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Current and Potential Uses of AR/VR for Equity and Inclusion

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AR/VR can make important contributions to equity and inclusion if it is designed with these goals in mind. It can serve as a tool to help tackle implicit biases, improve access to opportunities, and create new channels for communication, community, and collaboration across distances.

KEY TAKEAWAYS

- AR/VR technologies, due to their highly adaptable and immersive nature, are uniquely positioned to reduce barriers and create opportunities for marginalized groups and underserved communities.
- By creating the feeling of "really being there," immersive experiences offer new possibilities for bias training in key areas such as education and law enforcement, as well as corporate diversity, equity, and inclusion initiatives.
- Immersive technologies can make virtual services and experiences available to people who would otherwise be unable to access them because of geographic distance.
- AR/VR devices and applications can serve as assistive technologies for people with disabilities, making physical environments more accessible by adding virtual elements.
- Multi-user AR/VR experiences enable otherwise isolated users to form communities and support systems beyond the bounds of physical distance.
- Despite evident benefits, AR/VR is not a silver-bullet solution to equity and inclusion challenges. Further research is needed to better understand the efficacy of these tools, particularly for empathy and bias training.

INTRODUCTION

Digital technologies have played an important role in reducing opportunity gaps, especially among members of underserved and disadvantaged communities. From assistive technologies that allow people with disabilities to live more independently to social networks that help isolated users discover new systems of support, to telehealth and e-learning platforms that provide access to healthcare services and educational opportunities to underserved populations, these technologies have encouraged innovative solutions to inequity.

Augmented and virtual reality (AR/VR)—immersive technologies that enable users to experience digitally rendered content in both physical and virtual space—is a relatively new form of personal computing. But AR/VR enthusiasts hope these technologies will grow to become as ubiquitous as today's personal computing and digital communications devices. As such, AR/VR could make important contributions to equity and inclusion if designed with these goals in mind, presenting opportunities to reimagine how users interact with the world.

AR/VR Equity & Inclusion Series

AR/VR devices and applications are uniquely positioned to enhance equity and inclusion efforts. First, they use a diverse set of sensors and inputs as well as digital outputs. This means that they have the potential to be highly adaptable and customizable to individual users and specific use cases, while minimizing physical barriers. Second, because immersive experiences place the user in partially or fully virtual environments, they can manipulate and tailor these to their individual needs, making these technologies more inclusive for a wider set of users. And, most notably, immersive experiences offer more engaging and realistic interpersonal and sensory experiences than their two-dimensional counterparts, creating new opportunities for digital communication and allowing virtual experiences to mirror the physical world.

AR/VR could make important contributions to equity and inclusion if designed with these goals in mind.

While certainly not a silver-bullet solution, these capabilities can allow AR/VR to enrich initiatives to reduce barriers and create new opportunities for marginalized groups and underserved communities. There is already a rich field of academic research into the benefits of digital and immersive technologies in addressing issues such as racial bias, sexism, ableism, and other forms of discrimination, as well as AR/VR's role in reducing barriers and forming new systems of support. Now, as the quality, affordability, and ease of use of these technologies continue to improve, new opportunities are emerging to apply these technologies to practical solutions.

Drawing upon input from stakeholders in disability rights, workplace equity, and other key areas of concern for vulnerable and marginalized communities, this report reviews the key literature on the potential benefits and limitations of AR/VR in equity and inclusion efforts and discusses the ways in which this potential has been leveraged in specific applications of the technology for implicit bias and empathy training, accessibility, and community-building. It also raises

important considerations, potential drawbacks, and outstanding questions relating to these uses, and considers opportunities for future innovations in this space.

This report is the first in a three-part series exploring the wide landscape of equity and inclusion in AR/VR.

HOW AR/VR CAN PROMOTE EQUITY AND INCLUSION

AR/VR is still a relatively nascent technology, and new possibilities for its use in equity and inclusion efforts are continuously emerging as the underlying technology improves and a more diverse set of users experience it for the first time. There are three key areas of opportunity for AR/VR to support broader equity and inclusion efforts: leveraging its potential as an empathy tool, adapting its extensive capabilities to meet the needs of users with disabilities, and mitigating barriers that arise from physical distance to strengthen communities and enhance person-to-person interactions across locations.

Addressing Bias Through Empathy Interventions

One of the unique advantages of AR/VR over other digital solutions is its ability to place the user in any setting or scenario. With AR, users can view and interact with changes to their physical surroundings in real-time. And with VR, a user is fully immersed in a virtual world in which everything from their surroundings to the laws of physics are digitally rendered. This makes AR/VR users feel like they are "really there" in a virtual experience—a phenomenon that has prompted the widely touted hope that these technologies could be "the ultimate empathy machine."[1]

Indeed, these immersive, first-person experiences have been used as a tool to raise awareness and build empathy and understanding for those with different life experiences. For example, some experiences manipulate a user's field of vision, audio output, and surroundings to demonstrate what it is like to navigate life with a disability.[2] Others have the user assume the identity of a person of a different race, gender, or other characteristic.[3] Still others place a user in a 360-degree video recording to give a "ground truth" view of distant or otherwise hard-to-imagine places, like a refugee camp or the site of a natural disaster.[4]

It is worth noting that there is some debate among equity and inclusion advocates about the efficacy and value of such embodiment interventions, due to uncertainty about their outcomes as well as concerns that they could replace direct engagement with the communities being represented. And of course, the practice of prompting individuals to imagine others' lives as a way to elicit empathy is not unique to AR/VR, nor is it a novel concept.[5] But, as Stanford Virtual Human Interaction Lab director Jeremy Bailenson has said, immersive technology—particularly VR—"takes the cognitive effort out" of exercises that have long been employed to build empathy, namely perspective-taking.[6]

Immersive experiences can increase public awareness, and aid in prompting social change to mitigate the harmful impacts of racism, ableism, sexism, and other forms of bias.

Immersive technologies allow users to feel they are "really there"—physically present within a virtual space— thereby offering a more engaging, interactive, and individualized experience than similar audiovisual technologies. Research has shown that individuals feel a sense of

embodiment with their virtual representation (avatar) in VR, whether or not the avatar reflects their physical appearance.[7] This greatly reduces cognitive distance between the individual and perceived "others," which is a key objective in empathy interventions.[8] Because of this sense of self in a partially or fully manipulated environment, VR experiences can be incredibly powerful in eliciting an emotional response to the challenges this virtual self faces, even if the user does not share this lived experience.

Although research into the efficacy of such interventions is ongoing, evidence indicates that these immersive interventions could build and sustain empathy, and even prompt behavioral change among participants. In one recent study from the Stanford Virtual Human Interaction Lab, participants were presented with perspective-taking exercises designed to elicit empathy for the homeless. The results of the study showed that, while short-term emotional responses were similar across VR and non-VR interventions, the immersive experiences "led to more positive, longer-lasting attitudes toward the homeless up to two months after the intervention" than similar, narrative-driven approaches.[9] Similarly, a study by researchers at the University of Barcelona found that reductions in implicit bias after a VR experience lasted for at least one week, even after a single encounter.[10] Evidence also indicates that placing a user in a 360-degree video, in which they are presented with a third-person rather than first-person perspective, may also elicit a greater empathic response than two-dimensional media.[11]

For immersive empathy interventions to be truly effective, they should not only lead to a change in emotions or perspective, but also prompt action or changes in behavior that could lead to broader social change. As Courtney Cogburn, a researcher using VR for racial justice initiatives, warns: "feeling bad or connecting to bad feelings that are being experienced by a group is really not sufficient for social change."[12] While this aspect of immersive empathy interventions is largely under-researched, several studies indicate that AR/VR technologies can be a useful tool—though likely not the sole driver—of this kind of behavioral and social change. For example, the Stanford study on perspective-taking exercises about homelessness found that participants in the VR intervention were also more likely to take action to help the homeless in the form of signing a petition.[13] Another study of the use of VR experiences in charitable fundraising conducted by Nielsen found that individuals exposed to immersive, 360-degree video appeals were more likely to donate, made larger contributions, and indicated greater interest in seeking more information about the charitable subject than those exposed to traditional advertising methods.[14] Similarly, a Tow Center for Digital Journalism study of journalistic storytelling through 360-degree video found that both immersive and non-immersive VR were more likely than text-based media to motivate changes in behavior.[15]

Use: Prompting Social Change and Reducing Harms From Bias

Because immersive technologies, particularly immersive VR, allow users to directly take on new perspectives and navigate virtual environments in real-time, these technologies present exciting potential for implicit bias and empathy trainings in a variety of contexts. Multiple studies have indicated that immersive embodiment interventions can reduce implicit racial biases, making AR/VR technologies a valuable tool for these kinds of trainings.[16]

At the most general level, immersive experiences can increase public awareness, and aid in prompting social change to mitigate the harmful impacts of racism, ableism, sexism, and other forms of bias. There has been a notable effort to examine and deploy these tools to address racial

bias. For example, the film *1000 Cut Journey*, a joint effort between the Stanford Virtual Human Interaction Lab and Courtney Cogburn, places the user in the body of a Black man who encounters racism at various life stages. The film premiered at the 2018 Tribeca Film Festival with the explicit intention of providing sympathetic audiences with a deeper understanding of the many facets and deep impacts of structural racism—and prompting meaningful engagement from these individuals.[17]

Similar approaches can be used in targeted settings to prompt more empathetic responses in sensitive or high-risk situations. This approach is already being deployed in law enforcement training, particularly in de-escalation training aimed at reducing use of force in high-stress encounters. As the Department of Justice Office of Community Oriented Policing Services notes, "through deeply immersive VR experiences, police officers can experience life as a community member in the city they serve."[18] This added layer of perspective-taking can enrich law enforcement training. As one example, a series of virtual reality experiences developed by Axon (the company that develops Tasers, body cameras, and other law enforcement technologies) places police officers in the body of a person having a mental health crisis before running a simulated intervention.[19] Similarly, implicit bias training for law enforcement personnel developed by the University of Maryland Lab for Applied Social Science Research integrated VR simulations in both training and assessment approaches.[20] The data gathered during virtual encounters, such as a simulated traffic stop, can provide insights into both observable actions and physiological responses that can better inform both officers and training staff.[21]

Another important use context for such empathy-driven training is education. Immersive simulations can help teachers identify and correct implicit biases in the classroom. For example, the VR application "Teacher's Lens" simulates interactions with a diverse set of students to identify whether they demonstrate unconscious preferences for students of a certain gender or race.[22] In "Passage Home VR," an immersive experience developed by researchers at the MIT Center for Advanced Virtuality, users assume the identity of an African American student accused of plagiarism, while computational models based on racial socialization determine how their actions will influence the outcome of the game.[23] Such models could be used to enrich immersive experiences and provide valuable feedback to teachers on their own racial and ethnic socialization. For example, the game yielded statistically significant relationships between users' perceptions of and empathy toward the student and the teacher, and their awareness of racial biases.[24]

Use: Improving Workplace Engagement in Diversity, Equity, and Inclusion (DEI)

Among enterprise enthusiasts, one eagerly anticipated application of immersive empathy interventions is in the field of professional Diversity, Equity and Inclusion (DEI) initiatives. Management experts have presented a strong business case for prioritizing more diverse and equitable workplaces: effective "diversity management" can increase competitive advantage, lead to higher employee retention, and enhance innovation within the company.[25] One study by McKinsey found that the top-performing companies in terms of diversity had a high likelihood of outperforming their less-diverse competitors: 25% for the top quartile of gender-diverse companies, and 36% for the top quartile of ethnically-diverse companies.[26] Further, a proven track record in DEI can help a company attract top entry-level and early-career talent.[27] It is hardly surprising, then, that a significant and growing number of companies employ diversity trainings—but many of these programs fail to achieve substantive or long-lasting results.[28] These

trainings are typically in the form of seminars, presentations, or passive web-based curricula. However, in recent years, a market for VR-based diversity trainings has started to emerge.

The developers of these programs, and the employers who use them, hope that the promising evidence of VR's potential in perspective-taking exercises could translate into more effective and impactful diversity training. As discussed, immersive experiences can have higher retention rates and greater impact on individual behavior than traditional perspective-taking interventions. This could in turn lead to deeper impacts on workplace culture, including at the higher levels where decisionmakers can implement structural changes toward a more diverse and inclusive workforce. These experiences place individuals directly in a situation in real-time, allowing them to not only empathize with the experiences of others, but also to assess their own biases and assumptions and prepare them to respond effectively to real-world instances of discrimination, bias, and harassment.[29]

For example, in one program called "pivotal experiences" from Praxis Labs, participants take on the perspective of both an individual facing bias or discrimination and a bystander, allowing them to both empathize with the targeted individual and practice responding to instances of bias in the workplace.[30] Another company, Vantage Point, offers perspective-based immersive trainings for both DEI and sexual harassment.[31] Still others offer immersive experiences focusing on specific manifestations of bias in the workplace, such as microaggressions, or develop custom trainings tailored to the unique contexts of specific organizations.[32] These programs often include both individual and aggregate analytics to help identify implicit biases across an organization.

Improving Access to Opportunities

Efforts to build more inclusive spaces are often constrained by physical limitations, from capacity limits to proximity to public transportation. Individuals with mobility impairments or other disabilities, social anxieties, or insufficient access to reliable transportation, or those who would have to travel significant distances, may find themselves at a disadvantage when physical presence is necessary. While not a substitute for accessible spaces, immersive technologies are uniquely positioned to overcome the limitations of physical space to create more accessible, equitable experiences. Ensuring devices and experiences are accessible to all users is increasingly important as AR/VR technologies are adopted as workplace productivity tools, training solutions, entertainment systems, and social platforms. Fortunately, as AR/VR technologies continue to evolve, so do new approaches to accessibility that not only make it possible for more users to take advantage of them, but also leverage the unique capabilities of immersive technologies to enrich the overall user experience.

While not a substitute for accessible spaces, immersive technologies are uniquely positioned to overcome the limitations of physical space to create more accessible, equitable experiences.

While the sense of presence that AR/VR technologies create benefits all users, it can make both social and professional spaces more accessible specifically to those who would otherwise be limited by geographic distance, lack of accessible transportation, or a lack of accommodations for disabilities. In a 2017 survey of VR users with disabilities, many respondents highlighted access to previously inaccessible environments as a key potential benefit of the technology. One

described the experience of VR as "being transported to another world, one where I can see sights I normally never would, take part in experiences I can't in real life, and be a part of social spaces my visual impairment would restrict me in."[33] The affordability and accessibility of immersive experiences, many of which can be accessed with a smartphone or personal computer, has accelerated this potential.

If done right, AR/VR technologies could drive innovative new approaches to the field of accessible technology and design. Pursuing universal design for AR/VR will ensure the technology is accessible to the widest array of users, including those who wear glasses, require hands-free controls, or must use AR/VR in small spaces or while seated, while also making the technology more accessible for people with disabilities.[34] There is already a significant effort underway by accessible technology advocates and industry actors to develop standard practices for accessible design in VR. Many recommendations transfer existing practices from two-dimensional media, such as magnification, text-to-speech, and captions.[35] However, "what is at the heart of AR/VR is being able to apply computing to the environment, and not just to 2D screens," says Dylan Fox, an advisor for XR Access, a group that informs and advocates for accessible design in AR/VR, "which is fundamentally different than the other technologies we've had before."[36] AR/VR experiences are more complex than those offered by other digital media, and there are many opportunities to take advantage of the immersive nature of these technologies to deliver more accessible, engaging experiences.

Because they rely on a variety of sensory inputs, AR/VR experiences present potential workarounds for audiovisual barriers that users with vision or auditory impairments might encounter—without minimizing the user experience. For example, color contrast and magnification can improve VR displays for users with certain types of vision loss.[37] However, AR/VR experiences can engage users even without visual media. Combined with head and motion tracking, immersive 3D audio that mimics 360-degree sound in physical space can provide a sense of spatial awareness for users with visual impairments: a musician performing in front of them, a friend calling out from behind, an object appearing on their left, and so on.[38] Additionally, the accessibility applications for haptic feedback, which simulates tactile sensations through vibrations, could be expanded. Haptics are already standard in technologies such as smartphones as well as immersive experiences. In VR or other immersive experiences, haptic feedback can allow users to navigate three-dimensional space and receive signals through touch. Although most AR/VR users currently experience haptic feedback through mobile devices or handheld controllers, this technology is rapidly evolving to include gloves and other wearable devices that more precisely mimic and even enhance real-world kinesthetic sensations.[39] In this way, a blind or visually impaired user could navigate through three-dimensional objects as they might with their hands, a cane, or other aid in physical space.[40]

Meanwhile, mobility disabilities present both significant challenges and unique opportunities for accessibility in immersive experiences. On one hand, most immersive experiences require some form of movement or physical activity, whether that be moving physical controllers, standing, or head, limb, or full-body movement.[41] On the other, immersive experiences rely on these motions to replicate three-dimensional movement in virtual space—so it is possible to translate limited motion or alternative inputs in physical space into a full range of virtual motion, allowing users to have greater mobility within this experience than in the real world. For example, a program called WalkinVR adapts controller motions into full-body movements, adjusts controller height or

orientation without physical repositioning, amplifies small movements in virtual space, and allows a second person to assist with gameplay using a controller.[42] Further, advancements in other non-controller-based inputs, such as eye tracking, hand tracking, and brain-computer interface (BCI) technologies, will further expand users' ability to navigate their virtual environment with minimal physical motion.[43]

Use: Immersive Experiences as Assistive Technology

While accessible design will enhance immersive experiences for all users and across use cases, the unique capabilities of AR/VR technologies also enable innovative uses of these applications and devices specifically as assistive technology. Users with certain types of vision loss have reported that VR enhances their sight.[44] This could mean that fully virtual environments are more accessible for these users than their physical counterparts, e.g., using a virtual workstation or attending a presentation in VR. There are also a number of projects and programs that utilize the sensors, processing, and immersive output capabilities of AR/VR to assist blind and low-vision users in navigating their physical surroundings. Some can assist low-vision users in navigating physical space, such as by overlaying virtual visual aids on their surroundings or digitally enhancing images in real time.[45] Others emphasize non-visual cues, using combinations of location tracking, spatial mapping, machine vision, and spatial audio to provide blind users with real-time guidance through their surroundings.[46] For example, the *Canetroller* project from Microsoft Research simulates the experience of using a cane in virtual spaces through a combination of tactile and auditory feedback.[47] Such a device could not only make fully virtual immersive spaces more accessible; it can also help blind users practice navigating an unfamiliar space, such as a new workplace, in advance.

Immersive experiences could serve as alternatives to physical locations, making these more easily accessible to individuals who may have difficulty reaching or navigating them.

For users who are deaf or hard of hearing, AR/VR devices have unique capabilities to provide additional cues about their surroundings. AR heads-up displays can provide users with real-time captioning: for example, the HoloSound project from the University of Washington used a Microsoft HoloLens AR headset to display real-time text captioning both of conversations and other sounds, such as a phone ringing or someone knocking on a door.[48]

AR/VR devices and applications can also serve as assistive technologies for people with mobility impairments. Immersive experiences could serve as alternatives to physical locations, making these more easily accessible to individuals who may have difficulty reaching or navigating them. Disability advocates have highlighted the value of AR/VR in augmenting existing efforts to make public spaces and services more accessible. According to Lydia X.Z. Brown, a disability rights advocate and policy counsel at the Center for Democracy and Technology, "virtual access could be amazing to have as an alternative to requiring physical presence or physical travel."[49] AR/VR is also increasingly used as a tool in physical therapy.[50] VR programs can make physical therapy more accessible because patients can use them at home. Most programs are also highly customizable to the specific needs of each user, and the "gamification" of physical therapy exercises could make these therapies more enjoyable and engaging for patients.[51]

In addition to assisting users with physical or sensory disabilities, AR/VR technologies can also assist individuals with cognitive disabilities. For example, VR simulations and trainings have been shown to support skill-building among individuals with Autism Spectrum Disorder (ASD), and VR therapies have been deployed to help individuals with social anxiety disorder, post-traumatic stress disorder, certain phobias such as fear of heights, and other mental disorders.[52] AR/VR can also serve as an assistive technology for individuals with cognitive disabilities in real-time, such by as guiding users with ASD through a shopping trip using AR.[53]

Use: Enhancing Inclusive Design

As discussed, one of the potential applications of VR's perspective-taking capabilities could be demonstrating what it is like to have a disability. Although purely empathy-oriented embodiment exercises are somewhat controversial in the disability community, there is a recognition that this use of AR/VR could be valuable in informing inclusive design of both virtual and physical spaces.[54] These technologies have the capability to alter the way in which users experience their surroundings—allowing developers, designers, builders, and others to determine quickly and easily whether their project meets baseline accessibility needs. For example, an application called Eyeware uses VR and AR filters to allow users such as architects and designers to walk through existing spaces or CAD models from the perspective of people with a range of visual impairments.[55]

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Similar approaches can also apply to fully virtual spaces: product teams could test accessibility features to make sure they meet baseline standards before entering the user testing phase, or someone building a venue for a virtual event could test the layout for different accessibility needs. These perspective-altering tools are already available for two-dimensional virtual elements. For example, some browser extensions can manipulate elements to show developers what users with cognitive, vision, mobility, and other impairments might see when accessing their website or product.[56]

Building New Channels for Support and Inclusion

AR/VR technologies and immersive experiences open new channels for users to connect, interact, and access a range of spaces that may otherwise be inaccessible due to distance or other barriers. This is reflective of the benefits offered by any new communications technology, but unlike two-dimensional communications channels, AR/VR can more fully replicate in-person, human interactions. AR/VR's potential as a communications medium offers many opportunities to support marginalized and underserved communities and reduce barriers to participation in, and access to, everything from social experiences to public services.

Marginalized communities are often among the early adopters and avid users of digital communications technologies. This is especially true of users who may seek resources or peers beyond their own immediate area, such as members of the LGBTQ community, or those who find digital social interactions preferable to in-person ones, such as users with hearing impairments.[57] Others in underserved communities may have a strong desire to take advantage of

communications technologies but are precluded from doing so due to physical, technological, financial, or other challenges.[58]

Multi-user platforms, including social media, multiplayer games, and social immersive experiences, offer opportunities to seek out information and participate in communities that may not be readily available in a user's day-to-day life. For example, a special interest "guild" in the online multiplayer game World of Warcraft (WoW) created a space within the game for LGBTQ users. With over 7,000 members, the group repurposed the capabilities of the game to create community-building experiences, such as a virtual pride parade.[59] Online multi-user experiences also allow users to access resources and interact with experts in real-time, engaging environments—and practitioners recognize the value of this capability. A 2009 survey of health-related activities on the multi-user online platform *Second Life* found that the majority of these activities provided users with services or resources: half were focused on disseminating health information to users, and about 20 percent provided some form of support services, such as support for people with HIV.[60]

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AR/VR platforms could present the next iteration of these virtual communities and resources. Already, communities for under-represented or underserved groups are emerging on social VR platforms. Microsoft's *AltspaceVR* platform includes public channels such as "LGBTQ+ and Friends Meetup," "Autism VR," "ADHD and Neurodiversity," and "Indigenous Peoples in XR."[61] In addition to such channels, which any user can join, most social VR platforms allow users to create private, invitation-only spaces. This expands the potential of immersive experiences beyond general interest meetups to more specific, small-group interactions. Immersive experiences can also open up new experiences to people who would not otherwise be able to participate. For example, Pride for Everyone allowed LGBTQ youth to experience pride parades around the world using a Google Cardboard headset.[62]

AR and mixed reality (MR), which allow users to manipulate and interact with virtual elements overlaid on physical space, also present opportunities to overcome distance or other physical barriers for inclusion. These technologies combine virtual objects with physical space—meaning that an individual could virtually access a physical environment. This is a growing trend among AR/VR collaboration tools that translates well into the inclusion space. For example, Microsoft's Mesh platform aims to enable users to access collaborative workspaces using MR, VR, desktop, or mobile devices.[63] Some virtual collaboration applications already in use have similar cross-platform capabilities.[64] As this technology continues to advance, it will have the potential to all but eliminate geographic barriers to inclusion by integrating in-person and virtual interactions.

Use: Combatting Social Isolation

Given the relatively low adoption and emerging nature of AR/VR, particularly in underserved and marginalized communities, many potential uses for community-building and support services are largely aspirational. However, some of this potential can already be seen in efforts to combat social isolation. The ability to form connections and interact with other people is a critical aspect

of human experience, and a lack of these interpersonal interactions can have significant mental and physical health impacts. Already vulnerable or underserved groups, such as the elderly and people with disabilities, are particularly at risk. The COVID-19 pandemic highlighted the need for accessible, virtual alternatives to in-person interactions for those who may experience social isolation—and solutions that rely on two-dimensional video conferencing are a poor substitute for in-person contact.

Some have proposed immersive experiences, particularly VR, as an alternative. For example, AARP Innovation Labs developed a "virtual living room" program called Alcove.[65] The application is aimed at families or other intergenerational groups, and offers virtual spaces for users to communicate, play games, and engage in a number of immersive experiences and activities together. It is hardly difficult to imagine similar applications and activities being used to engage other communities who face distance or mobility barriers. For example, many existing platforms allow users to create private spaces and bring together smaller groups for meaningful social interactions. This sensation of interacting "face-to-face" and engaging in shared virtual experiences "is an empowering experience that [you] can't really replicate on a Zoom call," notes Carlos Gutierrez, whose organization LGBT Technology Partnership and Institute envisions organizing VR social experiences for LGBTQ individuals who may not otherwise have access to a large LGBTQ community or support system.[66]

LIMITATIONS AND KEY CONSIDERATIONS FOR AR/VR TOOLS FOR EQUITY AND INCLUSION

Although AR/VR technologies present exciting opportunities for use in equity and inclusion contexts, there are factors that should be considered before implementing the solutions discussed in this report. Broader risks and challenges for use of these technologies by vulnerable and marginalized users will be discussed in the second report in this series.

First, it is worth noting that there are limitations to immersive approaches to sensitivity and empathy training, and indeed these interventions could further entrench stereotypes if not executed correctly. VR researcher Jessica Outlaw has argued that "while empathy has a role in our lives, I don't think it should be the end goal of any VR experience, because empathy does not necessarily lead to the fair treatment of others."[67] As one study on using VR embodiment to increase empathy toward individuals of a different race cautioned, "inaccurate embodiment may simply make race extremely salient and highlight the differences between the race of the person and the race of the avatar."[68] Indeed, the same study found that stereotype activation could outweigh the empathetic gains from an immersive perspective-taking exercise, highlighting the importance of considering potential consequences before implementing these solutions.[69]

Even the most transformative programs are not a substitute for systemic changes to the ways companies approach hiring, professional development, and human resources management.

Another study from the University of Barcelona found that decrease in bias was dependent on the social situation that was depicted: in simulations that subject the participant to social discomfort (such as unpleasant encounters with passerby in a crowd), reductions in implicit bias are less likely, and increases in implicit bias could occur instead.[70] Further, many advocates in areas such as disability rights have cautioned against approaches that over-emphasize empathy while

failing to meaningfully engage with the very individuals whose experiences are meant to be represented in these programs.[71] "You don't want people walking away feeling 'sorry for,'" notes Regine Gilbert, a UX designer and educator specializing in accessible design for immersive experiences, "you want them to have an 'understanding of.' And there is a fine line … of when it's helpful, and when it's harmful."[72]

Immersive diversity trainings for workplaces also have significant and noteworthy limitations. Even the most transformative programs are not a substitute for systemic changes to the ways companies approach hiring, professional development, and human resources management. Rather, they are a valuable tool in shifting workplace culture, which can create a more enabling environment for these changes to take place. Further, as with other empathy-driven immersive experiences, it is possible that these immersive trainings could have the opposite effect, further entrenching biases. For example, it is not clear whether these trainings will have the same impact on participants with more explicit or deeply entrenched biases.[73] There is also a question of the ethics of subjecting individuals to a traumatic experience, even if only a simulation, particularly when that experience is mandated or strongly encouraged by someone's employer.

Finally, if the objective of immersive solutions is increased inclusivity, virtual alternatives should be just that: alternative solutions. Disability advocates have cautioned that fully replacing physical spaces or services with virtual substitutes can minimize, rather than expand, means of access.[74] Similarly, perspective-taking tools should not take the place of seeking input from disabled users. "Stepping in and out of an experience does not give you that experience," says Cynthia Bennett, a researcher at Carnegie Mellon University's Human-Computer Interaction Institute. "You need to actually listen to real people."[75]

OPPORTUNITIES TO EXPAND THE POTENTIAL OF AR/VR IN EQUITY AND INCLUSION

As this report has discussed, AR/VR technologies are already in use for key equity and inclusion applications. However, there are many opportunities for future applications to build on this work and achieve greater impact. First, further research is needed to understand how empathy interventions can be translated into widespread and lasting social and behavioral change. Such applications have enormous potential, but as experts have noted, they can also have adverse effects. Once researchers, practitioners, and policymakers better understand where to draw the line while also bolstering efficacy, such interventions could be deployed in specific contexts, building on existing work in policing and teaching while expanding into other fields such as government services.

AR/VR's ability to render virtual, collaborative spaces is also under-utilized. As the technology improves and gains more widespread adoption, there will be more opportunities to augment physical, in-person services and activities with virtual alternatives. One key sector for this capability is telehealth, which can offer specialized services to patients who would otherwise have to travel significant distances to reach the necessary provider. Current uses in physical therapy offer a glimpse of these possibilities, but it is easy to imagine the value of more widely available "face-to-face" counselling services or health consultations conducted within immersive experiences. While this might not be possible for all healthcare needs, immersive telehealth offers capabilities that current phone- or video-based services do not. Of course, to fully utilize

AR/VR in healthcare will require broadband to more areas currently lacking it, and support for broadband adoption among low-income communities.

Technological improvements will also create more opportunities to use AR/VR devices and applications as assistive technologies. Brain-computer interface (BCI) and eye-tracking technologies could help individuals with speech impairments communicate in virtual spaces as well as in their day-to-day lives.[76] BCI-based inputs could also allow users with mobility impairments to navigate virtual environments without physical motion or controls. Meanwhile, wearable AR devices, such as smart glasses or other heads-up displays, will provide all users with rich information about their surroundings through visual as well as auditory outputs. This information would be especially valuable to users who would benefit from assistive features such as real-time spatial captioning, machine vision guidance, or even memory recall—all on a relatively unobtrusive interface.

CONCLUSION

If AR/VR technologies are indeed the next iteration of personal computing, communication, and human-machine interaction, they have the potential to build a world that is more inclusive, equitable, and accessible. The use cases discussed here are not fringe benefits of these technologies: they are the cornerstone of their potential to transform the way people work, learn, and communicate. These applications can certainly help to level the playing field and create new equity and inclusion opportunities for vulnerable, marginalized, and underserved individuals. But all users (and many non-users) will also benefit. Successful empathy interventions and DEI trainings will enrich classrooms, campuses, and workplaces; assistive technologies and inclusive design will allow users to personalize how they engage with both physical surroundings and virtual environments; and collaborative virtual spaces will expand social networks as well as build a more efficient and geographically diverse global workforce.

As these technologies continue to develop and gain widespread adoption, further opportunities will also arise. These innovations will be essential to the overall success of AR/VR, and it is critical to begin integrating them into our increasingly virtual world today so that this potential is fully realized in the future.

Acknowledgments

The author would like to thank the stakeholders quoted in this paper for contributing their insight and expertise to this project. Any errors or omissions are the author's own.

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