Top 2020 Trends: Enterprise AR & VR

15 industry experts share why it's poised to be a transformational year

What's inside

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Executive summary

60%

of all AR/VR content is powered by Unity

In "The Incredible Impact of Enterprise AR & VR," we spotlighted the innovative work of Lockheed Martin, which has seen a tenfold ROI building products virtually versus physical builds and testing. Notably, VR-assisted validation saved them more than $10 million in costs in one year.

Mixed reality (XR) programs that produce results of this scale and magnitude have historically been rare and exceptional, but according to the dozen-plus industry experts who shared their insights with us, that's changing.

Here's why 2020 is shaping up to be a year to remember for XR in the industrial sector:

— **The proof is in the proof of concept.** The question is no longer if XR is a worthwhile investment – it's how to scale the positive results from initial forays into the technology to "iterate faster, mitigate risks, and increase high-quality throughput."[1]

— **XR is primed to enter its "grown-up phase."**[2] With its effectiveness well established, the time has come for XR to move beyond "fancy demos, proof-of-concepts and pilots" to become "an indispensable digital productivity tool"[3] used across the entire product lifecycle, from R&D to marketing to maintenance. There's an industry-wide need to "put in the arduous work of scale,"[4] but in so doing companies can achieve "faster time to market, lower total costs, better trained employees, [and] happier customers."[5]

— **XR will reach meaningful scale, spurring a new wave of companies to join the party.** It's projected that by 2020 "there will be more than a billion people who could have an AR experience with their own devices."[6] Expect even cautious companies to finally follow in the footsteps of their pioneering counterparts as XR becomes more accessible and mainstream, driven by a wave of new and improved HMDs, mobile AR and standalone VR, and the onset of 5G networks.

1 David Golembiewski, Director of Enterprise Sales – Automotive & Manufacturing, Magic Leap.
2 Alice Bonasio, XR Consultant, Tech Trends | Inside AR | Inside VR.
3 Dirck Schou, CEO, Taqtile, Inc.
4 Maria Fernandez Guajardo, Director, Enterprise, AR/VR, Facebook.
5 David Weinstein, Director, Virtual Reality, NVIDIA.
6 Mark Billinghurst, Professor of Human Computer Interaction at the University of South Australia (2019). In Charlie Fink (Ed.), _Convergence: How the World Will Be Painted with Data_. Toronto: Convergence Press.

Augmented reality

magic leap

Greater adoption of spatial visualization helps manufacturers iterate faster, mitigate risks, and increase high-quality throughput

Spatial computing is transforming the way companies design and manufacture products, as well as how they train the employees responsible for these jobs. Using spatial visualization, companies can optimize their design and manufacturing processes and become more efficient.

In 2020, we expect more companies to follow in the footsteps of some of the largest automakers and manufacturers, who are leveraging spatial computing and the power of 3D spatial visualization to:

— Rapidly ideate and iterate on their product designs to shift left and upstream in their product development processes – before ever making a physical prototype

— Understand how changes to CAD will fit by visualizing updated digital models in their intended environments – preventing problematic parts from making it into their products

— Onboard workers quickly and provide spatial guidance to enable them to do their jobs with greater efficiency – increasing product quality while reducing production time, costs, and defects

David Golembiewski
Director of Enterprise Sales – Automotive & Manufacturing
Magic Leap

Courtesy of Magic Leap

ptc

Connected products, the AR Cloud, and super-fast networks

Courtesy of PTC

Michael Campbell
Executive Vice President,
Augmented Reality
Products
PTC

2020 is set to bring new advancements in network speeds, cloud computing, and connected products – offering more opportunities for augmented reality to add value in the industrial enterprise.

As machines and factories become more connected, the need for greater visualization capabilities will be increasingly critical. Workers will have access to an abundance of new data, and AR will enable them to not only see it but also to interact with it, offering digital interfaces that can control physical machines in real-time.

The AR Cloud will also play a big role in connecting workers to their jobs, allowing persistent experiences based on location, sensor data, and specific machines. Pair the need for fast access to data stored in the cloud with the introduction of 5G, and AR solutions become even more powerful. Super-fast mobile networks can enable low-latency streaming and make it even easier for companies to adopt SaaS offerings.

AR Insider

Industrial AR breaks out of "pilot purgatory" by focusing on people rather than numbers

Image credit: Microsoft

Mike Boland
Founder & Chief Analyst
ARtillery Intelligence
@arinsider

Industrial AR continues to hold lots of promise. But like many AR subsectors, it's taking longer than expected to materialize. This has less to do with the technology's efficacy – which is strong – than roadblocks from human and organizational issues.

We're talking inertia, politics, changes in management, and fear of new technology among stakeholders such as frontline workers. The biggest symptom of these stumbling blocks is the dreaded "pilot purgatory."

ARtillery Intelligence has identified sources and solution areas, classified as the Three Ps: People, Product and Process.

— For people, it's about customizing AR's ROI story to individuals at all levels of the organization… not just the C-suite.

— For product, it's about addressing real operational pain points, uncovered through ground-level research.

— For process, it's about multidisciplinary prototyping rather than top-down innovation. Industrial enterprises that tackle these human-centric issues, rather than just ROI figures, have a better shot at enterprise-wide adoption.

TΛQTILE

Digital transformation makes its way to frontline workers using spatial computing

Courtesy of Taqtile

Dirck Schou
CEO
Taqtile, Inc.

Office workers have been reaping the benefits of computing and its associated productivity tools for over 30 years with solutions like word processors, spreadsheets, enterprise resource systems, and more. In 2020, spatial computing is going to move beyond fancy demos, proof of concepts, and pilots.

Not only will it be used to bridge the major skills gap that industrial organizations are experiencing, but it will become an indispensable digital productivity tool that enables workers to perform tasks more consistently and efficiently while reducing the risk of harm to both man and machine.

Web AR sees broad adoption and succeeds by focusing on utility instead of gimmickry

After an initial phase of experimenting with "off the shelf" software with their new AR HMDs and earning immediate results, corporations will invest in customized and bespoke solutions for 2020.

Early adopters in 2019 made small-batch device purchases of AR HMDs, largely for testing and prototyping. Many used generic solutions and tools for key use cases like step-by-step instructions or remote assistance.

However, as companies understand the transformative potential of AR and their demands on the technology grow, they will find themselves needing to extend both the capabilities of the tools and, equally importantly, to create custom connections to their legacy workflow and asset and data management systems.

Jason Yim
CEO
Trigger

Responsive design reflects the real world

Timoni West
Director of XR Research
Unity Labs
@timoni

Computers are taking in massive amounts of world data and are able to instantly process and do something useful with it. This is what makes augmented reality possible.

UX designers will have to adjust accordingly. Instead of making responsive design just for different devices, they'll have to start thinking about responsive design as computers react to everything in the real world.

Gestures, voice, gaze, time of day, how many people are in the room, and where you are: all of these variables are now new user inputs that have to be taken into account.

Virtual reality

⬭ oculus

VR goes mainstream with Quest

Maria Fernandez Guajardo
Director, Enterprise, AR/VR
Facebook
🐦 @marifes

Courtesy of Facebook

After all the hype in previous years and the so-called nuclear winter of VR, the technology is climbing back fast with real, meaningful adoption. This momentum is fueled by the success of more approachable, yet performant, standalone devices like Oculus Quest, which launched only six months ago.

The consumer success of devices like Quest is driving real content sales with more titles crossing the $1M mark, while at the same time exposing more people to the superpowers of the technology. These newcomers will wonder how to implement them for work, resulting in a pressing need for education and enablement.

After a few years of testing applications, many verticals and use cases have proven ROI. The perception of gimmickry has given way to real business value. 2020 is going to be a critical, but not glamorous, time for enterprise VR. The industry will need to put in the arduous work of scale: establishing infrastructure, integrating workflows and connecting a comprehensive ecosystem.

The venture capital community has also been paying attention to the surge in demand in both enterprise and consumer VR. 2020 will bring a new wave of investments and, therefore, more startups and innovation in the space.

VIRTUAL REALITY

VIVE
htc

Platforms bring scale to hardware innovations

Vinay Narayan
VP, Platform Strategy and
Developer Community
HTC VIVE
@Vinay_Narayan

Courtesy of HTC

The upcoming year will present the most robust ecosystem of innovations yet, and Unity is making it easy to integrate those experiences. Eye tracking, gesture recognition, inside-out/computer vision, 5G, and spatial computing will lay the foundation for new industrial XR experiences.

To drive scale, however, these tools need to be quickly integrated with existing technology stacks. Through our efforts with Unity and NVIDIA, integrating industry-leading eye tracking capabilities with VIVE Pro Eye and Variable Rate Shading (VRS) can be completed in as little as five minutes!

Technological innovations such as these will make XR experiences a widely accessible tool for industrial enterprises of any scope and size in 2020.

innerspace
THE DEEPTRAINING COMPANY

Daniel Bösze
Lead 3D Artist
Innerspace – The
DeepTraining Company

Deepening skill sets and mindsets in authentic VR-based trainings

Real-time rendering of one of Innerspace's DeepTrainings, running at 90 fps and 8x AA in Unity. Courtesy of Innerspace

When it comes to highly critical production processes, there is a clear trend that customers want to deepen two essential aspects of their training:

—   **Deeper and more authentic training experiences in VR.** The trend goes towards more authentic, realistic experiences in VR that are made possible by cutting-edge hardware and expertise in software design. These experiences are all about truly mastering the real key moments in the production process: when something goes wrong.

—   **Deeper understanding of the causes of human errors.** Systematic analysis of human errors has shown that their root causes are linked to setting-skill set (do I behave correctly?), setting-mindset (do I have the correct understanding?), as well as to self-skill set and self-mindset (can I keep control in key moments?). To permanently avoid human errors, all areas must be addressed equally in training.

An authentic VR representation of the environment is essential to deepen the immersion in training, making it possible to transfer skill sets and mindsets into a successful mastering of key moments.

Innoactive®

Andreea Raducan
Head of Marketing
Innoactive

Developing the unsexy layer of VR: The infrastructure that scales

VR training from Innoactive (image copyright: Audi AG)

By now we've all seen many well-executed examples of how VR can be leveraged, with training as the lead use case. Tech enthusiasts have managed to convince budget owners of the worth of investing in this tech.

If so far most of their efforts went into crafting the best use experiences and measuring impacts, now they finally get the space (and pressure) to think about the next level: making the data accessible in a manner that scales.

Whether 3D assets, VR apps, internal processes information, or lines of code, the data needs to flow across platforms and reach various locations in real-time. It needs to be usable, reusable and maintainable by multiple teams simultaneously.

Therefore, we can expect that enterprises will be spending less time on UX experiments and more time on designing a solid infrastructure around the data.

Mixed reality

XR

NVIDIA.

Our XR future: Real-time ray tracing, 5G, and broad enterprise adoption

Courtesy of NVIDIA

David Weinstein
Director, Virtual Reality
NVIDIA

Three major trends will drive tremendous growth in VR and AR:

— **Faster, more powerful graphics.** With NVIDIA RTX™ and Unity, XR developers can take advantage of powerful new graphics technologies such as real-time ray tracing for stunningly realistic experiences and NVIDIA variable rate shading (VRS), which allows perceptual optimization of the rendering pipeline.

— **Disaggregated graphics is driving mobile XR devices from the cloud.** As 5G networks come online, graphics and compute will increasingly be served from the network edge. NVIDIA's CloudXR™ distributes rendering, making it possible to explore even the most complex models and environments on mobile XR devices.

— **Deeper XR penetration within enterprises.** In the last couple of years, major companies everywhere ran proof-of-concept XR projects. The results were uniformly positive: faster time to market, lower total costs, better trained employees, happier customers, healthier patients. These early results will drive a virtuous cycle of growth and innovation.

MIXED REALITY

TECH TRENDS

Enterprise XR grows up: Moving past experimentation toward evidence-based deployment

Alice Bonasio
XR Consultant
Tech Trends | Inside AR |
Inside VR

🐦 @alicebonasio

XR has proven to be a paradigm shift for enterprise in terms of boosting productivity, cost-savings, and learning and development, particularly in relation to highly skilled and specialized areas ranging from surgery to spacecraft engineering. Yet where so far we have seen pioneering companies work largely on an experimental trial-and-error basis, this next decade will see research catching up to meaningfully support this deployment on the ground.

Instead of a one-size-fits-all approach, enterprise stakeholders will increasingly have the information and expert guidance at their disposal to tailor and customize solutions optimized for their specific industry, goals, and needs. Academic research is now being conducted all over the world to investigate not if XR works but how it works and what considerations must be taken into account when designing content.

As more studies are conducted and more use cases are shared among enterprise stakeholders across an expanding ecosystem of different industries, we will move on from the heady days of experimental exploration and marveling at the power of immersive technologies towards more targeted, considered, evidence-based and industry-specific approaches. In other words, enterprise XR is about to enter its grown-up phase.

TALESPIN

Closing the skills gap through VR and XR

Courtesy of Talespin

Kyle Jackson
CEO & Cofounder
Talespin
🐦 @kjplanet
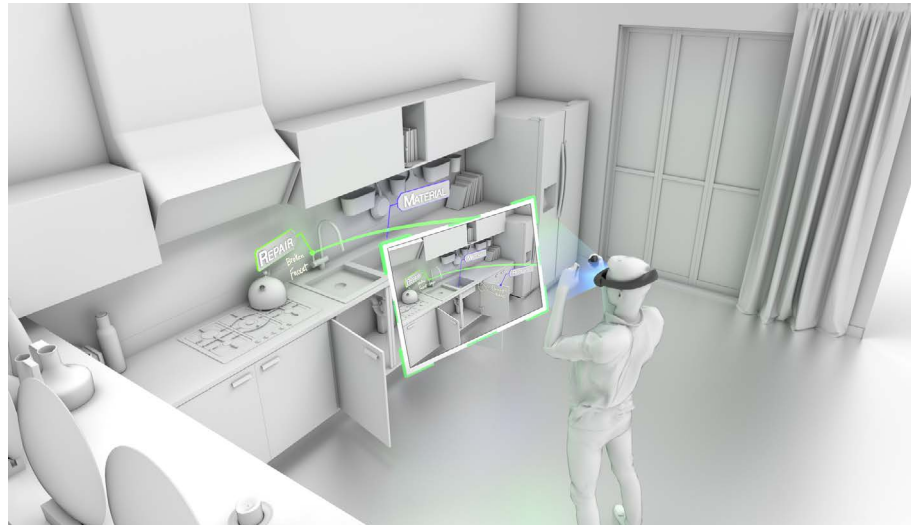
VR training will drastically reduce learning curves and enable prescriptive training for process-oriented jobs in the industrial sector. Jobs are rapidly evolving as automation augments business processes, and employees need to continuously adapt and reskill to keep pace.

VR training will not only accelerate learning for new skills, it will also enable employees and companies to align skill sets with roles and opportunities in real-time. Training impact in the sector won't stop at process work, as the evolution of people's job roles will make leadership and communication skills invaluable. VR will enable us to hone these skills and level up as leaders, managers, and colleagues.

Intelligent mixed reality tools will take transformation a step further by collapsing training and execution into one step. Support in the form of real-time access to data, 3D references, and remote collaboration while we complete tasks will lead us to a new level of job performance.

VARJO

Mixed reality will break through as a valuable industrial tool with new levels of photorealism

Varjo Workspace allows design processes to be moved inside the virtual space, with Unity and your 3D model around you.

Courtesy of Varjo

Niko Eiden
Cofounder & CEO
Varjo

In 2020, the use cases for industrial AR/VR will shift towards mixed reality – and there's no turning back. It is a natural next step to bridge the existing value of virtual and augmented realities into one seamless experience.

Thanks to video pass-through technology, mixed reality is finally photorealistic instead of holographic, enabling perfect control over every pixel the user sees. Pass-through-based mixed reality enables the operation of physical interfaces while being immersed inside a virtual environment, transforming training and simulations as well as virtual prototyping.

We'll see new mixed reality workflows introduced in 2020, resulting from 2D/3D interfaces such as Varjo Workspace. In 2020, the industry will come to see the first signs that VR/AR devices will eventually all become mixed reality devices. With pass-through XR and Varjo Workspace, 2020 will mark the start of this computing revolution.

XR at scale – delivering on the potential

Ed Martin
Senior Product Manager,
Manufacturing
Unity

In 2020, VR and AR will move out of pilot deployments into scale applications, enabled by tools that make it easier for non-developer professionals to reuse content and create experiences that integrate with IoT data and enterprise business systems.

Lower costs to deploy and maintain these experiences will combine with improved returns from integrations to significantly improve ROI. We're going to see wider adoption of VR and AR across multiple industry verticals.

Build the best experiences
for AR and VR

60% of all AR and VR content is powered by Unity. We offer the widest platform support, and our tools and workflows give you the power to create extraordinary interactive and immersive experiences.

AR
AR Foundation: A framework for creating multi-platform AR experiences across ARKit, ARCore, Magic Leap, and HoloLens devices.

Unity as a Library: Insert AR powered by Unity directly into native mobile apps.

VR
High Definition Render Pipeline (HDRP) for VR: Achieve stunning, realistic graphics and lighting effects that let you push the boundaries of high-fidelity VR without sacrificing performance.

XR
XR Interaction Toolkit: Add interactivity to your AR and VR experiences across all supported platforms without having to code the interactions from scratch.

In 2020, we'll release Mixed and Augmented Reality Studio (MARS), a new authoring tool for working with real-time data directly in the Unity Editor. MARS provides a work environment for intelligent AR authoring that allows you to create context-aware, flexible, customizable AR experiences that work in any location with any kind of data, with little-to-no custom code.

Unity Learn: Build expertise in AR and VR development

Courtesy of Varjo

[Introduction to XR: VR, AR, and MR Foundations](#)

In this 11-hour course, you will learn how to build two simple XR applications on your smartphone, as well as how to conceive your own original concept for an XR application.

[Getting Started with the Post-Processing Stack for VR](#)

In this project, you will learn how to apply effects to a camera and scene, create a reusable set of effects, and understand the impact post-processing has in VR.

[VR in Unity: A Beginner's Guide](#)

If you are new to creating virtual reality experiences in Unity, this project utilizes a popular free plugin called VRTK to create a "Jump Start Your Car Battery" app prototype that focuses on getting started quickly, with little or no development experience.

Start your free trial of [Unity Learn Premium](#) or log in to the [Unity Learn](#) platform with your Unity Plus or Pro ID for complimentary access, included in your subscription.