SYMETRI
ADDNODE GROUP

VIRTUAL REALITY

WHY VIRTUAL REALITY HAS BECOME AN ESSENTIAL ELEMENT IN THE ARCHITECTURE, DESIGN, AND CONSTRUCTION PROCESS

CONTENTS

PROJECT SUCCESS

ENSURED WITH SPATIAL UNDERSTANDING, AT EVERY STAGE

The construction sector has almost universally embraced the critical role of collaboration in driving improved project outcomes and mitigating risk. In communication and information sharing between architects and designers, contractors, subcontractors and customers, technology delivers capabilities to enable and promote mutual understanding among the many parties involved in a project. Virtual Reality (VR) is one such technology.

This white paper explores why and how VR is a game-changer for construction professionals.

PURPOSE OF THIS WHITEPAPER

This paper discusses the value of VR as a visualisation tool which brings to the construction sector a deeper understanding of the anticipated outcomes of a project as it develops, and the potential problems it may present along the way. VR is no longer viewed as simply an 'add-on' as designs near the finishing line, using visualisation just to show how wonderful the project will end up looking.

As far back as 2018, VR was a rapidly emerging theme in construction. A GOV.UK announcement at the time[1], for example, attached transformational capabilities to the technology of VR: "Virtual Reality to revolutionise UK's construction sector". Since then, it has done so.

Innovation, by definition, is about doing new things or doing old things differently and better. It is how successful businesses differentiate themselves and strengthen their competitive advantage; improving efficiencies and results, and challenging traditional routes to achieving them.

The paper looks at perceived barriers to adoption, and outlines how any business can get started on a revolutionary, innovative, collaborative and, above all, efficiency-enriching journey. The paper also includes a 'Top 10' checklist of the major benefits: The value of VR in design and construction.

A NOTE ON THE AUTHOR

The author of this paper is Geoff Alder, Application Specialist at Symetri. Geoff has been training in, and developing training materials for the construction sector software solutions for over 30 years.

Geoff has trained on Autodesk products all over the world; from a nine-year stint in Southern Africa, to five years in China. He worked in South Africa, Lesotho and Botswana developing technical vocational curricula for vocational training colleges. Geoff has also been instrumental in designing technical training apprenticeships in computer-aided design (CAD) and computer-generated imagery (CGI) and the development and training for 3ds Max and postproduction composition in media CGI and video game studios.

Focusing on 3D development within Autodesk software, Geoff's training initiatives led him into an in-depth assessment of the role and value of visualisation as an aid and driver for clarity in communication. He believes that VR is often misunderstood and undervalued, with a tendency among construction professionals to view VR as a 'gimmick'.

Geoff brings to the VR discussion deep experience in 3ds Max and AutoCAD, with Rendering being a major area of training over the years. He has trained and developed rendering workflows for interior designers with V-Ray, the CGI rendering engine. He has researched and developed workflows towards Virtual Reality for Architectural, Engineering and Construction disciplines, with a focus on visualisation and spatial development: "We live in a three-dimensional world," he says, "Our spatial awareness and perceptions are developing and tested continually. This must be the best way to communicate space." In this white paper, he explains why.

HOW DECISIONS ARE MADE

TVR brings immense value in terms of the all-round understanding it offers to all stakeholders at every stage of the design process.

DIGITAL FIRST

With VR, information is no longer exclusively about data, sometimes introducing its own barriers to comprehension and interpretation by people who are not overtly familiar with handling data. It is about visualising outcomes and foreseeing problems by literally seeing them as they emerge, as the design progresses. It is about seeing the likely outcomes of decisions and choices, rather than interpreting them.

In the UK and globally, the construction sector looks to create smarter and more sustainable built environments; a legacy for future generations, not simply in terms of how the built environment looks but also—for enduring value and asset optimisation—how it works.

Technology drives the evolution of this environment; digital, self-monitoring, self-communicating and self-rectifying, through the two-way device to machine exchange of and response to data –the Internet of Things. Data is providing the fuel. Collaboration is driving the change.

The vision and the reality start not with the physical but with the digital, long before the foundations are poured;

Ensuring designs that pre-empt every eventuality, that at pre-construction the contractors can envisage their approach and ask informed questions about every detailed aspect of the project, that construction moves forward without a hitch or delay and as close as possible to budget, if not exactly-on or even under.

MEETING ON COMMON GROUND

At every stage of construction, transparency and good practice dictate an overriding need to keep clients informed of progress. The need is fulfilled by involving clients as much as possible in the project's evolution, in such a way that eventual users are given the opportunity to add their own real-life experience of, and requirements for, the facility being built; from a block of apartments to a campus, from hospitals to schools, leisure facilities to transportation hubs, and every aspect of the built environment in between.

Clients can make these contributions far easier and to greater value if they fully understand what they're looking at. That's the key — 'looking'. When presented with drawings and models, clients, unless entirely tuned-in to such styles of presentation, can only connect with what they are looking at if they fully understand the language and mediums of the architect. There is a disconnect between the intention and the reality. VR replaces this with a direct connection.

It's not only clients who gain a deeper appreciation of design intent when they can see it. So do engineers who will fully understand drawings and models, but when they see the reality can more easily appreciate the impact of clashes, for example, and how the proposed resolutions will look when the structure is built.

Informed decisions reflect the experience of the decision maker, combined with the completeness and trustworthiness of the view provided to inform the decision. The more complete the view is, the more meaningful the decisions can be.

FEELING WHAT ITS LIKE TO BE THERE

VR is an indispensable tool for bringing stakeholders together, to view intentions and potential outcomes together, to improve the project as it evolves and to solve problems together as they can be seen to be emerging; seeing inconsistencies, clashes, and under or incorrectly or inadequately used space… spatially.

Many companies continue to adhere to traditional approaches. They present drawings and 3D models and everybody seems happy enough. These approaches are fit-for-purpose. But in a technology-driven world, 'fit-for-purpose' does not win the race. Exceeding expectations does. Getting things done faster, with less re-thinking, fewer errors, and the removal of barriers in the communication of design intent, do.

Clients being happy enough is not a ringing endorsement, but when they're thrilled to see a design come to life, can interact with the building or asset, can make comments informed by what it feels like to be there—rather than trying to work that out from drawings and models—the competitive advantage is secured.

AN AID TO FOCUS, CONCENTRATE AND APPRECIATE

Design decisions are frequently made in meetings. There's nothing wrong with that; it is what collaboration is all about. Pre-Covid-19, the meetings were often in busy offices with distractions all around. Then, the office became dispersed, as remote working became necessary. Remote working transitioned into the hybrid office we work in and around today. Collaborative technologies rapidly emerged, ensuring that location became largely irrelevant to progress.

Virtual Reality fulfilled the specific need that all stakeholders could understand, at all stages, the precise nature of the intended finished project. It helped remove misinterpretation of requirements, from foundations upwards, from building services—HVAC, plumbing, electrics, waste disposal and others—to interior design, room layouts, orientation and even the more difficult to define atmosphere of a place. People could now understand what it would feel like to be in the place.

THE TOP 10 BENEFITS

OF VR IN DESIGN AND CONSTRUCTION

Virtual Reality turns up the dial on focus and attention. It sends environmental sense stimulation to the brain from the eyes. The optical systems manufacturer, Zeiss, states that:

“By far the most important organs of sense are our eyes. We perceive up to 80% of all impressions by means of our sight”. [2]

Therefore, if you harness that 80% in a VR environment, you bring 100% attention to the project under review. This leads to saving time and money. It precludes misunderstandings. It prevents any key points being missed. If you have your meeting in VR with clients and stakeholders, their attention is 100% within the boundary of the VR immersion. They are focused, they concentrate and they appreciate what they are seeing more completely. With this overview in mind, here are my top 10 benefits of VR.

1. Better Project Planning:
Viewing and testing in a virtual environment reveals valuable information at every stage of development. This insight helps identify areas to review in the early design stages and the pre-planning stages of construction. Construction order and supply availability becomes smoother and more precise since all teams will be involved at the earliest time, gaining the opportunity to contribute further to their area of involvement in the initial design stages.

2. Clash Detection in Visual Form:
VR helps to identify conflicts between design and the requirements of engineering professionals and subcontractors.

3. Improving Safety Measures, Advising Actions in Case of Emergency, and Clearly Identifying Evacuation / Escape Routes:
Final stages of design allow fire and emergency routes and procedures, for final building occupants as well as site operatives during the build, to be rigorously identified. This process can be used to design and form a virtual orientation programme, enabling familiarity with the building. Adding to this, Augmented Reality can be used to help during practice drills in fire escape situations; wearing the AR glasses and seeing the fire route overlaid in the real world.

4. Build Safer:
Provide phased safety on site, pre-empting difficult areas during construction.

5. Improved Project Workflow:
Smoother transition between design and construction as everyone gains a clear picture of how the finished project emerges as intended. This eliminates isolation between teams and phases.

6. Try Before You Build:
Construction areas can be explored and practiced in VR. Equipment placement, temporary works, potential

dangers can be highlighted and factored into the phases.

7. Demonstrate Compliance:
VR can demonstrate that the model is built to specification and building regulations.

8. Collaboration is Quickly Effective:
All interested parties can have important input. An example of more effective consultation with impacted stakeholders would be having doctors and nurses involve in spatial design in the design of a hospital. The public could also be offered the opportunity to view a development, smoothing the way towards more informed acceptability and greater understanding of the ultimate impact of a development on the community.

9. Superior Customer Experience:
Customer experience is achieved to a depth and with clarity of understanding in a way not achievable with any other medium: “Try before you buy”.

10. Line of Sight:
A simple benefit I have seen many times in recent training sessions is that we have line of sight from any given point. Once again, a benefit unattainable with any other type of technology.

THE ROLE OF AUGMENTED REALITY

Alongside VR, Augmented Reality (AR) is becoming an essential concept in design and presentation. The main function of AR is to overlay objects or features onto real visual content through either a headset or a device such as a smartphone or tablet.

What the eye can’t see…AR is also extensively used in situations where a 3D model is projected at full scale in an environment. For example, whilst being on site or in an existing build, users can view new services behind walls.

As with VR, AR offers an instant feel for, and comprehension of, spatial impact on a project. Getting involved in these developments is crucial in our ever-increasing demand to satisfy the full creative design process. We literally see from all angles, potential reviews and changes. Thus, avoiding costly unforeseen mistakes.

BARRIERS TO ADAPTION:

TO SEE OR NOT TO SEE

CONSTRUCTION IS GOING DIGITAL

There are still companies who dismiss VR as superficial ‘show business’ in AEC; seeing it as just another way of presenting glossy marketing materials to clients. Although undeniably more engaging than a brochure, and more easily grasped by industry outsiders than a 2D drawing, or even a 3D model, VR is still considered by the unconvinced to be not much more than a tool for sales.

Once you strip away the ‘showmanship perception’ of VR, you find a rich source of insight which does far more than just improve the customer experience. You find a means of understanding spatial relationships in a building or a project that can enhance safety aspects, promote greater understanding of roles and directions, and support information sharing in a way that everybody involved in a project can understand and benefit from.

Building Information Modelling (BIM) has played a catalytic role in driving transformation in the industry, emphasising the importance of sharing information and the immeasurable value of collaboration. Covid-19 was a further catalyst in accelerating the adoption of remote working practices, as outlined earlier.

UNDERSTANDING SPATIAL RELATIONSHIPS

To be able to collaborate, people depend on information. This was traditionally provided in the form of documents and spreadsheets, the sharing of which was accelerated through the advent of email, and has now expanded into real-time tools for collaboration, from common data environments, to screen and model sharing, to video conferencing and mobility. This is where VR comes in, helping, alongside Augmented Reality, to transform design, construction and the operation of the built environment.

THE ORIGINS OF VR TECHNOLOGY: DISPELLING THE MYTH

Digital construction is driving resounding change in collaboration, and the sharing of information, to the betterment of project outcomes and the greater sustainability of the built environment.

The question that companies across the construction sector value chain should be asking at this point in time is not why they should adopt VR, but how soon can they do so. I'd like to explain why they should be asking that question.

PLAYING THE GAME, FOR REAL

The entertainment industry has often initiated technologies and ideas that have passed into industry by being harnessed for broader ranging technology deployment. A good example is what's known as the 'gamification of IT'. This is about picking out those nuggets of value from game playing that get round the complex aspects of using technology that can slow down or even prevent adoption.

When users are resistant, old ways persist and the inefficiencies, that the technology was designed to eliminate, continue to occur. The design of the 'intuitive' user interface using icons and simple signposting and reducing instructions to the minimum, is a direct descendant of game play.

KEEP IT SIMPLE

VR provides visual understanding of an environment by immersing those who use it into the three-dimensional world. This is the world we live in, work in, and build in. Collaboration in understanding this world, via a tool that faithfully reproduces and represents 3D reality, has logic on its side.

The concept is flawless. Anything less than a view that is as close to reality as it's possible to get is, the converse logic dictates, inherently flawed; open to varying interpretations and one step removed, if not more, from the object it represents. Spatial awareness can never be a function of flat representation.

Prior to the advent of 3D models, traditional two-dimensional drawings had long been the means used to describe design. The more complex the elements within a project, the greater the proliferation of drawings; reams of them being a daunting prospect to any project participant let alone those not of a technical bent.

It was a prerequisite of viewing and understanding a 2D design that anybody looking at the design would have an intrinsic familiarity with visualisation such that they could convert 2D data in their heads to imagine and envisage the 3D project.

It was a complex and instantaneous cognitive process of imagining what something could look like by taking in visual cues composed entirely of elements that it didn't look like. Interpretation was all important. Misinterpretation was thus an ever-present danger.

Assuredly, many Towers of London, Cathedrals, Palaces, Historic Places of Learning and Stately Homes have come to fruition enduringly enough. As they say, however, that was then, and this is now. We do things differently. Our duty as an industry and our responsibility to the future, is to do things better.

In a complex technological world, simplicity rules. The more that people understand something, they more warmly they respond to it, see its value, and start using it; comfortably and confidently.

VR TECHNOLOGIES

YOU CAN SEE CLEARLY NOW

INCLUSIVE, IMMERSIVE, PERSUASIVE

Virtual Reality is not a complex technology. It's a technology that strips out complexity and promotes faster understanding and easily comprehensible sharing of the proposed physical status of a construction and the constituent parts within it.

At its most basic it's about putting on a headset and seeing an all-round view of a building, a room, or any aspect of a construction project where clarity is required and understanding is important. That means every aspect of a project; every project.

USER FRIENDLY TECHNOLOGY

When 3D scaled models came into the mix in architecture and engineering, they significantly improved perceptions of space and volume. They also introduced another factor in making it possible to represent the aesthetic of the overall project. On your journey into adopting Virtual Reality, you will find that people are confident about being immersed into a new world.

Among construction professionals, initial apprehension and concerns are fading as it becomes increasingly evident that the visual immersive experience allows

constructive design observations. For this reason, VR is increasingly becoming an essential tool in the design process.

While a 3D model on the desktop gives a visual understanding of the overall project, it is however, a ‘bird’s eye’ view. Far more encompassing, VR allows the viewer to be in any position and scale within the design or outside the design. This flexibility offers significant design options to be considered. It introduces the ability to spot inaccuracies not fully apparent in the 2D drawing or the physical 3D model. Immersing in the VR world is the only way to fully absorb the spatial interpretation of a design.

PRACTICAL MATTERS

It may appear that a technology that improves the way we see and interpret things – itself a bold and transformative claim – might imply complex adoption and implementation. This is not the case. The process of transposing a CAD design into a VR experience is simple.

A 3D view in Revit can quickly be converted into a VR visual through a number of solutions, allowing the geometry, together with textures, to be viewed through an interactive viewer either on screen (with navigation with a mouse and keyboard) or more impressively with a VR headset such as HTC Vive, Oculus Rift, and Varjo Aero.

The particular solution you select depends on the uses you have identified for VR, from the creation of large-scale environments to make something like the campus experience come alive, through to specific uses, either for client sharing or for work-in-progress visibility.

THE BIGGER PICTURE

To create an inspiring overview there is a combination of three solutions which works in an integrated fashion; starting with the Revit model, then taking the model into

3ds Max to create detailed textures and finishes, and then taking the result into Unity or Unreal Engine 5 for full immersive VR visualisation. You can create rich scenarios to bring interactive experiences that engage viewers. In this case Autodesk are partnering with Unity, and Epic Games with Twinmotion.

There are some excellent applications for the process of getting the 3D model into a VR and AR situation. The following solutions are all supported by Autodesk for use in association with Revit:

There are five easy-to-work with solutions:

1. IrisVR: The fastest way to start
There is a solution that enables you to get going with VR almost instantly but does not link into BIM 360. In this regard it is more about bringing the 'wow' factor into play to demonstrate to clients where the project is going and how it can look, giving them the chance to express meaningful input on finishes and other choices where choice is relevant. With IrisVR you simply load your 3D file and click launch, and you're in the VR world. This is a fast way to get going with VR, particularly where BIM is not of priority or concern on a project.

2. InsiteVR: Cloud-share the vision
The sharing of VR views between locations, even internationally, accelerates understanding and empowers decisions in a powerful way. InsiteVR's Resolve enables remote collaboration meetings in the Revit model, in the cloud, linking with BIM 360. Participants can annotate the view in real-time and see each other's annotations as they are made.

3. Enscape: Create a live link from BIM to a virtual walkthrough
For conceptual designs, Enscape enables operatives to move around the Revit model but is not appropriate for collaboration. This is more a work-in-progress tool. The user has the software installed on the system (not a cloud-based or Internet shareable solution) and simply opens it as required to do walkthroughs. It is a perfect tool for enabling designers to 'get' the final picture as the project develops. They can add textures and surface finishes to gain a sense of visual impression, and a sense of volume. The views can be shown to clients, but not remotely; they have to be at the designer's screen.

4. VisualLive: Overlay services details onto real world geometry
Augmented Reality (AR) is bringing a level of spatial understanding to the building services industry never before possible. With VisualLive you can overlay a model onto the natural (existing) view in a process known as 'mixed reality'. This provides a heads-up display (HUD) where, for example, you can look at real world walls via a HoloLens or even a tablet and then overlay the services pipes behind them to see exactly how they will lay out. Effectively, the overlay is a model and what it is overlaid onto is real world scenario.

5. Twinmotion
Twinmotion is a revolutionary standalone application for 'real-world' rendering against the 3D evolution of a project. In Revit, with just one click, the full Revit model to be sent to Twinmotion as a fully independent 3D project. Synchronisation with Revit enables Twinmotion to update the revisions in the Revit build.

VR gives a vast array of possibilities in the design and the final presentation of a project. Further interactivity can be achieved with features that allow the viewer to swap out or change materials on a surface, or change floor tiles or carpet tiles. Interior design options can be completely changed in line with client expectations; the viewer can set different scenarios. Entire room plans can be changed. Projects can evolve. Outcomes can be improved.

FINAL THOUGHTS

BUILD IN SIGHT BEFORE BUILDING ON-SITE

It is no bad thing that VR is considered by some as a sales tool. If that works for you and your purposes then long may it do so. Perhaps, however, its use can be qualified by referring to it as work-in-progress consultancy. If rooms can be changed, entire projects can be changed. Buildings can be inserted into a campus, access and egress can be repositioned; orientation can swivel in any direction practicable. Any option can be explored, before any commitment is made.

VR is immersive but, more than that, it is inclusive. VR invites and inspires collaboration. Its use demonstrates transparency. It serves as a customer-centric opportunity not just to achieve greater customer satisfaction through an inclusive customer experience, but also to gain thoughts and opinions, feedback and buy-in as a project develops.

VR also invests the creative zone, the place in which designers and architects work, with a deep level of focus that extends beyond the VR world and back into reality. In my experience I have met with many professionals in this field who say they come back from the VR experience with a greater sense of clarity about how a project is unfolding. They have a faster understanding of how things will look. They see things clearer. I believe this is because they have had a glimpse of the future; they then understand better how to get there.

The journey into a new vibrant, practical and relevant way of looking at the future you plan for the built environment can be faster than you may imagine. Once you arrive in the VR world you may then start to imagine faster than you ever have before.

DOCUMENT REFERENCES

[1] www.gov.uk/government/news/virtual-reality-to-revolutionise-uks-construction-sector

[2] www.zeiss.com


LEARN MORE AT:
WWW.SYMETRI.CO.UK
SYMETRI
ADDNODE GROUP