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Practical Uses of Immersive Technology—from Design Through Construction

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Learning Objectives

- Differentiate between the variety of immersive technologies available and the appropriate times to use each
- Identify practical points in your project timeline to introduce immersive technology for every project
- Learn how virtual reality can aid in spatial understanding, design quality, and increase knowledge sharing
- Discover how augmented reality can be used for improved communication between design and construction teams

Description

This session will provide a series of examples showcasing the variety of immersive technology that SmithGroup uses throughout the design and construction process. In early design phases, virtual reality is a powerful tool for understanding spatial dynamics and gaining client sign off. As projects move into construction, the ability to digitally overlay data on a construction site becomes invaluable—the use of augmented reality and the Microsoft HoloLens enables for vital Revit model data to be transferred to site for field verification during construction administration. We'll review the wide range of hardware and software available for use, as well as how to best use BIM to make immersive technologies a practical and integral part to your workflow.

Speaker

David Fersh is an architect and the Visualization Technology Leader for SmithGroup's national Technology in Practice Group. Based in Washington, D.C., he has worked on a variety of project types and utilizes his background in technology to help translate abstract designs into real experiences. As a technology leader, Fersh works to streamline design and documentation processes. He specializes in immersive technologies, 3D visualization, and computational design.

Immersive Technology Basics

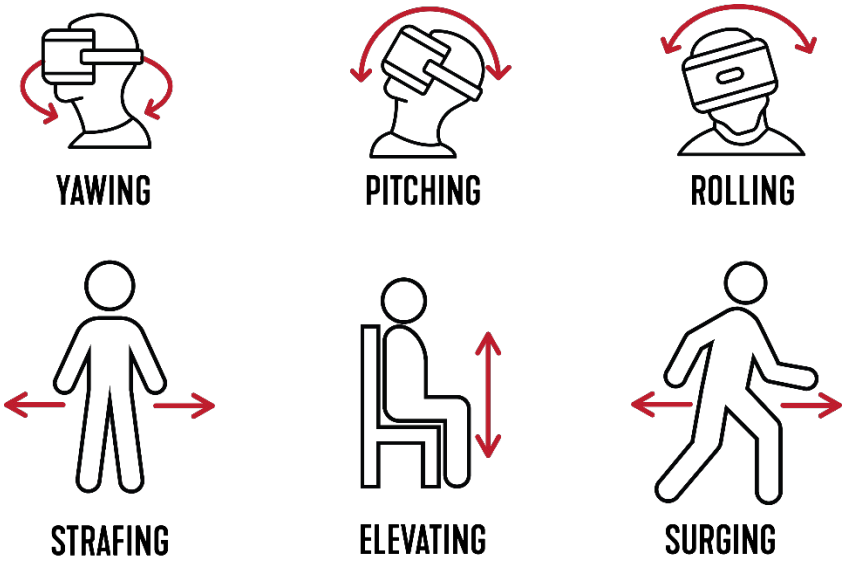
When introducing immersive technology to project teams (both internal, and client facing) it is advantageous to review a few basic terms to aid in selecting the correct technology.

Augmented Reality (AR), Virtual Reality (VR), and the Mixed Reality Spectrum (MR/XR)

The differentiation between AR and VR is important to understand. VR fully immerses the viewer in digital world and removes any visual trace of the physical world around them, AR overlays additional information on top the physical world – it *augments* the real world while maintaining a visual connection. There are many technical explanations differentiating between AR and MR which center on your ability to interact with the digital world. While these differentiations may be important to some, I do not think it is vital to understanding the technology. I like to think of Mixed Reality as a full spectrum of immersion, with a fully digital world on one end and the physical world on the other end. Refer to Microsoft's Mixed Reality Spectrum diagrams.

Degrees of Freedom (DoF)

It is important to distinguish between three degree of freedom (3 DoF) and six degree of freedom (6 DoF) virtual reality. 3 DoF creates the illusion of immersion through a rendering or image taken from a single fixed point. Six DOF virtual reality allows for your environment to react to movement through space – this allows for you to "sit down" at a desk and have your environment react. 3 DOF VR is most often accomplished using a mobile phone and simple holder, 6 DOF VR is most often accomplished through a head mounted display with either internal or external sensors to track movement.



A FULL SIX DEGREES OF FREEDOM IS IMPORTANT FOR REALISTIC IMMERSION

Why use Virtual Reality

Virtual Reality provides value to all design professionals because it is a valuable tool for understanding space – both for communication and learning.

As a Learning Tool

Learning by doing is powerful. For design professionals in the building industry, experience is hugely valuable, and difficult to come by. Virtual Reality can exponentially increase the amount of spaces that you are exposed to and able to learn from.

SMITHGROUP HAS A PERMANENT VR SETUP IN EACH OF THEIR OFFICES NATIONALLY TO PROMOTE USE OF VR.

Functional Understanding

A better understanding of your spatial surrounding through immersive technology, can have a powerful emotional impact – *how does a 20 foot ceiling make you feel* – but it also can serve as a test of functionality. VR can replace some aspects of a full scale mockup in a way that allows for functional testing and iterative design. If a virtual mockup does not function properly, it is much simpler to adjust a digital model, then to re-create a full-scale construction.

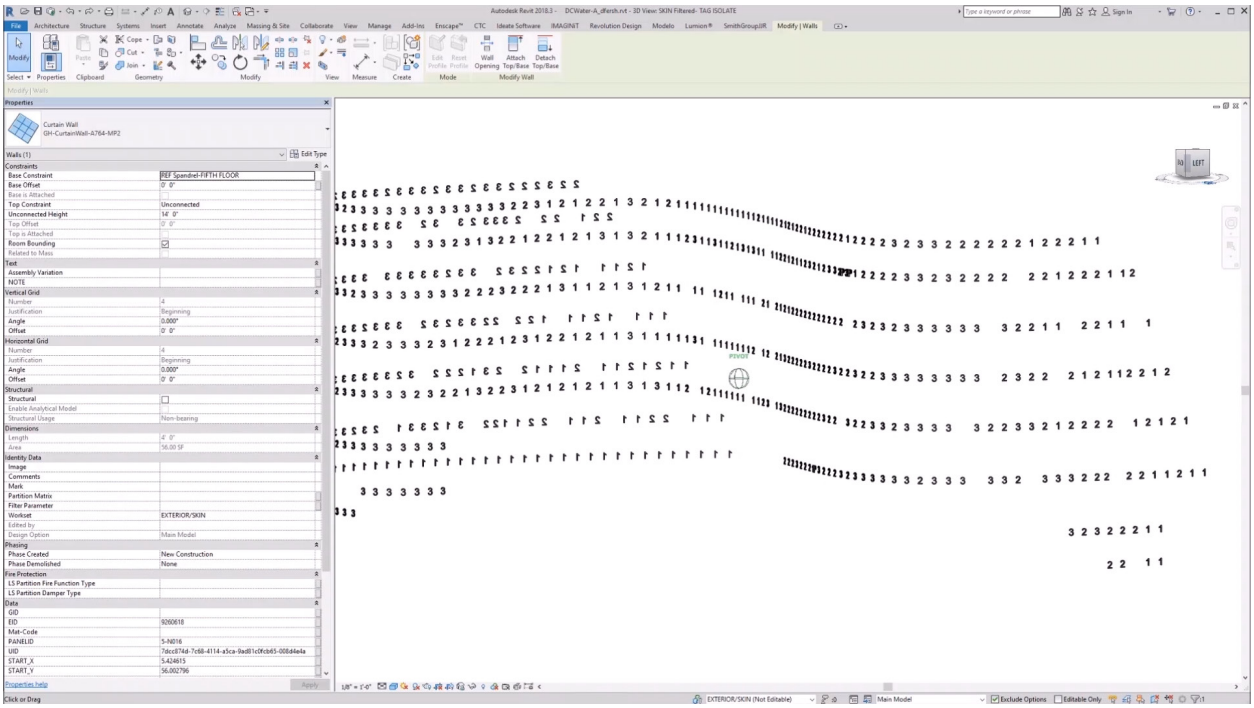
VIRTUAL MOCKUP OF A KIOSK DESIGN – EXACT CONTROL LOCATIONS BEING FINE TUNED

Augmented Reality and Construction

AR is by definition less immersive than VR, and for this reason VR is often the preferred technology to use as an abstract idea takes form. As projects begin to account for real world conditions more thoughtfully, AR may become more valuable.

Quality Control

AR has proved to be useful in a variety of settings in which digital information can be placed on top of real-world environments. This method serves as a coordination tool to ensure that what is modeled in the digital environment is aligning with reality. SmithGroup's use of a HoloLens at DC Water Headquarters for construction administration is a good example of how using this technology practically can greatly improve efficiency.

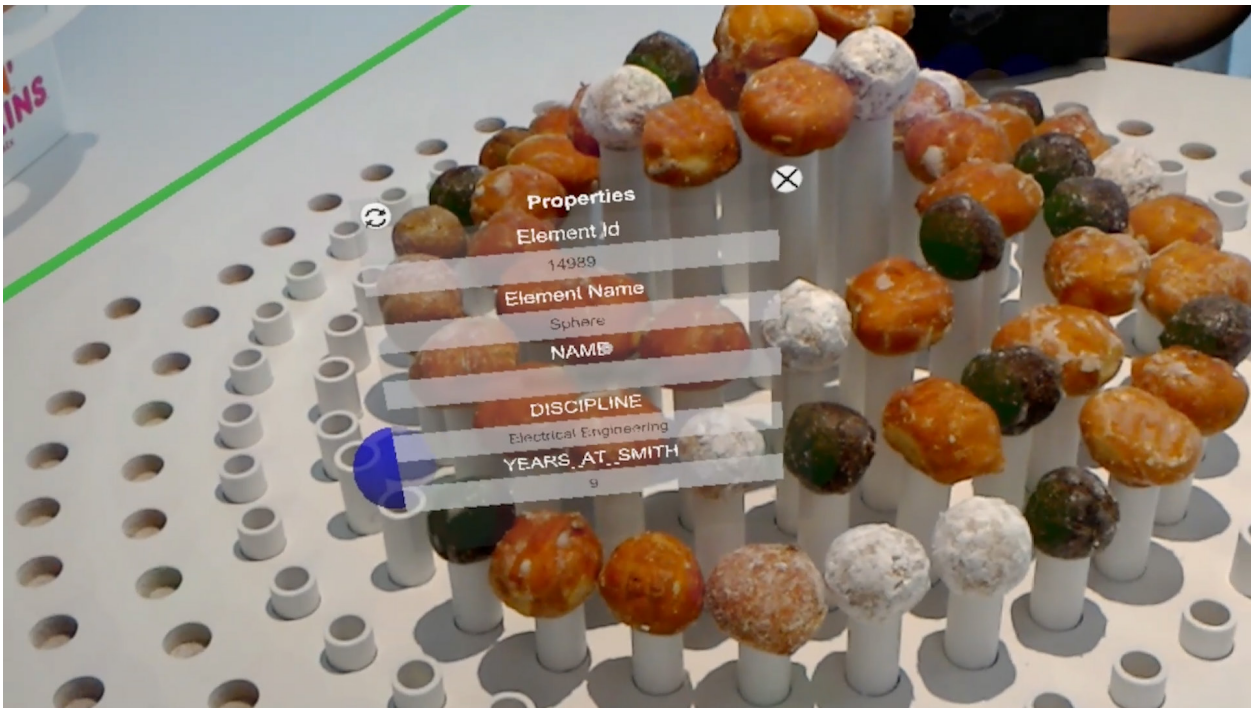


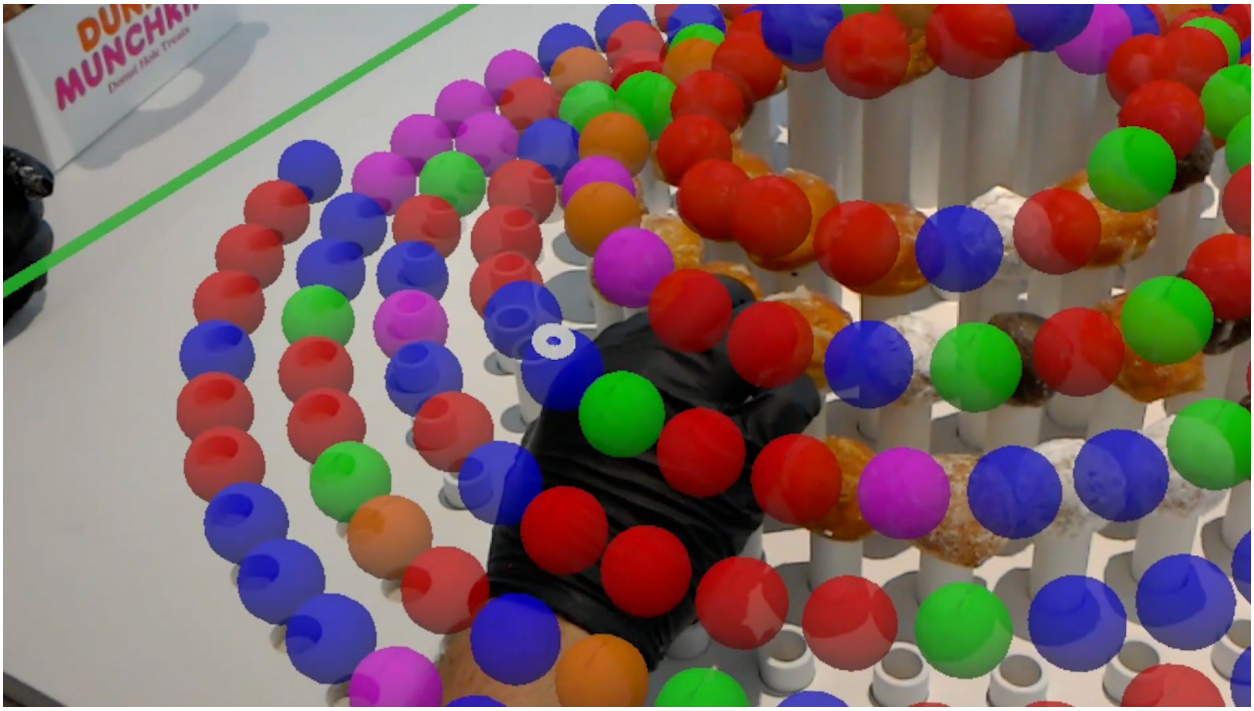
Panel types are isolated in Revit, and then digitally overlaid on site to verify construction at DC Water Headquarters

The Future of Project Delivery

While using AR for quality control and coordination can be hugely valuable, but as the technology improves, what is possible will continue to grow. SmithGroup created a proof of concept sculpture to aid in thinking about how AR may contribute to the future of contract documents. In this sculpture each donut hole represented an employee in the Washington DC office. The height of the donut in the sculpture represented seniority (1" = 6 years) and the type of donut represented discipline of the employee (glazed = architect, powdered = engineer, etc.). The sculpture was assembled through AR using a tablet and HoloLens in order to ensure accurate location and type. After the sculpture was assembled, it remained a living document with long term value– from within the AR experience, a donut can be selected to pull up additional information for the viewer, including the name of the employee, exact years of experience, and discipline. This workflow suggests a future in which a digital model works in conjunction with traditional contract documents as a delivery method, and its value lasts beyond completion of construction.

A MICROSOFT HOLOLENS WAS USED TO GUIDE CONSTRUCTION OF THE SCULPTURE





SCREENSHOTS FROM WITHIN THE AR EXPERIENCE.