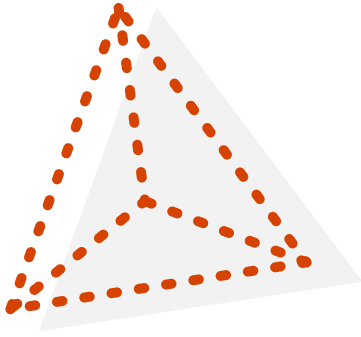# BUILTWORLDS
INSIGHTS

# Digesting the Immersive Reality Experience:
VR, AR, MR, + 3D

TECHNOLOGY ALPHABET SOUP

There is no shortage of acronyms when discussing new technologies impacting our daily lives. Everything from HTML (Hypertext Markup Language), SaaS (Software-as-a-Service), IoT (Internet of Things) and AI (Artificial Intelligence), acronyms seem to act as a right of passage for new and innovative concepts brought to market. Maybe this comes from the desire to be less intimidating to consumers, or perhaps it's meant to limit the amount of time spent typing them out in conversation, but Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR), are no exception.
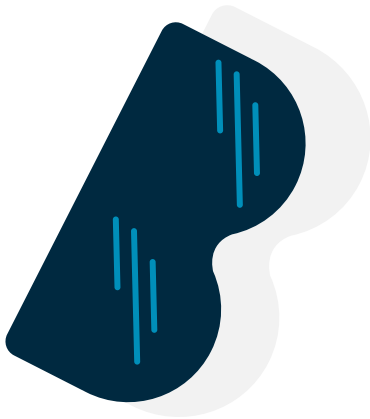
We know it can become confusing to keep track of all of the terms used to describe the immersive experience. Nearly all of the major technology players are seemingly competing to establish themselves as leaders in the evolution of the immersive experience, so it should come as no surprise that the world is moving in this direction.

Whether it be augmented reality as demonstrated by Apple's recent launch of ARKit, which makes it easier than ever for developers to build augmented reality experiences for both consumers and businesses or the more consumer-friendly Google ARCore platform that brings simplistic AR capabilities to everyone's smartphone. Virtual reality, which is backed by none other than Facebook as evidence of its multi-billion dollar purchase of Oculus Rift back in 2014, is another player fighting for its spot on top of the podium. The recent release of the Oculus Go only solidifies the technology as a priority for Facebook founder, Mark Zuckerberg, who has publicly stated his ambition to get one billion people using VR technology. Amazon is taking an agnostic approach through it's Sumerian platform that brings a level of simplicity to VR, AR and 3D application creation and utilization, without having to commit to one or the other. Microsoft's Hololens hardware has coined the term 'mixed reality,' leading many to anticipate a blend of VR and AR together into one seamless platform with exciting and undiscovered capabilities in the near future.

> **"If you can't think of any way that your reality can't be better, then you're not thinking hard enough."**
>
> *– Mark Zuckerberg, Founder of Facebook, Inc.*

LET'S BREAK IT DOWN FURTHER

Although big names like Facebook and Google have taken to these groundbreaking technologies, they are still young in their development. Reality altering tools for the AEC industry are becoming increasingly prevalent and cheap, creating a need to understand how they fit into your particular industry. According to Statistica, the worldwide AR and VR market size will reach over $215 billion by 2021 (Source). It is difficult to ignore this likely step toward commonality within these technologies on our job sites and in our offices so before we get too far down the rabbit hole, let's take a moment to understand exactly what all of this industry jargon means:

## Forecast AR and VR Market Size Worldwide from 2016 to 2021

Market size in billion U.S. dollars

Year	Value
2016	6.1
2017	9.4
2018	17.8
2020	143.3
2021	215.0
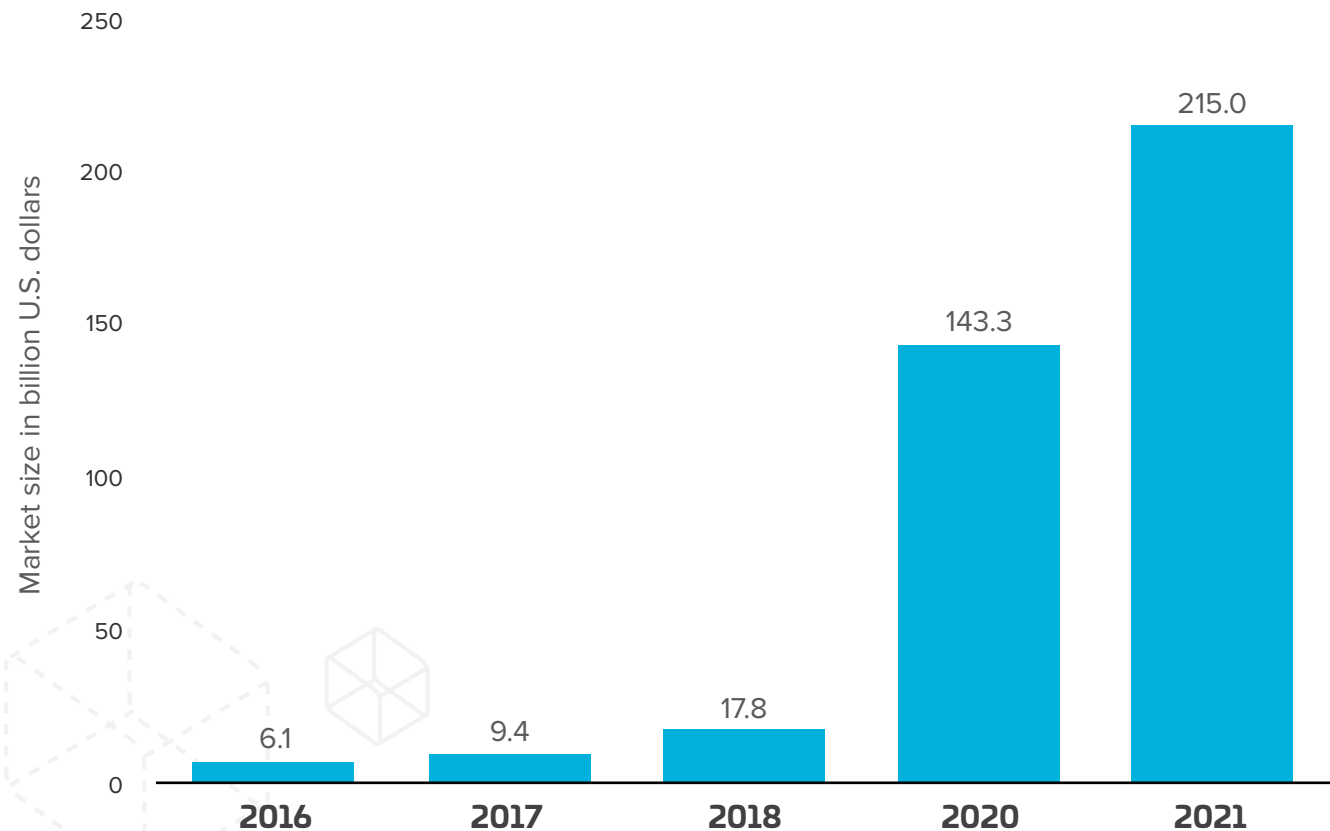
Source: Statistica

"The next frontier of compute will empower people to build, solve, create and play in a world where the barrier is diminished between the physical and virtual worlds."

– Achin Bhowmik, VP & General Manager of the Perceptual Computing Group at Intel Corporation

IMMERSIVE EXPERIENCE SPECTRUM

REALITY

AUGMENTED

MIXED
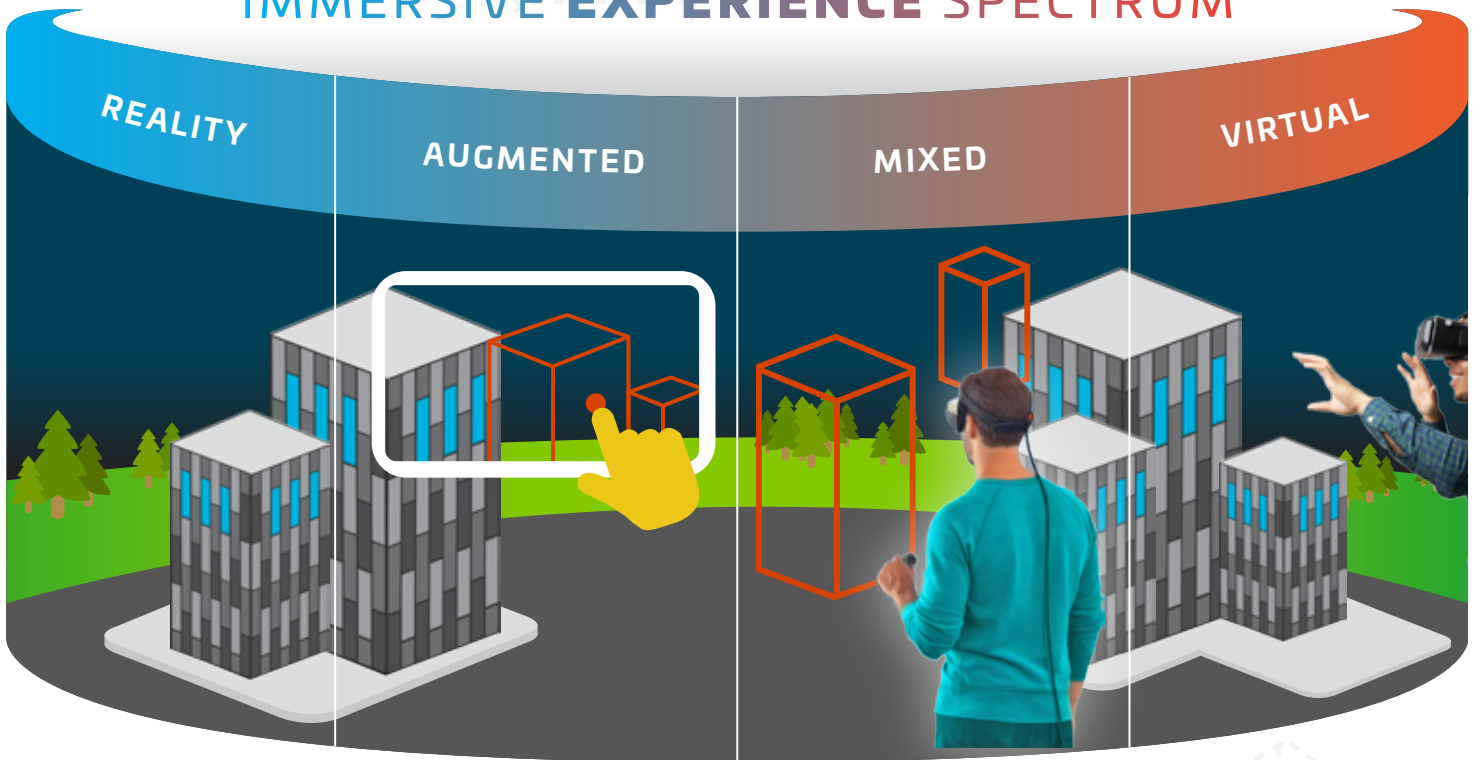
VIRTUAL

"Virtual technologies hold tremendous potential for the future, but industries have only begun to scratch the surface of what's possible."

– Achin Bhowmik, VP & General Manager of the Perceptual Computing Group at Intel Corporation

3D TECHNOLOGY DEFINED

3D technology is defined as an image that enhances the illusion of depth perception, hence adding a third dimension.

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In its essence, 3D captures form the basis for an immersive experience through its inherent incorporation of "depth perception". A 3D model can be built digitally or captured in the real world through 360 degree cameras and video stitched together. But in any case, the technologies to follow would not operate without the use of 3D technology, viewing, and manipulating.

VIRTUAL REALITY DEFINED
Virtual reality is a computer-generated simulation of a three-dimensional image or environment that can be interacted with in a seemingly real or physical way.

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What this definition is getting at is that VR is a simulation and immersive environment projected through a wearable headset that places the curated world in the users sight. Added interactive applications come about through the use of sensors opening up more usability for commercial purposes allowing the user to interact more freely with the digital world around them. Immersive first-person VR experiences have gained significant traction within the video game industry. Previously, VR headsets had been computer desktop-constrained devices, requiring the physical connection to a powerful computer able to withstand clunky programs to run. But as computing power has made leaps and bounds in recent years with VR being a heavy focus for many technology companies, you can now take VR on the go opening up a world of use cases within the built environment. Contractors can now bring virtual training to the job site and even walk a fully constructed render of their project before breaking ground. Architects can work through design errors in a virtual space, improving the chances of spotting problems before they become headaches in the real world. In order to keep VR on the right path, people will have to begin thinking of the technology as less of a toy and more of a tool.

AUGMENTED REALITY DEFINED
Augmented reality is a technology that superimposes a computer-generated image on a user's view of the real world, thus providing a composite view.

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if we simplify the technicals, AR technology creates the illusion that virtual objects are occupying your physical space, using devices such as smartphones and smart glasses. Think the recent popularity of Snapchat face-altering filters and the augmented reality game: Pokémon Go. This allows the user to be conscious of their surroundings in the physical world, but with the added enhancements that digital information can provide. Often, an architect's ability to visualize a three-dimensional space using a two-dimensional representation can be difficult to convey to contractors, engineers, and other members of the building process. Just imagine the possibilities when you can enter 'to-scale' renders of a space prior to any final decision making. This opens up a sense of proportions that only the best architects and contractors could understand from two dimensional design plans.

MIXED REALITY DEFINED
Mixed reality brings a sense of real-time manipulation to augmented reality allowing users to interact with the digital components 'mixed' within the physical world.

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Mixed reality is a term coined by Microsoft that allows for users to change the digital components of an augmented reality experience while in use. As such, mixed reality offers greater use for both fun and work as we combine the immersion of a virtual experience while anchoring your position in the real world that you know so well. Construction workers can tag and note areas of interest while walking the site. Architects and engineers can demonstrate movement within models and potentially include simulations of predicted operations of buildings and sites in the pitching process. Mixed reality applications open up a greater opportunity to collaborate and demonstrate thought processes in a partially digitized world.

Definitions are helpful, but real life examples paint a better picture of what terms like VR, AR, MR and 3D cameras are capable of today. We're going to break these down further to show you exactly how they touch the built environment and what technologies are most aligned to disrupt our daily workflows.

FROM TECH FADS TO LEGITIMATE TECHNOLOGIES

3D CAPTURES + VIRTUAL REALITY IN REAL ESTATE

Not everyone can look at a set of blueprints and imagine in their head what those will end up looking like post-build. Not only is there a disconnect between photos and spacial awareness, but it becomes difficult to schedule site visits. In recent years, however, advancements in three dimensional (3D) technology have broken this inefficient cycle, bringing the power of visualization and time back to the end consumer.

> "VR gives a buyer a sense of space, size and most importantly: depth."
>
> *– Hemanth Velury, CEO of VirtualSpaces*

3D viewing of a property impacts all stages of the real estate process. Real estate developers have been selling properties for ages but this process has always relied on blueprints as storytelling vehicles. Technology has evolved since that time but the process to sell hasn't. Virtual reality allows you to see a representation of a space before it is even built. Companies like **Virtual Xperience** and **VirtualSpaces** are bringing photo-realistic 3D models to the real estate market. By improving the quality of the expectation of a post-build view, these companies assist in speeding up the sales process for everything from new developments and renovations to pre-construction processes as customers can make more well-informed decisions and ensure satisfaction with the final product.

Clients no longer have to be onsite to tour a property, be that residential or commercial. Instead of driving across town or sending someone in your place a person can tour a property from any place and at any time. Companies like **Matterport** have made this effort a staple of their business with leading 3D mesh software and high definition cameras allowing them to produce one of the smoothest 3D walkthrough experiences on the market today. Immersing yourself into a space adds a sense of depth that previously could only be found in a physical property walkthrough.

Real estate demonstrates just one example of the benefits that 3D technology and virtual reality applications have on the built industry, but the use cases reach much further, with safety for instance. VR is being used to train construction workers prior to entering a job site. Safety is becoming a greater emphasis with organizations like **OSHA** cracking down on poor regulation and bad practices. Workers can practice unsafe tasks to help them better react when faced with emergencies on a real construction site. Another popular VR use case is within the design phase of a construction process. VR capabilities offer an opportunity for a client to virtually walk through their building that only exists on paper. VR software companies like **IrisVR** are partnering with hardware's like the **Oculus Rift** and **HTC Vive** to bring fully immersive collaborative experience of unbuilt spaces before breaking ground.

FROM TECH FADS TO LEGITIMATE TECHNOLOGIES

AUGMENTED AND MIXED REALITY IN ARCHITECTURE & CONSTRUCTION

When it comes down to it, the line between augmented reality and mixed reality blurs in their practical applications. Use cases span from the visualization benefits of AR in architecture to the manipulation of BIM models that MR brings to construction sites.

> **"In the future, people won't be able to believe they ever started construction without first taking an immersive walkthrough."**
>
> *– Taylor Freeman, Co-founder & CEO of Upload, Inc.*

The architecture design process is inherently visualization-based work. Architects literally create a building in their head before a single hole is dug or any concrete is laid. Most of the time, the designing of a new building stretches an architects brain farther than most people can imagine. However, with the aid of augmented reality hardware and advanced modeling software, architects now have the ability to see what they're designing at scale without having to leave their office. They can now look around the building in question at various stages of the design, place objects and compare structures to get a better sense of spatial awareness without the need for bundles of 2D drawings or 3D physical models.

As much as augmented reality is used for visualization and the speed of creative decision making, mixed reality adds significant functionality that reaches beyond storytelling and more into collaboration. **John Marino, Director of Alliance and Channel Sales, North America at DAQRI,** spoke about the greatest use cases for AR and MR technology including "the sharing of remote expertise and telestration that allows two or more users to connect and weigh in on a situation without having to travel."

But it doesn't stop there: as hardware becomes more efficient, CAD/BIM model overlays allow for more informed collaboration and for the overlay of CAD information onto the real world to show visual conflicts and enable clash detection. Construction companies are also using AR to see beyond what's on the surface and identify utilities and mechanical components to be avoided during excavations and remodels. Using systems like the Hololens, software companies are creating products specialized for these devices. Users can mark up areas of interest and even record audio to aid in the digestion of their walkthrough by another party. Soon, users might be able to make virtual changes in person and see how the design is affected, but for now, we remain in the early stages.

> *Cost should not stop architects from incorporating augmented reality and even virtual reality into their daily workflows.* With so many cheaper options, there is no excuse to hold off on taking steps into the future of the AEC industry. Implementations range everything from reality altering headsets like the **Microsoft Hololens** and the **DAQRI Smart Glasses** which fall on the pricier side but offer a more immersive and hands-free experience, to the cheaper tablet and smartphone devices that take a step further back on the immersion spectrum.

DON'T SETTLE FOR MEDIOCRE

We understand it can be difficult and uncomfortable to fix something that isn't necessarily broken, but concepts like virtual reality, 3D capture, augmented and mixed reality undoubtedly improve our existing workflows. Immersive reality does not have to be "something for the next guy". Incorporating new technology usually comes at the cost of redesigning workflows but there are smaller steps to be taken that can drastically improve your day-to-day to save you time, energy and most importantly, money. Our goal is to make that decision a little less intimidating by laying out the benefits provided by immersive reality technologies.

The truth is, we are in the early innings as far as immersive reality experiences go within the built environment. However, that is no excuse to ignore the fact that this is the direction our industries are moving in. Just simply educating yourself on how these technologies are disrupting not only your industry but those around you today is the first step. Next, it's time to look in the mirror and see how you can begin to make changes in your own business to set yourself up for success in this fast-approaching future landscape.

> **"It's not about escaping reality, it's about making it better."**
>
> *– Mark Zuckerberg, Founder of Facebook, Inc.*

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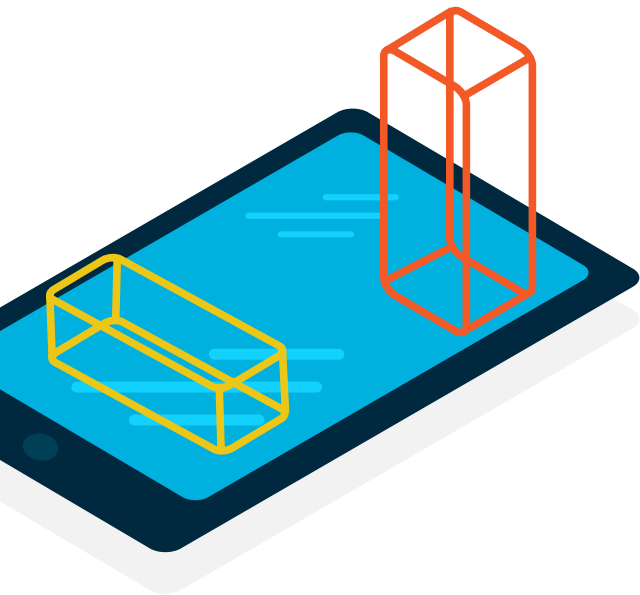
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