



A brave new world with virtual worlds

How virtual worlds are the next evolution in communication and collaboration

Digital Reality

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As the world moves toward virtual collaboration, there is an increasing shift in requests from developing traditional communication and collaboration tools to the creation of customized, virtual worlds that replicate real-world functionality and enable people to engage with others. Once viewed as a sci-fi futuristic concept, virtual worlds are becoming a business tool to enhance the human experience with large audiences, simulate real-world spaces, and create imaginative worlds that users want to engage in. We are at the dawn of virtual worlds.

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Introduction

A corporate executive spends the morning exploring a tradeshow floor, viewing videos and presentations on new products and networking with companies, vendors, and other attendees from around the world. In the afternoon, they teleport to the grand auditorium for a keynote presentation, followed by a postkeynote breakout session in which the executive plans to present their latest corporate findings to a stakeholder audience. As they teleport into this new room, they are greeted by a host of avatar stakeholders, including the top 10 CEOs to whom they hope to present. Grateful for everyone having the time to meet, the executive's avatar begins presenting, using collaborative tools.

ASSUMING THE TECHNOLOGY works smoothly, this scenario highlights the potential convenience and elevated engagement of a virtual world: A digital environment where users can meet, communicate, interact, and collaborate without the hassle and expense of travel—or the current practice of face masks and social distancing.¹

Communication, collaboration, and engagement have evolved with technology. The forms and methods used to exchange ideas have advanced from enabling simple message exchanges between two participants to instantly, simultaneously conveying information to many participants across vast distances (figure 1). Each new communication technology—many of which have remained in use rather than being superseded—has expanded the geographic range of both sender and recipient. The next advancement takes this several steps

further: Virtual worlds enable many-to-many communication, simultaneously, with multiparticipant engagement unrestricted by the location where collaboration can be facilitated in a three-dimensional environment.

WHAT IS A VIRTUAL WORLD?













A virtual world is a computer-simulated environment that is *persistent*—always on—and that enables user participation by means of personal avatars that can, in turn, communicate, collaborate, and interact with each other in that environment. It enables multiple, concurrent users, equipped with headsets, to leverage its creators' innovation to collaborate and coexist in an all-day-every-day reality, mimicking that of real life.² Virtual worlds are most familiar in their use in massively multiplayer online video games,³ but a range of enterprises are beginning to adopt them for day-to-day applications.⁴

FIGURE 1

Communication and collaboration through the ages

By time

 Audio
  Visual
  Spatial

	INITIAL TOOLS	DISADVANTAGES	BENEFITS	MOBILITY	COMMS	PRIMARY SENSE(S)	POPULARITY	MESSAGES	WORLD
LETTER	Pen and paper	Takes a long time for the recipient to read and respond to communication	Enable serial, bidirectional communication over distance	Fixed	1:1, serial		Pre-1800s	One, simple, serial	Physical
TELEGRAPH	Telegraph machines	Communication encoded	Near-instantaneous communications over distance	Fixed	1:1, conversational		1830s		
TELEPHONE	Telephone	No visual cues to communication	Verbal communication over distance	Fixed	1:1, conversational		1900s		
EMAIL	Computer and networks	No visual or audio cues to communication	Instantaneous delivery of written communication	Fixed	1:1/1:many, serial		1980s		
CONFERENCE CALLS	Telephone or computer	Only one participant can communicate at a time	Enable group communications over distance	Fixed	1:many, conversational		1980s		
MOBILE PHONE	Mobile device	No visual cues to communication	Enable communications away from a fixed location	Mobile	1:1/1:many, conversational		1990s		
TEXT MESSAGE	Mobile device	Limited amount of information shared	Quickly share updates with others	Mobile	1:1/1:many, serial		2000s		
VIDEO CONFERENCING	Mobile device or computer	Only one participant can communicate at a time	Face-to-face communication enabled over distance	Fixed Mobile	1:many, conversational	 	2010s		
VIRTUAL WORLDS	Computer, game consoles, or VR HMDs	Limited visual cues from body language or facial expressions	Collaborate and communicate ideas with many users at any time	Virtual	Many:many, multiple and parallel	  	2020s		
IMMERSIVE HOLOGRAPHY	AR/VR HMDs, haptic devices, omnidirectional treadmills, scent cannons, etc.	Unavailable to average consumer	Sensory-driven collaboration and communications that mimics the physical world	Virtual	Many:many, multiple and parallel	Multisensory (lifelike)	2030s	Many, complex, simultaneous	Virtual

Source: Deloitte analysis.

Real work and life in virtual worlds

A VIRTUAL WORLD PROVIDES a potentially infinite number of configurations and customizations, offering almost too many possibilities for companies to determine which experiences to bring to life to deliver value to customers. Since the environments and ecosystems require setup and active curation, leaders should begin by looking at use cases that have driven immediate benefit to users and the enterprise. Ultimately, virtual-world experiences demonstrate the greatest potential around delivering group collaboration and networking, especially during times when people are virtual or must be socially distant from each other.

Conferences and trade shows—both sites to showcase new ideas and products and as central networking locations—are perhaps the most obvious application for virtual-world technology. With over US\$300 billion of direct annual spending and over US\$800 billion of economic impact in the United States alone (in a typical nonpandemic year, that is), conferences and trade shows demonstrate the value of communication and collaboration.⁵

Virtual worlds show great promise for facilitating all kinds of many-to-many group events, bringing together accessible and scalable virtual audiences in a unified virtual location. User avatars can navigate a digital campus as if they were navigating a physical event location; they can attend keynote presentations in virtual auditoriums, engage in

question-and-answer activities by raising their hand, network with other avatars in virtual coffeeshops or on a virtual beach, engage in breakout sessions, and more. Designers can include unique features, functions, and gamification that would be impractical or impossible at a physical conference, driving enhanced user engagement and additional networking opportunities.

At conferences and trade shows, virtual worlds also enable opportunities to present revenue-generating marketing and advertising that would be difficult, if not impossible, to recreate in the physical world. Traditionally, marketers and vendors are limited by the physical facility space to showcase a brand's messaging and products, while in a scalable, virtual experience, there are few limitations to the branding and product booths that can be built and tailored. Using features such as video and portal experiences to educate attendees 24/7, marketers and vendors can significantly reduce the need for booth staffing—or tailor direct engagement for the moments that matter most to target audiences.

And virtual-world events have another advantage over their real-world counterparts: *persistence*. Virtual conferences can be “always on,” allowing attendees to engage with the content and each other at any time during the 24-hour day; global attendees can communicate and collaborate with their peers as if they were all in the same room.⁶

A CONFERENCE GOES VIRTUAL

In March 2020, with COVID-19 spreading globally, the Immersive Learning Research conference's planning committee discussed whether—and how—to proceed with the four-day iLRN2020 conference, scheduled to convene 80 researchers and scientists at California Polytechnic State University, in June. With the near future uncertain, the committee voted to change the conference location to one with which their attendees and experts were familiar: a custom iLRN virtual campus. The decision was fortuitous, since a day later, the United States curbed European travel, which would have cut attendance by half.

The committee also decided to open the conference to any educator who wanted to participate, on the basis that it provided a platform that enabled technical equity for the greatest number of participants. "Accessibility became the bylaw of the conference," says iLRN2020 cochair Heather Dodds. "We wanted to ensure that the platform could be downloaded on any PC machine and enable a large number of users to attend a session simultaneously and in the same room."

Seizing the opportunity, the iLRN2020 committee assessed how they could use the virtual venue to improve scalability and accessibility. As Dodds notes, "There are aspects of a traditional conference that are boring," such as unattended sessions and unread slideshow presentations. The committee articulated a new design purpose: "Why don't we utilize the flipped model, where the majority of content is presented before conference sessions, and then use the conference time together for question-and-answer and networking—the best parts of a conference?" The committee informed presenters that they would have to convert their papers into videos, present at the conference for three minutes, and spend another 12 minutes answering questions from the avatar attendees. After a session, attendees could talk with fellow avatars and interact with web-based portals that linked to the campus and enabled them to step into 360° rooms to explore various topics.

The iLRN2020 virtual campus proved popular—as did efforts to expand accessibility. Originally set to take place in a few rooms with 80 attendees, the planning committee wound up with 3,500 registrants.

Virtual venues

AS THE DEMAND for virtual presence and the need for global collaboration and communication grows, virtual-world platforms offer an increasingly viable option for enabling people to communicate new ideas and network in a familiar fashion to the physical world.

Sports and entertainment

As with companies that stage conferences and trade shows, those hosting a range of entertainment and social events are finding that virtual solutions can help to bring fans and consumers closer to collaborative experiences. The National Basketball Association has the ability to broadcast in virtual reality (VR).⁷ The U.S. Golf Association enables viewers to watch every hole and compare player shots at the U.S. Open with a mobile 3D augmented reality (AR) application⁸—and to relive previous U.S. Open championship wins with the champion and take 360° tours of the clubhouse, with the course historian’s voiceover, in VR.⁹ On the spectrum of what is possible for more collaborative events, the industry still lacks maturity but is heavily investing in experimentation in these technologies to meet rising user expectations.¹⁰

One can steadily see virtual-world experiences emerging, especially with the growing need for remote collaboration and group entertainment. Musical artists—especially with audiences still reluctant or forbidden to crowd together—are experimenting with high-tech livestreaming, building on virtual concert technology that has drawn millions of concurrent users for a single performance.¹¹ Film festivals are expanding to include immersive worlds to showcase new content and enable a greater, public audience to attend and

hear from famous performers’ avatars.¹² Imagine being able to walk around a virtual venue with avatar friends from around the world, excitedly discussing the performance soon to begin, watching it together, and leaning over to comment on a particular song. Virtual worlds offer the opportunity for people to engage and communicate with each other at events, with potential revenue opportunities and engagement for sponsors.

Classroom learning, training, and workshops

VR has established its value as a tool to teach concepts and train users in a safe, measurable, and repeatable way. Studies across many industries show VR’s ability to enhance long-term information retention,¹³ aided by its ability to incorporate immediate feedback from user motor and empathy training activities.¹⁴ In the industrial products and oil and gas industries, VR training enables employees to train on and in dangerous situations, such as loading and offloading dangerous gases and chemicals, so that they can perform those tasks with greater proficiency and enhanced safety in the real world.¹⁵ Doctors can learn new techniques and prepare for surgeries in VR simulations before operating on live patients.

These applications have highlighted the effectiveness of individual-based training. What virtual worlds offer is a *collaborative* environment, in which groups of people can train and learn together. Professors can conduct workshop or class breakout sessions with students and virtually walk from table to table, having conversations and providing insights to the various groups. If a facilitator wants to have avatars pair up to accomplish an assignment, they can simply click

a button to convert the virtual room's seating arrangement into two-seat tables that students can select and begin working with their avatar partners. In turn, these students may have access to virtual tools to further their collaboration efforts, including adhesive-note activities¹⁶ that automatically capture what one "writes down" for word processing later, technical architectural mapping tools,¹⁷ and learning activity tools.

Educational institutions, offered the possibility of enhanced group collaboration and tools, will likely look to enhance learning mechanisms. Schools such as Arizona State University are transforming the challenges and restrictions of social distancing into successful learning environments by creating their own virtual campuses where students and academia can network and learn about the school.¹⁸

COLLABORATION BEYOND VIDEOCONFERENCING

The Deloitte Greenhouse spaces are physical environments designed to help clients tackle complex problems by applying tested principles—including behavioral science, analytics, technology, and facilitation—to break through traditional problem-solving methods. These engagement principles have translated well to the virtual environment, since virtual experiences aim to expand possibilities by addressing today's reduced social interaction, the need to engage virtual audiences, and the desire to find new, enhanced ways to change how participants think about a problem.

"In the future," says Deloitte Greenhouse leader Kim Christfort, "there will be more tools to get people fully immersed in challenges. People process an abstract problem differently than one that they are experiencing not only intellectually but physically and emotionally."

Christfort further explains that with a virtual world, one can represent challenges via digital metaphors, which unlock new ways of thinking and can reduce resistance to change. A bold business statement could be brought to life as a mission to Mars; an alignment discussion could be conducted around a campfire. A virtual world can be designed and manipulated to do this in a way that a physical environment never could by enabling flexible tools that allow facilitators and experts to create an environment that engages multiple senses and is optimized for interaction and collaboration.

Virtual worlds also offer the opportunity to tailor environments to different working styles and to promote the "positive collisions" of diverse perspectives. Christfort's book *Business Chemistry* identifies four primary working styles and their strengths and preferences, outlining how to interact with others who have different types.¹⁹ The Greenhouse takes these differences into account in the design of experiences and in the way facilitators guide participants; virtual worlds, rooms, and content can be organized to provide the optimal working conditions for each type and to encourage more harmonious collaboration among the different styles. Virtual environments also provide the benefit of enhanced access, increasing the potential to scale the experiences to a broader range of participants and experts.

The Greenhouse experiences, then, look to combine the principles of interaction and engagement from our physical reality with the creativity, flexibility, and beyond-reality potential of virtual.

LOOKING TO VIRTUAL WORLDS TO ENABLE EQUITY

Heather Haseley and Dan Munnerley of Arizona State University's Learning Futures Collaboratory are envisioning the future of learning three to five years from now, directing volunteer-sourced minimum viable products that might scale into future tools enabling ASU students to interact with each other and their teachers in a more equitable and enhanced way. The lab runs 62 concurrent pilots and builds communities of practice across a multitude of technologies, but immersive learning and immersive technologies are front-of-mind. "The technology has caught up with the need," Haseley says; Munnerley explains, "Extended reality is one of our workstreams. What was one of seven workstreams, though, has become one of the most prominent workstreams."

As part of this workstream, Haseley and Munnerley were in charge of hosting the Learning (Hu) man Conference, where attendees could network and learn about the ASU culture. Due to the rapid development and scalability of a collaboration tool, the team was able to launch the conference, which saw more than 450 participants attend a virtual-world platform created in six months.

What they discovered is that people highly value serendipitous interactions, making this technology ideal for facilitating office hours, learning, and services. And they were able to conduct a playful conference filled with music, with six bands further drawing attendees who might have been dialing in from the integrated videoconferencing platform into the virtual world. Another appealing, humanizing feature: a concierge service that greeted attendees by name as they entered the virtual world, making them feel more comfortable and at ease in the environment.

Through the planning, Haseley and Munnerley aimed to increase accessibility, delivering solutions that enabled multiple modalities of collaboration: videoconferencing, mobile, closed captioning, and virtual worlds. The beauty of a virtual world is that it enables users to scale their participation by incorporating many of these technologies, so no one participant is forced into any given technology while trying to collaborate and communicate with others.

Future use cases

The VICE model

THE POTENTIAL FOR virtual worlds is great, but naturally, organizations want to aim for use cases that might generate user or participant value. The VICE model identifies how developers and business owners can think about virtual world use cases and ensure that they are enabling the greatest value around driving collaboration and communication.

Visualize & vision: Enable users to see and interact in an environment to which they would otherwise lack access. Most virtual-world experiences easily check this category of the VICE model, as they immerse participants in an environment that might be impossible to visualize in the physical world. Additionally, users can envision concepts and presentations that may have been challenging to create physically.

Inform & instruct: Greater access to instructors and information by developing an on-demand environment for instructor and user presence. Virtual worlds can simulate situations that an individual may have to undergo in real life and

with a group of people. Facilitators and experts can join from any geography to provide participants with leading content.

Communicate & collaborate: Users from anywhere can interact and collaborate with anyone at anytime from anywhere in a virtual environment. The single best use for virtual worlds is persistently communicating and collaborating with others at anytime from anywhere, as our example use cases have highlighted. Replicating this exchange can help participants interact serendipitously, as they would in the physical world.

Engage & entertain: Users can engage with each other and the world in ways that may not be physically or economically possible in the physical world. Additionally, users can have access to previously inaccessible entertainment and content. Having the flexibility to design virtual worlds demonstrates the ability for users to enjoy and fully engage with the developed product.



Keeping it real(ity)

The challenges ahead

LEADERS NEED TO consider many challenges as developers create more virtual worlds and as people spend more time collaborating and communicating virtually. Some issues to think about when identifying and developing virtual-world use cases:

Technology

Technical challenges may limit the extent that user experiences can be developed. Many barriers to virtual worlds will likely fall, as 5G enables greater processing speeds and bandwidth, but virtual-world technology currently lags in leveraging 5G benefits to enable more seamless experiences. Additionally, computer processing speeds require that users download many virtual-world platforms, which are essentially gaming platforms, to their hard drives, reducing some user access for those who might benefit from cloud-enabled platforms. However, with the enhancements of edge computing leading to the emergence of the Spatial Web, these challenges will likely recede.²⁰

In the short term, to provide truly immersive experiences in a virtual world, AR and VR technologies would have to mature to ubiquitous consumer-ready products; immersive holography will likely take longer, as sensory devices such as scent cannons, haptics, and omnidirectional treadmills.

Privacy and ethics

Organizations should keep privacy and ethics in mind while creating virtual-world environments, as those issues can drive data security and systemic issues around how people are included or excluded. The topic is vast, but some questions to consider on privacy include:

- In a particular virtual world, what information does a participant see about an avatar or content? Where is this information stored? Who has access to the data? Who owns the data?
- What other technologies process the information that the platform collects?
- How can participants have private conversations? Are these conversations encrypted?
- Should an individual's presence be visible to other virtual-world participants?
- When should a participant be able to screen their location in a virtual world?
- How is a participant able to manipulate the content and information that they are seeing?

Questions to consider on ethics include:

- How accessible is an environment to participants? Who might be at risk for being able to access the environment, due to socioeconomic issues?
- Is an environment being designed with inclusion in mind?
- How and when will the host delete event data—and can users delete their own data?
- How will avatar activities be regulated?
- What kind of disciplinary action is available for inappropriate behavior?
- How long should participants be allowed to engage in a virtual world?

These are only a few of the questions that creators of virtual worlds should begin asking to proactively protect user privacy and ethics. As ethical technology remains a challenge, regulating virtual worlds will likely require new levels of planning and diligence to safeguard users against malicious and unintentional breaches. One way to overcome this challenge is to solicit iterative input from subject matter experts and diverse groups, with the intent of improving feedback cycles and uncovering biases and nuances. Additionally, policies and standards, while sometimes time-consuming to pass and daunting to implement, could be essential to creating an organized, virtual space that delivers positive experiences for all.²¹

Health

Health is a consideration that needs to be taken into account, especially as users spend longer periods of time in immersive environments. Identified risks have included a reduction in neural activity,²² nausea,²³ digital addiction,²⁴ mental health risks with exposure to inappropriate content

or cyberbullying, head and neck muscle fatigue,²⁵ and visuo-proprioceptive coupling between virtual worlds and physical worlds.²⁶ While there may be benefits from leveraging immersive technologies for health treatments,²⁷ experts should further study the long-term side effects of immersive technologies and virtual worlds.

Walter Greenleaf, of Stanford University's Virtual Human Interaction Lab, suggests that basic research needs to be conducted in order to fully understand the health implications of spending extensive time staring at two-dimensional screens; he recommends that studies be conducted to determine the long-term effect on the brain and the visual system. Until the results are available, Greenleaf recommends, guidelines should be established and designers should build break periods into virtual world systems to mitigate the potential risks.

Psychology and sociology

Virtual-world technology adoption will likely be a challenge, as users learn how to leverage a new medium of communication and collaboration, in parallel with the physical equipment. The concept of identity will also be challenged, as event participants can presumably control their avatars' appearance and more.

As the many-to-many population becomes global, both organizations and users will likely face challenges in collaborating with diverse backgrounds and new policies that ensure user safety and cultural norms. Consider the time involved in designing machine learning engines that allow a user to create an avatar's virtual personal space, limit profane content, and provide an assortment of avatar customizations, all while taking cultural differences and laws into account.

The perfect storm is here

VIRTUAL WORLDS AND their potential are undeniably exciting, and organizational leaders are increasingly seeing the potential for accelerating their development. In a turbulent time, with travel and in-person gatherings uncertain or canceled outright, businesses are looking for more virtual experiences to conduct events and experiences to give many-to-many users a platform to communicate and collaborate.

As the world enters a phase of technology convergence, it will likely become easier to develop, run, and access virtual worlds. 3D modeling continues to be enhanced, lending to more realistic digital humans and content; voice recognition and artificial intelligence are enabling increasingly seamless interaction between user command and headsets; AR is quickly advancing to

consumer-based headwear; 360° capture is quickly advancing, especially with camera improvements on mobile devices and new technology incorporation; communication providers are rolling out 5G, enabling fast processing speeds; and hyperscale cloud computing enables processing at the edge and anywhere at any time.

With these converging technologies and a world moving toward immersive, virtual collaboration, we will likely see a shift: from developing individual AR and VR solutions to creating customized, virtual worlds that allow people to engage with others. The perfect technology storm is here, the new reality of virtual worlds is being created, and companies are taking interpersonal collaboration and engagement to the next level.

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