

A Guide to the Transformative Power of Virtual Reality and Mixed Reality

Immersive Technologies Bring
Considerable Business Benefits



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Executive Summary

Need to train your workforce remotely and cost-effectively? Want to simulate safety-critical, complex or dangerous scenarios in a realistic way? How about exploring your product design in 3D before building expensive prototypes?



Business leaders are experimenting with and investing in immersive technologies to save time, do work more efficiently and derive value from a new way of collaborating with colleagues and partners.

Currently, the most promising workflows for immersive technology include training and simulation, product design, product marketing in showrooms, sales situations or

exhibitions, behavioral research, data visualization, and remote collaboration.

Advanced organizations across industries are already reaping the benefits of immersive technologies. To keep up with your competitors, now is the right time to start with immersive technologies. Join Varjo on this journey as we show you the most prominent industry examples to help you get started.

1. Why now is the right time to start working with immersive technologies

Today, the whole Virtual Reality (VR), Augmented Reality (AR) and Mixed Reality (XR) market is experiencing major growth both in terms of the technologies as well as the applications that can make use of them.



It's true that consumers today are still largely glued to their 2D screens – phones, televisions, and laptops – instead of 3D screens.

But in certain forward-thinking professional sectors, change is already coming. Professionals across industries are realizing that for certain complex, detail-oriented tasks – such as designing objects, training for mission-critical procedures or researching human behavior – interacting within a 3D reality as opposed to a 2D screen represents a major breakthrough.

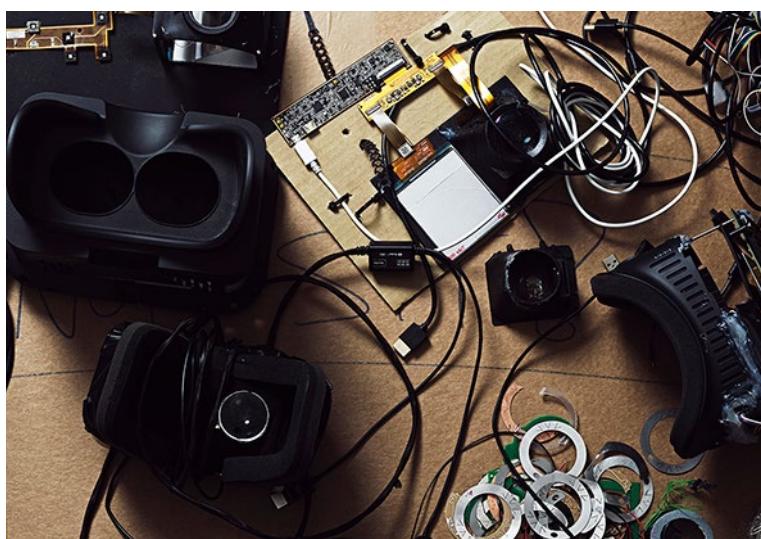
According to [industry forecasts](#), the compound annual growth rate of immersive technologies is estimated to reach between 35% to 52% from 2020 to 2024, with the total market predicted to exceed at least 72 billion USD by 2024.



Previous blockers to widespread professional adoption: Technology immaturity & Discomfort

The promises of immersive technology are nothing new: Augmented Reality, Virtual Reality and Mixed Reality have long promised to change how we interact in the world.

The first immersive experiences have been thrilling and raised expectations, but the shortcomings of the technologies have outweighed the upside of the initial excitement.



Previously, the weight, comfort, ease of use of XR devices have been extremely problematic. The cost to develop these solutions has been too high, while the visual quality and reliability have been so low that people have felt sick from using the devices. Finally, setting up and using the products have left room for

improvement, consequently blocking early adaptation. With major product issues it was also unclear what problems this technology was solving with a failure to offer convincing and tangible business benefits.

Smaller, cheaper, faster, better

VR/AR/XR headsets have seen significant improvements, becoming much smaller, lighter, more comfortable and more powerful in recent years – as well as being much cheaper. For professional users, the improvement in headset resolution has been a significant breakthrough.

Professionals need precision and clarity from immersive technologies. They need to look at the details of their designs or explore the switches and gauges in a cockpit.

Thanks to the revolutionary leap in quality, immersive technologies have begun delivering real results in the enterprise sector.

Today, through immersive technologies, enterprises and professionals can work in immersive environments akin to real life. This is largely due to the advances in high-quality 3D graphics, advanced devices and high-performance computers powering those immersive experiences. Professionals

can create, train, and work in ways that have not been possible before, saving time, money and effort along the way. The new, more advanced devices are also augmenting real-life senses, such as hand tracking and eye tracking – further bridging the gap between reality and immersive environments.

Rapid growth ahead

PwC predicted (prior to the pandemic) that enterprise VR will grow exponentially over the next 10 years. This was due to businesses increasingly adopting collaborative tasks like brainstorming, data visualization and product design. Organizations that adopt VR/XR early can see increased employee engagement, greater productivity, as well as lower travel expenses.

Now, as enterprise adoption is further accelerated by the global pandemic, the popularity of working with virtual tools is expected to grow even more rapidly in the upcoming years.

In fact, the next few years will be crucial for companies across industries. Those who invest in these technologies now – across the value chain – will be able to reap major business benefits in the long run. Companies late to the race will end up hastily scrambling to implement these technologies in order to catch up with their competitors – and they

will most likely fail to capitalize on the full potential.

As you can find out from this e-book, advanced organizations are already reaping the benefits from multiple different use cases. The right time to start with immersive technologies is now.

2. Choose the right tech – VR, AR, or XR?

As in any industry, there are a ton of abbreviations and jargon making the space less approachable for newcomers and hindering widespread adoption. Should you choose VR, AR or XR headsets?

Let's dive into these key technologies.



Virtual Reality (VR)

Virtual Reality means replacing the reality you see around you entirely with computer-generated 3D content. With head-mounted displays for VR, also known as VR headsets, you're completely immersed in the virtual simulation.

Depending on the device, you can also interact with virtual elements using your hands or with your eyes. VR headsets can be tethered to a PC, enabling a more powerful graphical experience. Alternatively, VR headsets can be untethered, which lowers the visual quality but allows the user to move around freely without wires.

The virtual experience that you see can be anything between a photogrammetric capture of the real reality or a computer-generated scene, which is 3D modeled and built with a gaming engine.



A 2D screenshot of a VR experience that showcases a Volvo car in Venice, Italy.

Pros: Complete flexibility, true immersion, an endless number of virtual scenarios and experiences can be created. A relatively easy way to get started with immersive tech.

Cons: Isolated experience, detaching the user from real surroundings and colleagues.

Augmented Reality (AR)

Augmented Reality (AR) means that the user is experiencing the real reality while certain virtual elements are projected onto it. Most of today's AR devices use optical see-through based glasses that create holographic images to float in front of your eyes in a narrow, augmented window.

The problem is, those images are hazy and ghostlike because optical see-through devices can only display light, not black or opaque content. AR devices must also make big compromises on the field of view, resolution, or both. On the other hand, AR goggles are often lightweight and portable. Some of them are also wireless, allowing users to wear and use them outside in the field.



With AR devices, virtual content can only be experienced as holographic augmentations in a narrow field of view.

Pros: Portable, wireless, lower cost, enables interacting with the reality around you. In addition, can be used also outside in the field, great for portraying simple content such as information overlay.

Cons: Holographic, unrealistic augmentations, narrow field of view, no immersion and limited enterprise applications.

Mixed Reality (MR/XR)

Mixed Reality is all about merging virtual content with the real world in an interactive, immersive way. In Mixed Reality, virtual objects appear as a natural part of the real world, occluding behind real objects. Real objects can also influence the shadows and lighting of virtual elements.

Mixed Reality gives the ability to see yourself and interact with your colleagues while (for example) designing a virtual object or environment. For Mixed Reality to be valuable for professionals, it's got to be convincing – blending real and virtual content to the point that it's impossible to tell where reality ends and the virtual world begins.



This image is an unmodified capture taken through the Varjo XR-3 headset, showing truly photorealistic mixed reality with realistic shadows and lighting.

Pros: An immersive environment that matches the reality, suitable for any simulations that need to reflect real scenarios. Mixed Reality provides complete flexibility of the virtual world with the reliability of the real world.

Cons: Higher price, larger, heavier headsets compared to AR goggles, tethered so it needs a dedicated environment for usage.

Mixed Reality is best accomplished with video pass-through technology instead of optical see-through. Video pass-through means using cameras to digitize the world in real time. Low-latency, high-resolution pass-through allows a seamless merging of the real and the virtual.

With video pass-through based solutions, virtual objects can be black or opaque, and appear as solid as anything in the real world. Colors are perfectly rendered and appear just as they should. You can also add, omit and adjust colors, shadows and light in the virtual world and the real world.



Mixed Reality provides the complete flexibility of the virtual world while offering the context of the real world.

Choose Mixed Reality if you need to...

See a photorealistic environment around you

Use a combination of physical and virtual controls

Read text on virtual and real-world screens and instruments

Operate with real-world objects: read manuals, write in notebooks

See other people and communicate with them in the virtual environment

Flexibly move around in your environment

Extended Reality (XR)

Extended Reality (XR) is an umbrella term that refers to all experiences combining reality and augmented or virtual contents. The term encompasses both Virtual, Augmented and Mixed Reality.

For Varjo, we have used XR in our product naming (e.g. Varjo XR-3) to refer to our headsets' ability to deliver anything between the real reality, Augmented Reality, Mixed Reality or full Virtual Reality to the user. Varjo headsets are in fact the world's only true Extended Reality devices – but as Mixed Reality is a much more commonly used term, we use it too.

Immersive Technologies or Immersive Computing

A generic term describing AR/VR/XR technologies or devices, referring to the immersion of the 3D experiences as opposed to 2D screens.

Which one will work for your application?

The right tool will depend on the job at hand.

Augmented Reality (AR) works great for scenarios where the device or glasses need to be lightweight, especially when you need an active presence and constant eye contact to your real surroundings. Example scenarios include customer service, maintenance and logistics.

Virtual Reality (VR), on the other hand, is better for cases where professionals want to experience a completely simulated environment, including training and simulation, architecture, or immersive entertainment.

Mixed Reality combines the power of AR and VR. Mixed Reality works best in situations where you need to interact with real-world controllers, objects or collaborate with your colleagues while experiencing virtual contents, such as designs or simulations. Video pass-through-based Mixed Reality also allows the switch back to “real” reality with a click of a button.

Extended Reality devices, such as Varjo, allow you to choose your level of virtuality freely in the experiences you decide to create. You can jump from 100 % reality to a fully synthetic environment and back – or anywhere in between.

Not sure exactly what you need?

Varjo devices cover all bases to give you the freedom to solve multiple business challenges. You can find more information about our latest headsets, Varjo XR-3 and VR-3, from [our website](#).

In the next section, we'll go through different use cases for immersive technologies, along with the right tech, practical workflows, and business benefits for each.



3. Most promising use cases for immersive technologies

Good technology should only replace existing systems if it improves the output for users and provides upside for the business. Varjo's six different use cases highlight the industries that have put immersive technologies into practice – and the key business benefits and Return on Investment (ROI) that came as a result.



Training & Simulation

Example applications: Firefighter training, surgical training, pilot training.

Industries with the highest value add in VR/AR/XR in training & simulation: Aerospace, Defense, Energy, Medical, Marine, Maintenance, Transportation & Logistics.

Benefits of Immersive Technology for Training & Simulation

Reduce the cost of training by up to 99%+ with immersive learning environments to replace or supplement traditional training solutions

Increase training velocity & enable more trainees to become proficient in less time, doing more sets and repetitions

Optimize user engagement with a solution where trainees want to engage in and repeat exercises

Reduce travel time and costs by providing training at the point of need, thanks to portability and reduced simulator size

Train effectively for the most dangerous scenarios in a completely safe, immersive environment

Training and simulation is the use case currently delivering the biggest Return on Investment (ROI) for XR in the enterprise sector. Using XR in training and simulation creates substantial cost savings and improves safety and the portability of training and simulation equipment.

Traditionally, training – especially in defense and aerospace sectors – has required building dedicated training facilities with physical simulators, such as dome-based visual systems. The simulators for these training facilities can cost up to \$20 million, depending on the required level of customization.



Besides the costly physical simulators, the traditional training process often involves numerous technicians and staff to support and maintain the training facilities. A one-hour training session in a physical aeroplane or helicopter simulator can cost multiple thousands of dollars.

As a result, the total cost of training can go up to millions of dollars yearly. In addition, due to the lack of portability of the traditional simulators, trainees are required to travel to specific locations to take part in their training exercises.



Immersive training brings about major cost-savings & portability

Immersive tools are creating major cost savings by substituting or complementing traditional simulators with Virtual and Mixed Reality. Moving even a part of the training from a physical to VR/XR can drastically reduce the total cost of training. For example, an hour inside a virtual trainer can save up to 99% in costs. Furthermore, headsets can be quickly and easily deployed to any location, allowing multiple trainees to train exactly when and where needed and making headsets a valuable accelerator to the traditional training continuum.



Immersive training solutions allow professionals to effectively train for the most dangerous scenarios in a completely safe immersive environment. Earthquakes, fires, or emergency scenarios can be simulated in

a life-like way. Finally, immersive training has shown to improve trainee engagement, which compounds to improve learning results across industries.

Moving even a part of the physical training to immersive environments has massive cost-reduction benefits. An hour inside a VR/XR trainer can **save up to 99% in costs.**



“Compared to traditional training, VR-based training can reduce training time by 40 percent, and improve employee performance by a whopping 70 percent.”

SOURCE: IBM EXPERT INSIGHTS - AR AND VR IN THE WORKPLACE

Case Finnish Air Force: Pilot training with XR simulators

Using Varjo's Mixed Reality headsets, the Finnish Air Force is able to simulate large-scale or dangerous training scenarios in a safe way to provide pilots with a new level of readiness before deployment. They can create highly realistic immersive training scenarios that can easily be modified or repeated. With Virtual and Mixed Reality technology, the pilots can simulate conditions of live flying, interacting with real cockpits, their own charts and documents, and virtual worlds.

“More motivating and efficient training while utilizing advanced simulators together with live flight training.”

TEEMU PÖYSTI – LIEUTENANT COLONEL
CHIEF OF AIR FORCE TRAINING

Case Osgenic: Surgical training with VR

Osgenic has developed a method and an immersive tool to train for open surgeries in a completely realistic and immersive VR environment. With Osgenic and Varjo headsets, surgeons can see even the tiniest parts of the human anatomy come into focus. Medical professionals can collaborate and simulate scenarios in a life-like environment, which can help reduce preventable surgical complications and the resulting human and monetary costs.



Case Fortum: Nuclear power plant operator training in VR

Fortum, one of the largest power generation companies in the Nordics, has developed the world's first fully interactive Virtual Reality (VR) control room using Varjo headsets. Fortum is able to train Loviisa nuclear power plant operators Exactly like they would in a physical simulator, with a fraction of the price of physical simulators. Fortum can realistically simulate real-life stress factors or natural phenomena like fire, smoke, flood, or earthquakes, which are impossible to accomplish in a physical simulator. Furthermore, the accuracy of operator performance assessment is improved with eye tracking data and analytics. The results have been so impressive that 90% of Loviisa nuclear power plant site workers have undergone VR training.

“The cost of a VR simulator is 1/10th of the cost of a building a physical simulator. With Varjo, the visual fidelity of our virtual simulator is finally on a level that it should be.”

JOACIM BERGROTH – FORTUM

Product Design

Example applications: Car design, boat design, consumer product design.

Industries with the highest value add in VR/AR/XR in design:
Aerospace, Architecture, Engineering & Construction, Consumer, Defense & Marine.

Benefits of Virtual and Mixed Reality for Product Design

Run more flexible, efficient, engaging and collaborative design reviews that give everyone involved a clear and realistic picture of the design before it's even built

Review virtual models with your peers or management, making modifications in real time

Conduct design reviews remotely, looking at the same virtual model from a different physical location

Save vast amounts of time, work and money by spotting any design errors earlier in the process

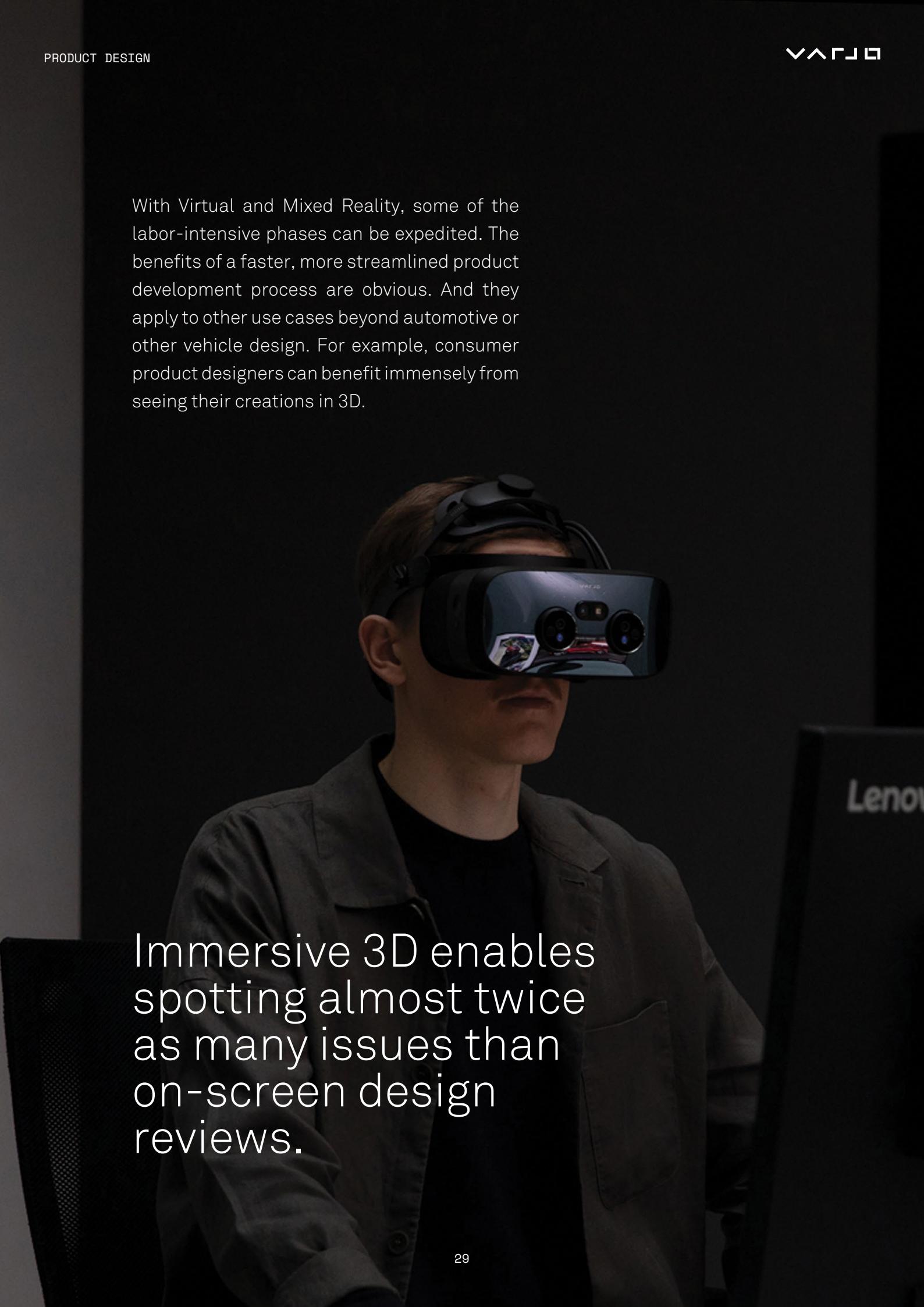
Do more effective visualizations and accelerate innovation speed with VR/XR

VR and XR are expediting the product design and development process. Product designers are now able to see and test designs in 3D (prior to building), leading to substantial cost and time savings.

The product design process of a car, for instance, can typically take many years. Designing a car involves dozens of phases from sketching, drawing and rendering on 2D screens. This is followed by building, tweaking and fine-tuning physical prototypes before actually being able to make decisions on the final data models. At large companies, daily in-person meetings and design reviews are held across the globe during multiple phases of the process.



With Virtual and Mixed Reality, some of the labor-intensive phases can be expedited. The benefits of a faster, more streamlined product development process are obvious. And they apply to other use cases beyond automotive or other vehicle design. For example, consumer product designers can benefit immensely from seeing their creations in 3D.

A medium shot of a person wearing a dark VR headset. The headset has two screens on the front and two cameras on top. The person is looking slightly upwards and to the right. In the background, a portion of a computer monitor is visible with the word "Lenovo" on it.

Immersive 3D enables spotting almost twice as many issues than on-screen design reviews.

Explore your product in a true-to-life 3D environment

Designers can test their new designs in immersive environments before they're built into physical prototypes and also explore the details of the design in a true-to-life 3D environment. This helps replace some of the costs with physical prototyping and enables more risk-taking in the design process.

Immersive technology also ensures better service quality. A photorealistic 3D design gives a better sense of a model's real proportions as opposed to a 2D model on screen. The real proportions provide greater accuracy to spot possible surface mistakes much earlier in the design process, saving time and adding efficiency.

According to Varjo's case study with Mindesk, designers can spot more than 80% of the problems that usually go unnoticed when experiencing and modifying projects on a 1:1 scale in an immersive environment. This is in contrast to reviewing a project on a 2D screen or surface. Furthermore, VR and XR allow designers to conduct pioneering user

research, test their designs before they're built and get critical feedback earlier on in the process. Concrete benefits include shorter go-to-market times that need to become faster than ever in a competitive context. In the best case, companies can literally go from spending years on projects to just months.

Case Kia: Global design reviews can go from days to an hour

Until recently, Kia Europe's automotive design process relied largely on 2D screen reviews and powerwalls, followed by physical clay models and prototypes to further refine and develop the surfaces.

Now, designers are complementing their entire workflow with Varjo's technology. The teams are using Varjo's VR and XR headsets to make their visualization work more effective while showcasing projects in new ways. For example, designers are able to review a virtual model directly against a physical model in the same room, or augment an existing clay model with virtual details.

“Varjo is a breakthrough for our design workflow. No one else has achieved this level of immersion before.”

THOMAS UNTERLUGGAUER - CREATIVE MANAGER CGI
KIA DESIGN CENTER EUROPE

Case Volvo: The world's first XR test drive

Volvo Cars has been using Varjo's Mixed Reality headsets in their workflow since the summer of 2018. By adding photorealistic virtual elements to the interior of the car, Volvo Cars designers are able to perform design studies of future cars before they are even built. For the first time ever, they are able to drive a real car while wearing Varjo's XR headset, seamlessly adding virtual elements that seem real.

With Varjo's XR headsets, Volvo is able to perform UX studies that keep as many real elements as possible – the real road, nature, road signs and more – while virtually testing various features such as a new display or interior. With Mixed Reality, Volvo can iterate design and UX concepts quickly and avoid tedious tool and software changes to save a significant amount of money along the way.

“We'll be able to do things in a day that would normally take weeks or longer.”

SENIOR TECHNICAL LEADER - VOLVO CARS

Product Marketing, Showrooms, Sales and Exhibitions

Example applications: Car showrooms, travel booking, selling architecture projects to clients and stakeholders.

Industries most benefitting from immersive technologies in product marketing, showrooms, sales and exhibitions: Automotive, travel, consumer goods, architecture and interior design.

Benefits of VR/AR/XR for marketing and sales

Improve conversions: Show a more personalized buying experience by displaying different customization options in photorealistic quality

Upsell and offer premium options

Reduce inventory and shipping costs by replacing physical showcase products with digital equivalents

Stand out from the competition: Bring your vision to life, surpassing any brochure or 2D image

Offer immersive experiences at exhibitions and in sales demos

Show full-scale, lifelike replicas and digital twins of end products when a physical scale model or demo product is not possible (e.g. architecture, construction, engineering, shipbuilding)

Immersive technologies are creating cost savings and improving the product experience and brand narrative prior to sale.

In any marketing and sales activity, seeing and interacting with the product is one of the most powerful ways to close a sale. This is especially true for high-value products that end users prefer to experience in real life prior to purchase. When it comes to physical goods and items, especially large or complex products, viewing the product in real life is often difficult or impossible. When you can't show the product live, you must resort to images, small-scale models, and similar solutions which do not have the same efficacy.



The problem is even worse when your product has a lot of variants or customization options such as architectural and other large construction projects (shipbuilding and car models). For example, cars have multiple trim levels, equipment packages, and so on. It is simply unrealistic to have all potential options available in a showroom or an exhibit hall where space is limited. While you can show designs on a computer screen or in a brochure, the feeling of immersion will be extremely limited at best.



Allow prospective buyers to fully experience your product

Immersive technologies are increasingly being used in marketing and sales to stand out from the competition.

Prospective buyers can experience your product in greater detail. Imagine the effectiveness of bringing your brand narrative to life in high-quality 3D or the ease of up-selling premium options when you can display those options in “real life”. Immersive tools can also bring significant cost savings, as you don’t need to supply display models of products for stores or ship them to exhibitions at considerable expense.

Gaining an edge over the competition with the use of immersive technology is not restricted to products. Services such as travel also have vast untapped potential for using these technologies. For example, Virtual Reality

(VR) can go a long way to make a particular destination or marketer stand out from a homogenous crowd where competition is fierce and margins relatively thin.

Research also backs this up. For example, research conducted in Germany by Statista found that 49% of people would be willing to use VR for choosing their next holiday destination if this was possible free of charge (and 13% would even be willing to pay for it). Imagine if you could show your clients the exact destination they were dreaming of, from the quiet white sand beach to the photorealistic sunset they will experience from their hotel room balcony.



49% would be
willing to use
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their next holiday
destination.

Close the sale with VR and XR

Virtual and Mixed Reality enable more effective marketing and help close the sale.

Immersive, digital replicas of the actual products (or services) can be shown to the prospective buyer with real-life scale, and customizations can be made on the spot based on their feedback. People can be exposed to more engaging and impactful storytelling where they can feel part of the scene. Virtual experiences can also be controlled on behalf of the client, allowing you to show crucial elements. Perhaps even more importantly, they let you follow what the customer is seeing. The sessions can also be recorded, allowing strategic follow-ups based on what the prospective buyer focused on.

Case Polestar: A virtual car showroom experience with Varjo

Polestar, a manufacturer of high-performance electric cars owned by Volvo, used Varjo's VR technology in their Oslo showroom. When the potential car buyers put on a headset, they were shown a life-sized, photorealistic car in human-eye-resolution. The virtual car could be modified according to the buyer's feedback in real time so that all possible configurations were viewed, letting the buyer easily see which color, rims, and other options they would prefer.

Case All Nippon Airways: Introducing business class virtually

All Nippon Airways, Japan's largest airline, used VR tours to promote the launch of their new business class at press events. The simulation allowed would-be passengers to explore the cabin, seats, entertainment systems, meal ordering and other experiences in an immersive way.

Behavioral Research

Example applications: User experience research, human-computer interface research, consumer research in retail stores, psychology research.

Industries most benefitting from immersive technologies in training & simulation: Consumer goods, retail, automotive, travel, psychology.

Benefits of Virtual and Mixed Reality for Research

Deeper insights about human behavior

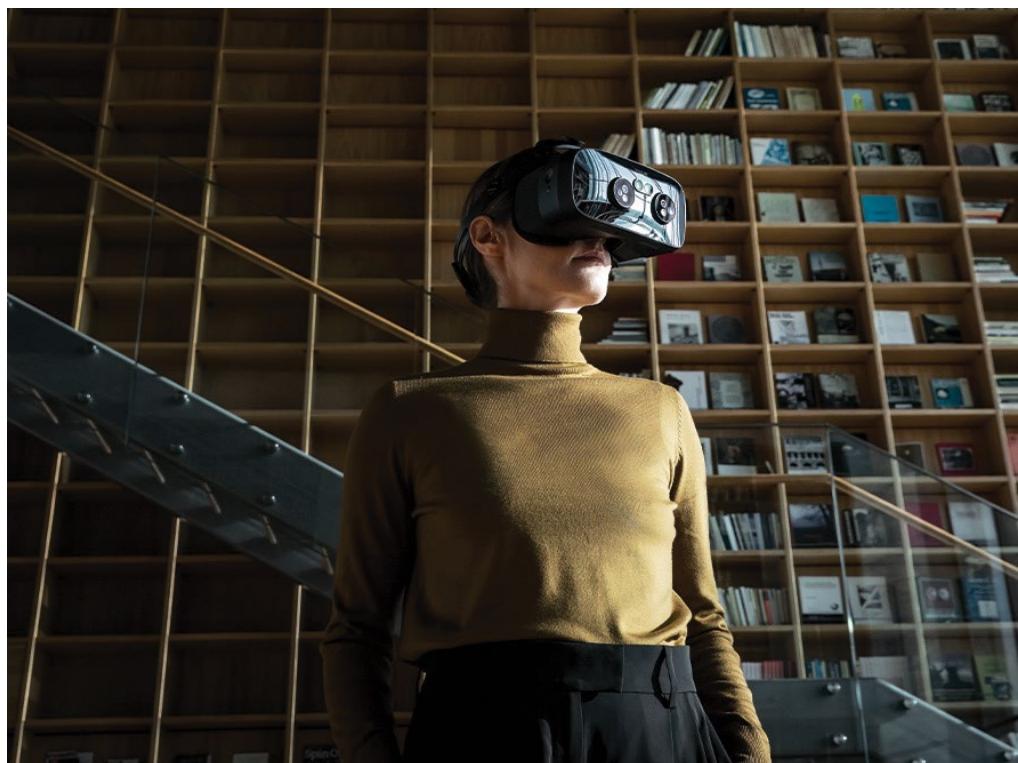
Efficiency compared to real world studies or larger sample size with the same cost

Remove the need to build physical assets or props and iterate faster by switching to digital assets

Mix real and digital objects in a natural way and allow research subjects to interact with both

Immersive technologies enable researchers to replicate real-world conditions accurately in a virtual form to generate strong insights with higher efficiency and lower costs.

Real-world research can be an extremely powerful tool for generating new insights about human behavior. Both academia and businesses continuously conduct research to further advance our understanding of the human mind and behaviour. For example, the global spend on market research alone was estimated to be over 73 billion USD in 2019, and entire new fields of research are continuously being founded.

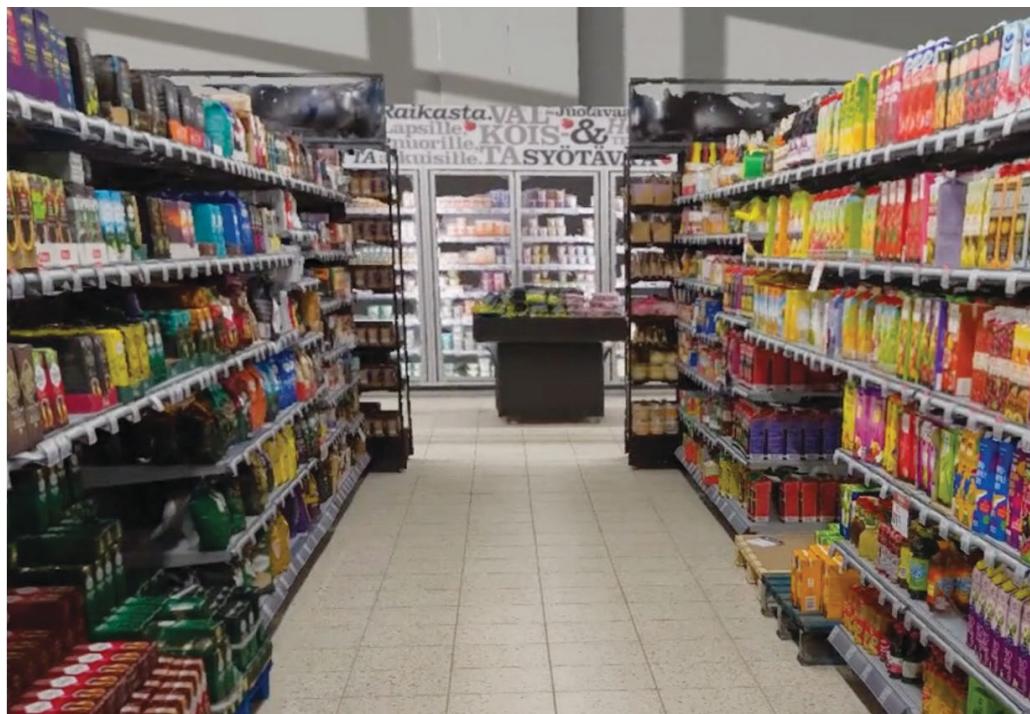


The challenge with real-world research is that it requires a lot of time, money and other resources. One practical example is store layout planning. You would typically plan a store's layout around certain best practices and past experiences from similar stores. However, testing new layouts in-store can be cumbersome and getting insights about which approach works best can take time. Alternatively, you might choose to implement a digital study – but when people are clicking around on a computer screen, the immersion is weak and might not accurately reflect their choices in real life.



Replicate real-world conditions accurately

Imagine being able to instantly create photorealistic renditions of your store digitally, changing details as you see fit. As your participants explore the different store layouts, you'll get insights from all possible scenarios without actually moving a shelf. This makes the research process a lot faster and far more reliable than conducting such studies on a computer screen. Furthermore, you can generate deeper insights by using technologies such as gaze tracking to accurately assess where people are paying the most attention.



This is a VR reconstruction of a Finnish supermarket created with a method called photogrammetry. The high-quality 3D model allows users to roam around the store freely, exploring product details and interacting with different objects. All eye tracking data of the VR experience can be analyzed later on.

Case iMotions: Using biosensor data and virtual environments for human behavior studies

The iMotions software is used by both academic and commercial researchers working within fields such as psychology, medical research, usability, tech, engineering, marketing, and beyond. The platform allows the collection of synchronized data from multiple biosensors, including the sophisticated eye tracking built into Varjo headsets. Eye tracking data can be seamlessly synchronized with signals from various biosensors, such as EDA (electrodermal activity).

The use of multimodal biosensor data in the iMotions platform can provide insights about the user's emotional and physiological states as they experience the virtual environment. This can be used for measuring physiological responses to stress of pilots or drivers, investigating biomarkers related to phobias, and capturing emotional responses, interest and interaction within simulated environments.

Case Volvo: Powering user interaction studies with mixed reality

Volvo Cars designers are able to perform design-studies of future cars before they are even built with mixed reality. The use of Varjo's mixed reality enables them to iterate design and UX concepts quickly, saving a significant amount of money along the way.

With Varjo's integrated eye tracking, Volvo can understand the relevance and results of user experience analyses. Eye tracking adds a huge layer of capability and trustworthiness – the research team can observe the vehicle as the customer would, so they get a much more efficient view of what's important and what's not.



Data Visualization

Example applications: Financial trading data, biological visualization in 3D, control room simulation.

Industries most benefitting from immersive technologies in data visualization: Finance, security, biology, medicine & research.

Benefits of Virtual and Mixed Reality for Data Visualization

Novel ways to process information and visualize data can help unlock new insights

Display as much information as needed, without physical screen constraints, and create comprehensive virtual command centers

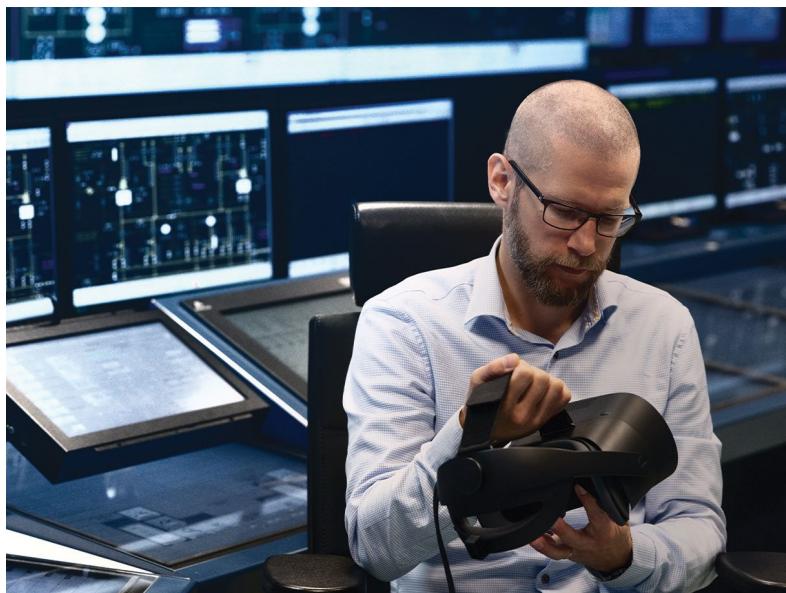
Better collaboration: share the same immersive virtual space with others

More natural interactions in addition to a mouse and keyboard: hand tracking enables the user to manipulate the data and interact with surroundings intuitively

Eliminate distractions: VR allows users to entirely shut out the real world and only focus on the data

Virtual Reality and Mixed Reality have the capability to unlock the power of data visualization. The high visual fidelity of the latest headsets is already on-par with computer screens.

Today, people in data-heavy jobs are used to working on multiple high-resolution screens to make decisions, operate complex systems, monitor system statuses, analyze security vulnerabilities, and more. These setups are often limited by practical considerations such as cost, screen size and resolution, and multi-screen hardware support.



The limitations of visuality are quickly met when there's a need to present large amounts of data on a 2D monitor. For decades, professionals such as financial traders and data scientists have been dreaming about

less restrictive and more efficient ways of visualizing data. In the past few years, many large companies and organizations have experimented with immersive technologies to leverage the flexibility of VR/AR/XR.

Visualize large amounts of data in 3D or on an infinite number of virtual screens

Information is no longer restricted to 2D only. Elements such as vectors or magnitudes can easily be incorporated far more clearly when the information is presented in three dimensions instead of just two. This can make generating new insights much easier, as additional details can be grasped more intuitively than before.

Furthermore, the cost of a high-end VR headset – although substantial – can easily be on par or lower than that of several high-end 4K 2D monitors. Virtual Reality has no physical limitations. Professionals can work with dozens, or even hundreds of virtual monitors if required. They can share the same virtual space while looking at the same data from different locations.



With Varjo's mixed reality, users can interact with an infinite number of virtual screens that are not constrained by size or shape.

Case Bloomberg: A virtual version of the Bloomberg Terminal

The Bloomberg Terminal is the de-facto tool for many finance professionals and traders. This tool typically uses several monitors to display the complex data needed by finance professionals to conduct their analysis effectively. The company has explored a product concept where they would convert the terminal into a VR version capable of featuring many more virtual monitors and data at once.

Case CSynth: Visualizing the data of biological molecules in a completely new way

Developed by MRC Weatherall Institute of Molecular Medicine, Oxford University and Goldsmiths, University of London, CSynth is a physics-based interactive platform for visualizing the 3D structure of the biological molecules. It can be used in VR, allowing users to explore complex datasets and structures in an immersive way.

Case HeadWall: A Secure VR Command Centre

HeadWall is a virtual command center application developed by ITI Systems utilizing Varjo's VR and XR devices. HeadWall is designed for operational command centers as it enables many separate visual inputs to be viewed all in one virtualized command center application. For example, Headwall provides the opportunity to replicate a large control room video wall with a VR headset, using a computer with compatible GPU.

Remote Collaboration

Example applications: Remote training of pilots or operators, remote maintenance, design reviews, virtual meetings.

Industries with most value add in XR for remote collaboration: All

Benefits of Virtual and Mixed Reality for Remote Collaboration

Potential for exponential cost savings and efficiency increase through reduced travel time and expenses

Several people can work simultaneously on the same digital object or training scenario with a shared understanding and a shared experience

Run immersive meetings and working sessions where 2D documents and 3D objects can easily be shared, edited and presented to all participants

The current VR and XR technology allows us to move beyond speaking with colleagues on 2D screens. Many meetings and tasks that required a physical presence in the same room have now successfully transitioned to cross country virtual environments.



With the global pandemic now preventing most business travel and larger team meetings, professionals have turned to videoconferencing technologies to collaborate, like Zoom or Microsoft Teams

calls on 2D screens. In many industries, this has complicated tasks and prevented progress – how can you discuss a prototype or a 3D model when you're not in the same physical location?



Some VR-equipped
teams report that
they now require
90% less travel.

VR/XR unlocks remote training and design reviews

Immersive technologies are paving the way for completely new remote collaboration possibilities. These possibilities feed directly into all the other workflows covered in this e-book. All industries can benefit from better collaboration – especially when working together remotely or when working on the same digital content.

The key benefit of immersive technologies is that they bring the benefits of both digital and real worlds closer together, with some VR-equipped teams reporting they now require 90% less travel. With AR, VR or XR, remote collaboration can be made into a more natural and intuitive experience compared to a 2D video conference.

Digital content can easily be presented in both 2D and 3D, something that is not possible through a traditional screen-based approach. The participants can also see and trust that they are looking at the same content at the same time. AR, VR or XR environments can build trust with participants via avatars that reflect real hand and eye interactions. .

Practical examples of areas that have a lot of potential are design collaboration (several people simultaneously working on the same life-like digital model, for instance in car design reviews), remote training combining physical and virtual simulators, as well as next-generation meeting technologies.

Case MeetinVR: More lifelike remote meetings enhanced with data

MeetinVR is a leading enterprise virtual collaboration software creating a true sense of immersion and presence while working with others in VR and XR environments. Pairing the unique human-eye resolution found in Varjo's devices with MeetinVR's enterprise-grade, easy-to-use software allows companies to collaborate around key use cases. This includes the remote sales of high value products such as medical machinery or new vehicles, the launch of new products, and the delivery of remote training to distributed teams.

MeetinVR's virtual avatars and Varjo's visual fidelity creates an authentic collaborative experience among meeting participants. They can now bring in their 2D documents and files – such as presentations, notes and videos – into the meeting to further enhance their interactivity.

“Varjo’s photorealistic resolution gives users the ability to see reflections and shadows of their 3D models, as well as read text, all of which create a realistic experience for collaboration amongst meeting participants.”

CRISTIAN EMANUEL ANTON - CEO
MEETINVR

Case Kia Motors: Remote design reviews

With COVID-19 currently preventing most business travel, Kia uses Varjo and Autodesk VRED's virtual collaboration feature to continue working with the other global studios. Designers can collaborate on the same photorealistic models, trusting that everything from the smallest details to the full-scale appearance of the car looks correct. The ability to carry out design reviews virtually presents Kia with the opportunity to save vast amounts of time, work and money.

“Before, reviewing a car model with design management meant flying to Korea and took at least four days. Now, I can do it in one hour.”

GREGORY GUILLAUME - VICE PRESIDENT OF DESIGN
KIA MOTORS EUROPE

4. Checklist – Is your organization ready to get started with immersive technologies?

Immersive hardware and software are already mature enough to be utilized for multiple workflows, and the leading players across industries are already reaping the benefits. But how ready is your organization to start benefiting from immersive technologies?



1. Is your organization actively involved with one of the use cases outlined in this e-book?
 - Training and simulation
 - Product design
 - Product marketing, showrooms, sales, and exhibitions
 - Behavioral research
 - Data visualization
 - Remote collaboration
2. Is there a willingness to improve on your current processes and workflows? Could VR, AR, or XR produce real value to your existing ways of working?
3. Are you prepared to invest in new hardware and software? Do you have a budget for implementing new technologies into your workflow?



If the answer to all three questions is yes, we recommend getting started today.

Interested in taking the plunge?

Connect with Varjo to validate your ideas via a product demo and discover how to transform your business with immersive technologies today.

Contact us

sales@varjo.com

Varjo HQ
Vuorikatu 20
00100 Helsinki, Finland

Varjo Technologies USA HQ
Washington DC Area
Suite 700, office: 723
2111 Wilson Boulevard
Arlington, VA 22201

5. Additional reading

[All Varjo Customer Case Studies on Varjo.com](#)

[PWC: Seeing is believing](#)

[Global Augmented Reality \(AR\) and Virtual Reality \(VR\) Markets, 2020-2030](#)

[Who's Offering Data Visualization VR?](#)

[Using VR to Unlock the Power of Remote Collaboration](#)

