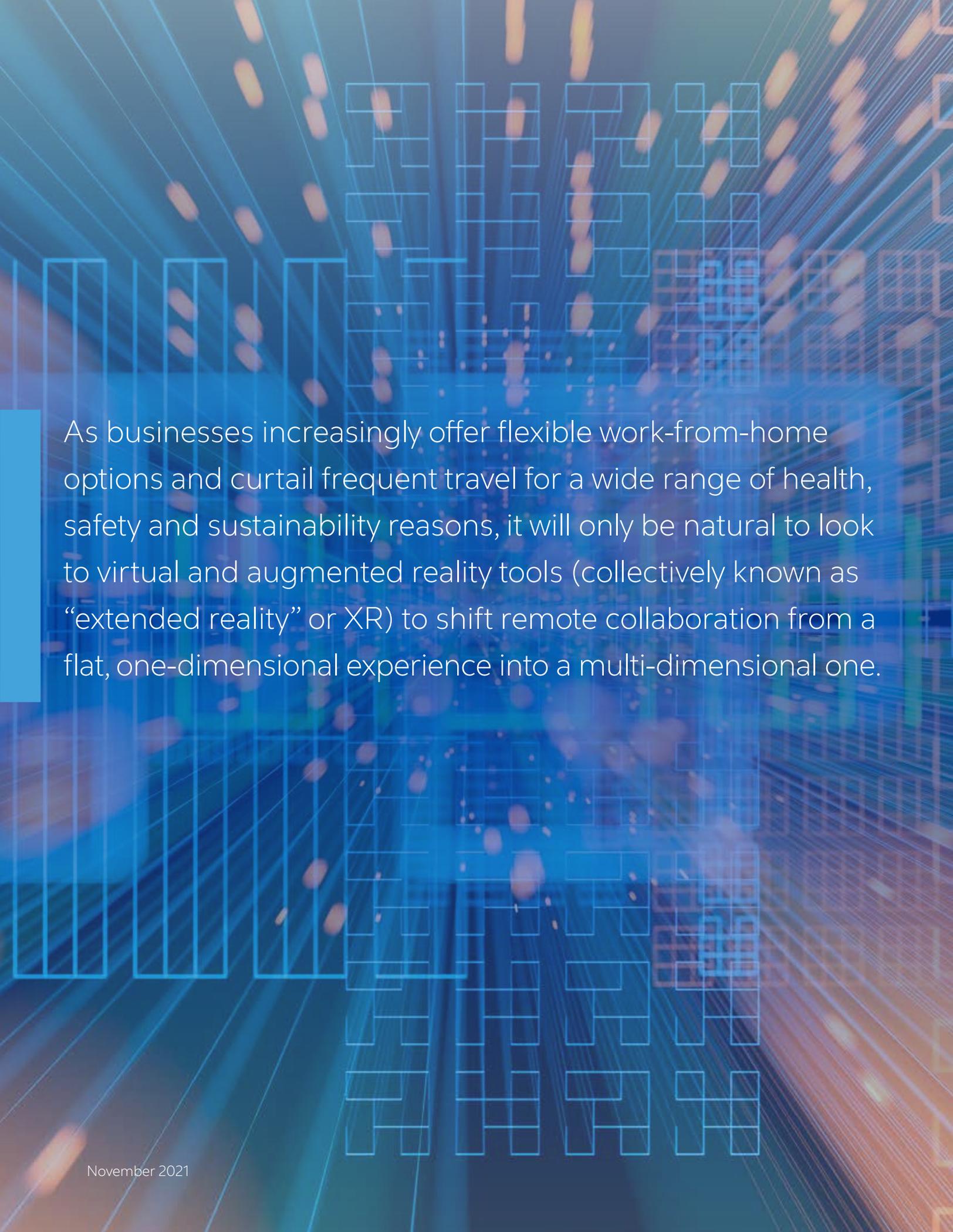


Infusing XR into Remote Collaboration

One-dimensional approaches to remote collaboration won't cut it in a world of hybrid workplaces and reduced travel due to sustainability concerns. Enter 'extended-reality' technologies, which can enrich interactions even when employees are more apart than they are together.





As businesses increasingly offer flexible work-from-home options and curtail frequent travel for a wide range of health, safety and sustainability reasons, it will only be natural to look to virtual and augmented reality tools (collectively known as “extended reality” or XR) to shift remote collaboration from a flat, one-dimensional experience into a multi-dimensional one.

Executive Summary

Employee collaboration post March 2020 has changed greatly — and also not at all. While there's no longer any guarantee that everyone (or even anyone) will be in the same room when brainstorming an idea, rethinking a workflow or designing a new product, businesses everywhere are continuing to rely on essentially the same tools for remote collaboration that have existed for over 20 years, albeit with a few bells and whistles added.

It's true that video calls, popularized in the early 2000s with the explosion of the internet, have improved in both quality and ubiquity, and tools such as whiteboards, online polling and screen sharing have been added. However, the fundamentals remain the same. Users sit essentially face-to-face with colleagues, and as the team involved on the call gets larger and tools are used to facilitate work, the screen real estate for seeing both colleagues and the information being shared becomes smaller and smaller. Attention drifts, fatigue sets in, and the sense of being together for energized, productive collaboration dwindles.

While “OK” or “meh” remote collaboration experiences were essential in the initial days of the pandemic lockdowns, they simply won't cut it as hybrid and remote work settles in for the long-term. As businesses increasingly offer flexible work-from-home options and curtail frequent travel for a wide range of health, safety and sustainability reasons, it will only be natural to look to virtual and augmented reality tools (collectively known as “extended reality” or XR) to shift remote collaboration from a flat, one-dimensional experience into a multi-dimensional one.

By equipping employees with anything from AR or VR head-mounted displays (HMD), to gaming-like consoles, to a browser-based enterprise “metaverse” (see Quick Take, page 8), businesses can pave the way to more natural, productive, inclusive and satisfying ways for workers to interact, wherever they are geographically.

With XR, people sharing a virtual space can move around, make eye contact when it really matters and use body language to express themselves. Moreover, it can bring those working remotely into the physical workspace so they're not at a disadvantage as they can merge into the geometry of a meeting seamlessly.

This may seem like science fiction, but the XR industry is picking up quickly, with a current value of around \$26 billion, according to one market intelligence organization, and much of the projected growth to \$463.7 billion predicted to come from the enterprise market.¹ Businesses are using XR to generate value and save costs today; from Nestle offering salespeople immersive factory tours to fully understand the company's quality and food safety standards, to BNP Paribas offering virtual banking services to replace rapidly closing branches, large organizations are moving from the pilot stage of XR projects to more scaled and practical use.^{2,3} Point solutions for XR collaboration are proliferating, and Microsoft's Mesh platform is kickstarting the platformization of the solution, creating a software development kit (SDK) to allow any XR experience to be a shared one.

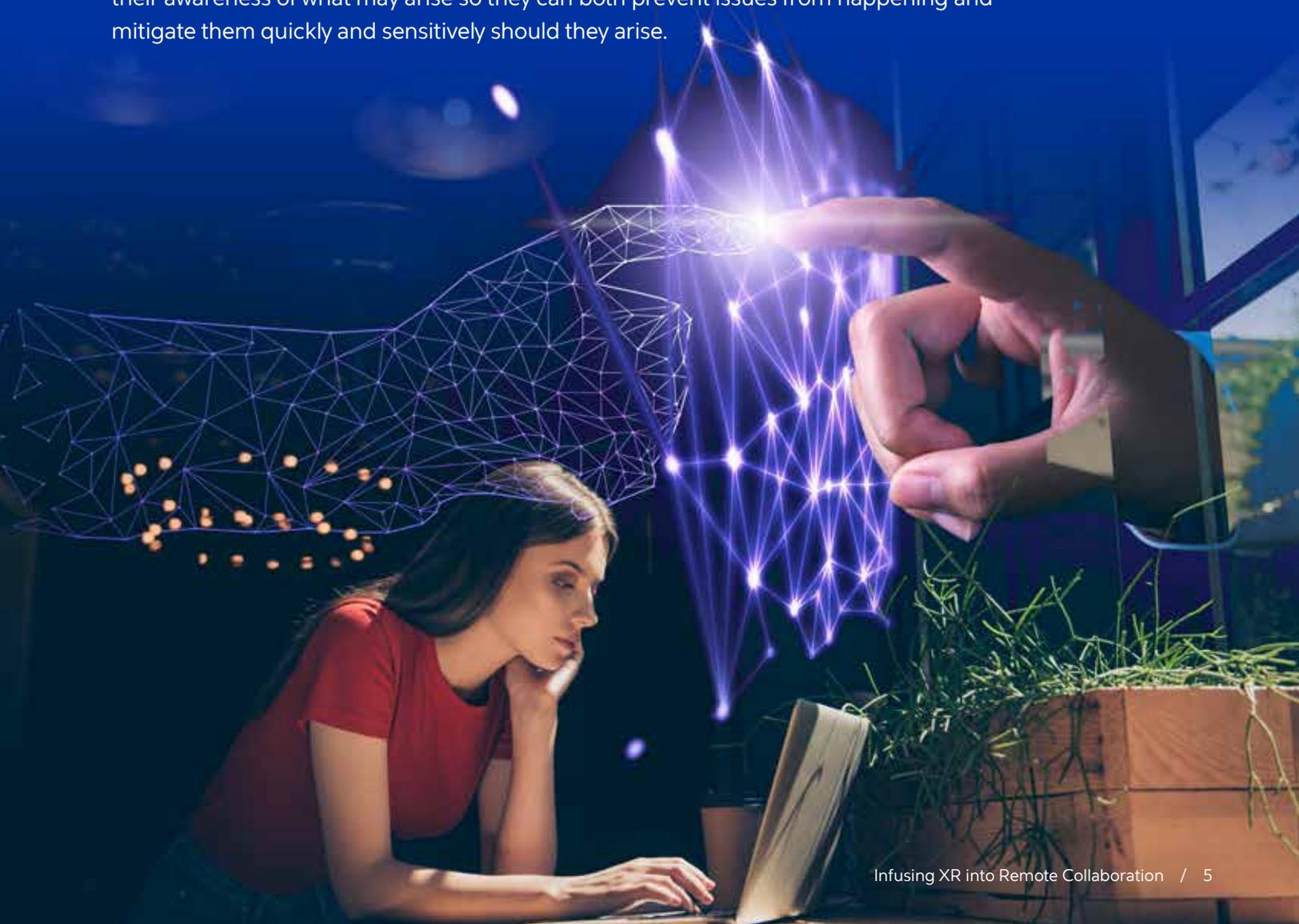
While XR has traditionally been long on promise and short on delivery due to tech limitations, high costs and a general sense that the tools are faddish, niche or oriented toward the gaming and entertainment worlds, it now stands to secure a hold on the enterprise. With the growing interest and the increased demands from employees for a solid remote-work experience, businesses need to understand more about XR collaboration capabilities and choices.

Guidelines for XR exploration

As more attention is focused on XR-based modes of collaboration, here are our key insights for business leaders who want to improve the employee experience and supercharge their remote/hybrid work experience:

- **XR can enhance many forms of collaboration.** From ideation and planning sessions, daily standups and training, to product design and the creation of digital twins, collaboration doesn't stop at simple meetings. Shared experiences with a goal and the need for interaction can all benefit from the natural human geometry an XR upgrade can bring.
- **Using the right virtual space will determine its success.** Augmented and virtual reality both have their benefits and limitations. Trying to shoehorn an interaction into XR that doesn't need it will damage its reputation in your organization. Ensure your implementation leverages XR's power and not the novelty factor.

- **Hardware and software integration needs to be tight.** Friction for entry is still high with XR. Headsets can make some feel nauseous and cause others discomfort. With good quality hardware and well-designed software, this can be easily mitigated to allow for a comfortable experience.
- **New forms of data can be leveraged.** HMDs and motion-tracked controllers provide a new level of biometric data that can be applied to improve business processes and products. When XR is used for collaborating on training or design, the resulting data on how people interact can be particularly insightful. Over-surveillance, however, could result in ethical concerns and privacy invasions.
- **Ethical issues are far-reaching.** From data collection to avatar representation, the ethical issues raised by a workplace infused in XR abound. Businesses need to increase their awareness of what may arise so they can both prevent issues from happening and mitigate them quickly and sensitively should they arise.



COLLABORATION THROUGH AN XR LENS



Collaboration is the lifeblood of an organization. Whether it be a simple quick meeting, a working session to design a product, train staff or plan a project, the act of two or more employees coming together to exchange ideas and interact is crucial for the benefit of both employee and employer.

That's not so easy in a remote or hybrid workplace. But the XR tools that have fueled a steadily growing range of use cases in a wide variety of industries could change the game for how employers deliver a remote collaboration experience.

As hardware has matured and software improved, small and large businesses are beginning to reap the benefits from virtual spaces and overlays that are not restricted by two dimensions, screen size or geographic location.

Consumer products giant Mars, for example, uses virtual reality tools to help retailers place products more effectively and train them on creating store environments that boost sales.⁴ Lockheed Martin, while building NASA's new Orion spacecraft, used augmented reality to assist with the manufacturing process, overlaying real components with digital instructions and visualizations to improve quality and increase speed.⁵

These examples reinforce how XR is adding value to specific tasks, but when examined through a collaborative lens, it becomes clear how these augmented experiences could be applied to almost any business interaction taking place today. From collaborative reviews of car designs reduced from days to hours by Kia using AR headsets to generate 3D models, to the European Consortium of Innovative Universities, created in VR, facilitating collaboration across all of its locations, both physical design- and knowledge-based industries can benefit.^{6,7}

XR can elevate the collaborative work experience in numerous ways:

I Enabling more natural human interactions. To display an accurate image of virtual space, VR and AR devices track the position of the user's head and hands through HMDs and handheld controllers. This enables people to both move physically around a space and manipulate the environment as they would in physical space. The added benefit is that when multiple people are in a shared environment, these physical movements are replicated through an avatar that appears in the shared virtual space, so body language cues are immediately apparent.

The experience is more intuitive and engaging than on a video call, as team members can gesticulate, point to objects, move freely around and even high-five each other. Technology is also available that allows for eye and mouth tracking, significantly improving the non-verbal communications that permeate everyday life and are so difficult to pick up on using today's videoconferencing methods.

Quick Take

What is ‘the metaverse?’

Like any emerging technology, XR is susceptible to hype, and nowhere is this more apparent than the recent publicity around the “metaverse.” The term, coined by science fiction author Neal Stephenson for his novel *Snow Crash*, refers to a shared, persistent, virtual space that is inhabited by representations of humans. Facebook (now Meta) is openly discussing the creation of such a space, committing to employ 10,000 EU workers dedicated to it and even renaming the entire company in light of this focus.⁸

The reality is that the metaverse is not one distinct concept. It means different things to different people, but no one company or application will, or should, end up controlling virtual space, as much as Meta may want to. The metaverse is a catch-all term for the different tools, applications and software that can be used in XR, the spaces that people collaborate in virtually and the infrastructure that surrounds it.

Businesses that want to use XR to create value and enhance the experiences of their employees and customers should consider the use of the term carefully to avoid appearing susceptible to hype and gimmicks, and to ensure they focus on XR developments with real and practical applications. A rising tide raises all boats, however, and the level of investment Meta and others are putting into the XR space is an enormous validation of the industry’s value.



While the humanistic avatars used by most collaboration tools are still somewhat cartoonish-looking (in part to overcome the “uncanny valley” that would result from looking “too human,”), the body movements and backgrounds in which the avatars appear are natural and complementary. This helps to compensate for the otherwise less realistic look of the avatars themselves (see Figure 1).

A new you, in virtual space

Three different avatar approaches, from the humanistic to the representational.



Source: Cognizant Center for the Future of Work.

Credit: Avatars created by the author using platforms provided by (from left to right) Spatial.io, Ready Player Me and Bigscreen. Avatars represent the author; any other likeness is unintentional.

Figure 1

Anyone in doubt of how effectively an avatar can convey human intent can look to the anthropomorphized creatures created by computer animation studio Pixar, which are some of the most engaging film characters of the modern era. When fully immersed, employees are likely to move quickly from the initial peculiarity of interacting as an avatar to engagement and productivity.

- **Experiencing the virtual as “real.”** While tools traditionally used in physical settings, such as whiteboards, sticky notes and presentations, can all be replicated in a virtual environment, multidimensional tools can enrich interactions with sensory experiences that simulate touch, feel and even emotion. For instance, video can be integrated into a whiteboard in real time, and presentations can utilize 3D models and graphics, ending the traditional “death by Powerpoint.”

Toy maker Mattel has partnered with Microsoft and XR collaboration provider Spatial.io to enable participants to create prototypes of new products virtually, saving the cost of building multiple iterative physical models.⁹ Through XR, people who are both physically collocated or remote can join in the process and design quickly and cost-effectively.

Similarly, using 3D visualization tools from Preevue, theater designers from Ambassador Theatre Group and Royal Shakespeare Company can create highly accurate representations of performance venues.



A director in Los Angeles and a producer in London can meet remotely to visualize how the set appears from any seat in the theater and collaborate live with the set designer to make changes on the fly, all without a single real object being built. Ticket prices and development costs can also be determined much further in advance than previously, as each seat's view can be ascertained from the virtual model.¹⁰

Taking this a step further, some businesses are combining XR with haptic feedback to collaborate on product design. Using wearables made by HaptX, companies such as Nissan have been able to collaborate and design in VR, feeling sensations, texture and weight through the HaptX gloves as if they were users with different builds and strengths, allowing for a more diverse and inclusive design process.¹¹

XR can also enhance emotional connectedness. In Stanford University's "Virtual Becomes Reality" program, XR-driven avatars build empathy by helping users experience what it's like to undergo racial discrimination or homelessness.¹² This type of XR-driven immersion could be applied in a company's diversity & inclusion (D&I) training exercise.

- **Establishing "collaborative geometry."** In same-space meetings, the collaborative geometry (i.e., the location of all the participants relative to each other in a session), is fundamentally different from that of video calls. When sitting in a meeting room, people tend to sit in circles or squares. When at a standup, they tend to circle around the speaker and move around depending on the dynamic of the room. And when working on an issue or design, people tend to surround the item being observed; even if it is displayed on-screen, a semicircle will generally form around it.

None of this is possible in video calls, where each participant faces the others directly, removing any energy and dynamism from the conversation.

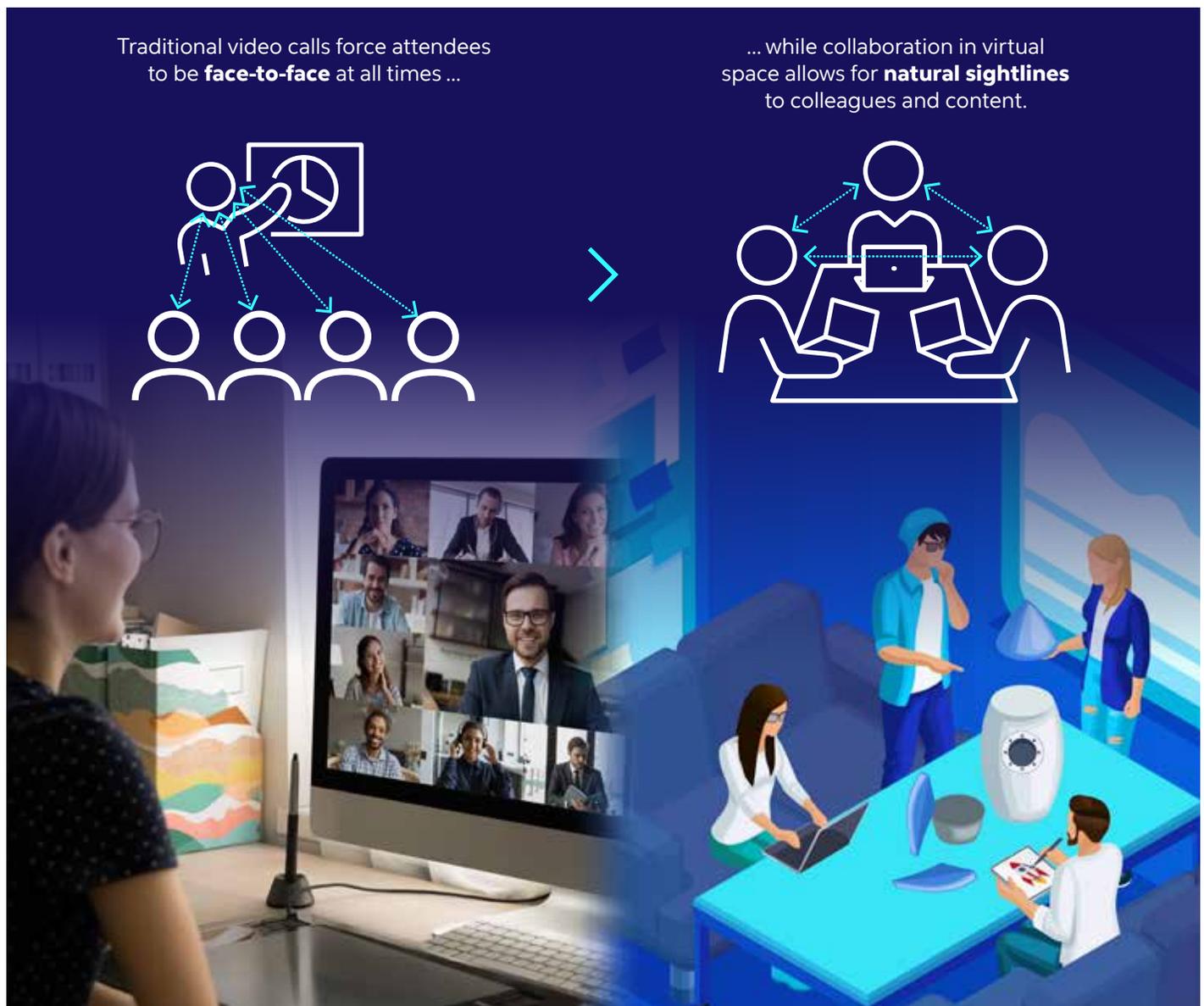
Stanford University's Virtual Human Interaction Lab recently studied why business video calls exhaust participants.¹³ Two primary reasons are:

- > Mobility during meetings is reduced due to the video camera's small field of view
- > Constant eye contact causes fatigue from attention being focused in one area for too long

Placing people in virtual space can bring the energy of collaborative geometry back to remote and hybrid work. Through the use of avatars or even a full volumetric capture of their real body through specialized cameras, all employees — both in-office and remote — can feel truly together for the first time. Virtual attendees can position themselves naturally in a group, rather than as traditionally conducted with a speakerphone in the middle of the room that is often forgotten about, or a video on a screen that may be overlaid and ignored for the sake of a presentation (see Figure 2, next page).

Townhall-style presentations, a crucial form of collaboration that ensures lines of communication are open between leadership and employees, can also benefit from taking place in virtual space, with both attendees and presenters using XR to be present. Global companies have turned to web-based presentations, where speakers talk to a faceless audience and answer voiceless questions. If they used XR to place a presenter in front of the audience, they'd establish the more natural geometry of a speaker facing a crowd and the crowd observing the speaker.

Bringing collaborative geometry to remote work with XR



Source: Cognizant Center for the Future of Work
Figure 2

PUTTING VIRTUAL SPACES IN THE RIGHT PLACES



All the benefits of XR are for naught if businesses don't take the right approach to using the virtual technologies available to them. Too often, XR has been used as a novelty — a technology trying to solve a problem that doesn't exist. The fact is, sometimes the right virtual space is no virtual space at all.

For instance, if two people are located in the same office and need to meet face-to-face and view some documents, it is almost certainly the wrong choice to try and shoehorn in the use of an AR headset. Similarly, if someone needs to speak to another person quickly or spontaneously while on the move, a simple phone call would be more appropriate than moving to an XR environment.

XR is not something that needs to be inhabited permanently; it is a tool to be used at the right time and in the right way, such as workshops, weekly team meetings or special gatherings.

The XR software must also be assessed on a case-by-case basis. Many point solutions have been created for XR collaboration, with one of the current market leaders, Spatial.io, boasting clients such as BNP Paribas, T-Mobile and Ford. Spatial facilitates more natural collaboration in XR, even allowing those without access to XR hardware to join in via desktop and mobile applications.

For more niche applications, however, such as a specific training program or the interactive design of a digital twin, specific software may need to be developed or multiple products used.

Acknowledging the proliferation of applications and differing requirements for the multitude of use cases for XR, Microsoft has developed Mesh, a platform rather than a point solution for collaborative XR. Mesh allows for any XR application to use Microsoft's SDK for creating a collaborative space. Hardware-agnostic, and with mobile and desktop accessibility, Mesh promises to bring much needed consistency of user experience to the expanding landscape, even soon integrating with Microsoft's own Teams platform.

Additionally, Meta is rapidly deploying new tools for its Oculus ecosystem. Horizon Workrooms is the latest in the suite, which is a closed platform exclusive to Meta's hardware. With general unease over the company's approach to privacy, it may face an uphill battle in winning over enterprise customers.

Smoothing out the friction points

Any software developed for XR needs to work in harmony with the hardware used in order to provide a comfortable experience for users. It's still the case that many can become nauseated wearing a VR headset, and both VR and AR hardware can be heavy and hot. As with any developing technology, however, strides are being made quickly to streamline the headsets, reduce heat buildup and reduce motion sickness.

Huawei, for instance, has slimmed down a VR headset to nearly glasses-like size, and HTC's most recent enterprise headset, the Vive Focus 3, includes a small and almost silent fan to keep wearers cool.^{14,15} Though not focused on enterprise use, Sony is understood to also be exploring whether the use of haptics within the headset can use vibrations to reduce motion sickness.¹⁶

Software itself must also run smoothly in conjunction with the headset screen. Any perceived jitteriness or lag in the view can cause serious discomfort for users. Because developing this kind of software can be time-consuming and expensive, solutions developed by specialist companies are recommended over in-house-built applications, and accessibility must be considered for those without, or unable to use, an XR headset. As with any other enterprise software and hardware, research into the products is crucial to ensure widespread user adoption.

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Cognizant

Duncan Roberts

Cognizant

The Work Ahead
in Manufacturing:
Fulfilling the
Agility Mandate

Woods

RESOLVING THE ETHICAL DILEMMAS OF XR



Through the combination of hardware that understands users' movements and software that knows where users are looking and how they are interacting, XR can provide a wealth of new data that can be analyzed and used in new ways.

"Gaze tracking" is the primary example, in which the headset gathers information on where a user is looking. This could be used in a soft skills training exercise held with multiple people in the same virtual space, where the amount of eye contact made can be determined and assessed for effectiveness. During a health and safety assessment, for example, businesses can use gaze tracking to accurately evaluate how well a trainee surveys a scene and where they're focusing their attention, such as in the VR training program created by Immerse for oil and gas giant Shell.¹⁷

How users interact both with each other and with any digital twins or models placed in the scene can be a powerful metric, used to understand employee engagement and performance through analysis of the interactions they perform with both the virtual world and their colleagues. Doing so can also pose ethical issues. The biggest player in the XR consumer market is currently Meta (formerly Facebook), whose track record with user privacy is well documented. As such, in order to maintain a positive perception of XR, businesses must both be aware of the data they are capturing and provide security around it.

The privacy and ethics considerations of XR do not just begin and end with data. In entering a virtual space and appearing to others as an avatar, the design of this virtual human requires attention. Businesses may decide to control exactly the parameters that avatars can display and enforce a policy that they must represent the real person as closely as possible. But this raises questions, such as whether the person creating the avatar will identify as their current appearance and would be more comfortable with a different one.

What if the parameters given by the software to create the avatar do not include aspects of that person's appearance that they feel strongly about, such as an item of religious clothing or a hairstyle that reflects a particular heritage? Before enforcing any policy, these subjects must be thought through and discussed openly with participants.

There are also aspects of ethical behavior that pertain to physical space that must not be taken any more lightly when applied to virtual space. Encroaching on someone's personal space is just as unnerving and uncomfortable for people in an XR environment as it is in reality. Some applications can place a "personal bubble" around the user in order to stop others getting too close, but this should not be relied upon, and proper behavior should be enforced. Even though touching is not possible in XR (yet), users moving their hand in the vicinity of other's bodies can be uncomfortable and inappropriate. As in the physical world, boundaries are vital in the virtual world.

MOVING FORWARD IN AN XR-DRIVEN WORKSPACE



The tools businesses use to collaborate have never been more important, especially amid the rise in hybrid and remote work, reduced travel due to sustainability concerns and a labor shortage that requires an expanded talent pool. A better, more natural way to interact with remote colleagues is needed if companies and employees are to thrive in this new environment.

XR's enterprise use has evolved over time, and as hardware and software has improved, companies are now looking to these tools to help employees better connect and collaborate. To supercharge collaboration and enhance the employee experience, businesses should consider the following:

I Use special events and pilots to overcome the perception of gimmicks. XR can be a difficult technology to describe — it has to be used and experienced to understand and then promote its value. To reach the greatest number of people possible, consider holding townhalls or all-hands meetings in virtual space, with even those unable to use a headset able to join via their phone or computer if the right software is used.

At the same time, identify teams who would benefit most from early implementation, either through high-value use cases or the need to collaborate across geographies, and pilot regular sessions held in XR so they can evangelize to their colleagues.

I Treat XR as you would other enterprise technology. Yes, XR can be used for entertainment, but so can any laptop or desktop PC. Treat your XR rollout as you would any other enterprise system and ensure due diligence on HMD choice and software selection. Work with enterprise partners and consultants to ensure your implementation meets your needs and expectations, as well as accounting for the unique challenges a successful XR rollout poses.

I Create data and ethics policies now. Don't wait for issues to arise before creating strategies to counter concerns over data privacy and user behavior in XR. Use demonstrations in XR, early in implementations, to provide training and guidance for how avatars should appear and users should behave. Create policies on which data is collected and how it is used, if at all. This will imbue your staff with confidence in your approach and help with adoption.

I Be creative. XR removes limits on the tools you can use for creativity. Don't simply try and replicate physical meetings and collaborative exercises in virtual space; brainstorm, create and utilize the technology for what it is. Use enterprise forums, such as The VR/AR Association, to leverage cross-industry knowledge on best practices and innovative use cases to ensure you are making the most of these new advances.

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He has developed applications for emerging virtual and augmented reality hardware, leading to working directly with large companies on experiences for their launches. He also advised small startups on using blockchain solutions for advertising within VR and AR. Duncan brings his passion for technology and experience in industry to researching the impact of virtual space on the workplace.

Prior to Cognizant, Duncan worked for one of the largest publishing houses in Europe, helping to transform the company's operations end-to-end and launching innovative products. He holds a master's degree in philosophy and classics from the University of St. Andrews.

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