture. Results show VR reduces attention-split and eye-strain, pointing toward signer-aware layouts for inclusive STEM instruction.
21. **Good Intentions, Real Barriers: Investigating Accessibility in XR Workflows**
    Mrunmai Abhyankar, XR Access
    Interviews with XR devs and testers reveal that existing guidelines are "too scattered." The poster presents a prototype information-architecture that groups checkpoints by build phase and impairment domain, making best practices more searchable and actionable.
22. **Inclusive Immersion: Accessible AR and VR for High School Education in Controlled Environment Agriculture**
    Maryam Bigonah, Auburn University
    A web-based greenhouse simulator merges stochastic crop models with Universal Design for Learning. The poster demos haptic-ready Accessible VR and screen-reader-friendly AR views that let all students practice sustainable farming decisions.
23. **INDYvr: Towards an Ergonomics-Based Framework for Inclusive and Dynamic Personalizations of Virtual Reality Environments**
    Raquel T. Cabrera-Araya, Texas A&M University
    Six linked modules capture reachability and walkability metrics, then reposition objects and adjust architecture in real time for diverse physical abilities. The poster visualizes how parametric rules reposition items in real time for shorter, wheelchair, or limited-reach users.
24. **Resilient Realities: A Deep Dive into the VR Journeys of People with Disabilities**
    Divya Laxman Bhadargade & Sanchay Murugan, Iowa State University
    This poster explores the motivations and goals of individuals with physical and cognitive conditions when using immersive technologies. Diary studies and contextual interviews document in-context XR use and surface barriers that shape "adapt and ignore" coping tactics, offering concrete recommendations for future inclusive XR development.
25. **Virtual Reality-Based Sensory Motor Rehabilitation Process**
    Dinesh Bhathad
    The poster introduces a VR rehabilitation model in which stroke survivors trace a therapist's finger movements and stack virtual boxes. Mobility changes are quantified against baseline values, giving patients convenient at-home therapy and data-driven motivation to keep exercising.
26. **XR-Enabled Clinics: Advancing Healthcare Access for Rural Communities Through Telehealth & Rehabilitation**
    Emily Lin & Sarah Canlas, University of Michigan
    This poster describes a Community Health Hub pilot in rural Michigan that layers XR, telehealth, digital-literacy workshops, and participatory design to create a scalable model for rural digital health equity in broadband-enabled regions.

Clockwise from top:

- “MapIO: A Gestural and Conversational Interface for Tactile Maps”
- “Aesthetic Access for VR: Centering Disabled Artistry”
- “Exploring VR for Emotional Self-Regulation in a Disabled Community”
- Symposium attendees enjoy the demo floor.
- “Exploring Virtual Reality to Mitigate Visual Split in Computer Science Education for Deaf and Hard of Hearing Classrooms”



Clockwise from top:

- Poster hall
- “Designing for Local Community Issues Using AR Rapid Prototyping and Ideation”
- Attendees try out the many VR demos on display. (x2)
- “INDYvr: Towards an Ergonomics-based Framework for Inclusive and Dynamic Personalizations of Virtual Reality Environments”


Towards a More
Accessible Future
XR Access

Key Takeaways

The 2025 Symposium held a bevy of unique insights into XR accessibility, far too many to be encapsulated here. Nonetheless, three trends shone through across multiple aspects of this year's Symposium.

Silicon Support

Artificial Intelligence (AI) is growing by leaps and bounds, and offers the potential to be a powerful tool for accessibility. But just like other technologies, we need to carefully consider the needs and views of those with disabilities in the training and deployment of AI technologies. Collin's presentation on AI Guides showed that the form factor of AI matters - we treat an agent shaped like a dog differently than one shaped like a human or a robot. Meanwhile, Meta's new "high-detail" mode for smartglasses shares information about its user's environment that sighted users might take for granted; and their integration of advanced sensors and compute power will continue to open up new possibilities.

Accessible Art

Though accessibility often focuses on the functional, art is a vital piece of the human experience, and everyone deserves to enjoy it. This year's Symposium explored new ways that XR-powered art can be made accessible, such as Wares' multisensory film "Inside" exploiting sound, haptics, and even scent; and Dhang's I4AD framework for describing chaotic 360° musicals. Works like "Cripping Up" and "territory" also showed the power of XR for storytelling, enabling disabled creators to communicate their experiences and visions like never before.

Make Room for Marginalized People

People come in nigh-infinite varieties, and it's vital to make room for the people that fall or are pushed outside the center. Even within the world of accessibility, some groups are often forgotten; Nigel Newbutt's presentation on "XR for Autistic Inclusion" showed how this has been the case for neurodiverse populations. Beyond that, groups like black women and immigrants that have often been given short shrift stand to benefit from inclusively-designed XR.

Looking Ahead

2025 marked another great Symposium, bringing together a wider variety than ever of knowledgeable and passionate people who care about making technology into a force for good. It's always encouraging to see so many commit to ensuring that we take seriously the needs and voices of disabled and otherwise marginalized people.

XR Access' work continues in the year ahead. We will be pushing ahead on our research into the ways that blind and low-vision people interact with AI and XR, exploring how people work with agents to shape their immersive experiences. Our Accessibility group in the Metaverse Standards Forum has been upgraded to a working group from an exploratory group, and we continue to work together with members of industry and academia to create a set of comprehensive accessibility criteria for XR accessibility. We also continue to hold monthly seminars to get the word out about the latest research, and Round Table discussions to provide a place for members of our community to gather and discuss.

However, this year has marked a big change in the landscape of federal funding in the United States. Now more than ever, we need the support of forward-minded organizations interested in sponsoring our Symposium and other activities. If you would like to support or collaborate with XR Access, don't hesitate to reach out to us at info@xraccess.org.

Finally, we'd like to once again thank everyone who came together and made the 2025 Symposium a great success: chairs, speakers, sponsors, volunteers, and everyone who made time in their lives for XR accessibility. (Including you, reader!) If you want to join XR Access and help secure a more equitable and accessible future, make sure to visit our website, sign up for our newsletter, and join our community on Slack. Looking forward to an even better 2026!