AS227190

How to Empower Design with Immersive Technologies

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Learning Objectives

- Discover challenges of the paradigm shift, and learn how to blend traditional design techniques and XR
- Discover how HOK applies XR in its projects and design process
- Explore different ways of doing conceptual design, including tilt brush and medium
- Understand how to enhance client presentations by using XR technology

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Description

This presentation will explore how immersive technologies (XR) can help designers in different phases of the design process and enhance workflows. The XR revolution is happening in the design industry, but many design firms and individual designers may have not thought about how they can do conceptual design and present design ideas differently. The concept of immersive technology implies a great paradigm shift from a 2D design space to a 3D world where designers can empower their creativity. With an innovative and open-minded work culture, HOK embraces new design technology and aims to create a more effective workflow and powerful design solutions. The class will focus on how XR can help create a more powerful work environment and push the limit of design communication, and discuss the impact of XR on designers, clients, and users.

Embla Huang Speaker

As an interior designer holding a Bachelor of Science in Interior Architecture from University of Wisconsin-Madison, Embla Huang has worked on all phases of the design process on a variety of project types, including workplace, healthcare, education, retail and justice. Embla specializes in design techniques that blend the traditional and the cutting-edge. With the passion for human-centered design, sustainable design, and immersive design technologies, Embla works closely with the Design Technology Team at HOK and pushes beyond the limits of her role as an interior designer. She aims to bridge the gap between traditional design and innovative technology, provide unique and functional design solutions to clients, and make positive changes to the community.

Rotimi Seriki Co-Speaker

Rotimi Seriki a visualization manager with many years of experience in the area of architectural visualization. He grew up in Southwest Nigeria, West Africa.
Over the past 5 years, he has helped manage the growth in-house visualization at HOK's San Francisco studio through collaboration with designers, architects and engineers.
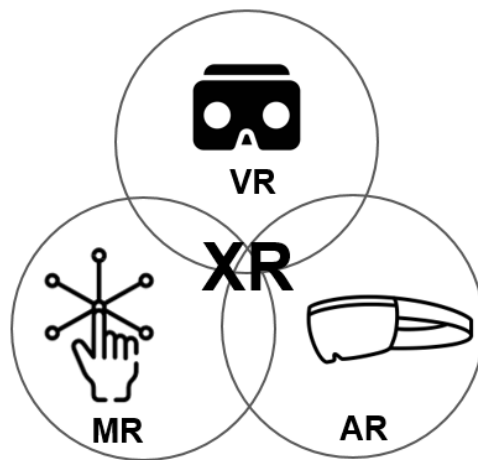Naturally, he has been leading the charge for implementation of Virtual reality and Augmented reality at HOK. In his spare time, he enjoys playing soccer, hiking and drawing.

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Problems

Background

Immersive technology is becoming more and more mainstream in the architecture, engineering, and construction (AEC) industry. Before we discuss the use of immersive technology in the design world, it is important for us to learn the differences between VR, AR, MR, and XR.

VR (Virtual Reality):

- An immersive experience; a computer-generated simulation of a three-dimensional image or environment that can be interacted with in a seemingly real or physical way by a person using special electronic equipment.
- Computer-generated stereo visuals which entirely surround the user, and replace the real world environment around them.
- VR world can engage different senses, including taste, sight, smell, sound, and touch, and create sensory experience.
- Devices: HTC Vive, Oculus Rift, Samsung Gear VR, Google Cardboard, and etc.

AR (Augmented Reality):

- The overlaying of digitally-created content on top of the real world. It is a technology that superimposes a computer-generated image on a user's view of the real world, thus providing a composite view.
- Utilizes the existing real-world environment and provides more freedom in the computer-generated sensory experience.
- Can replace or diminish the user's perception of reality.
- Devices: Microsoft HoloLens, Magic Leap Lightwear, Google Glass Enterprise Edition, Vuzix Blade AR, and etc.

MR (Mix Reality):

- A form of AR that is between VR and AR.
- Blends the user's real-world environment and digitally-created content, where both environments can coexist and interact with each other.
- Places new imagery within a real space in such a way that the new imagery is able to interact, to an extent, with what is real in the physical world we know.
- Devices: Still in development.

XR (Extended Reality):

- Big umbrella: all real-and-virtual combined environments and human-machine interactions generated by computer technology and wearables.
- The 'X' can be seen as a placeholder for V(R), A(R) or M(R), though it also represents an undefined or variable quality/quantity.
- Covers the hardware, software, methods, and experience that make virtual reality, mixed reality, augmented reality, cinematic reality and others a reality.
- Devices: VR, AR & MR devices.

History and Trend:

The origin of VR dates back to the early 19th century. The first device to pioneer 3-D was called "Stereoscope" and was developed by Sir Charles Wheatstone in 1838. Viewers looked through a lens with two of the same images. The brain blended them together to perceive a solid 3-D image. Fully immersive virtual reality has been the dream of video gamers since the beginning of gaming.

Interactive immersive technology is widely affordable and available across disciplines and in the private domain since 2000. According to International Data Corp., digital reality markets (AR and VR) are projected to grow from $5.2 billion in 2016 to more than $162 billion in revenue by 2020. The AR market is estimated to grow by 85 percent per year for the next three years.
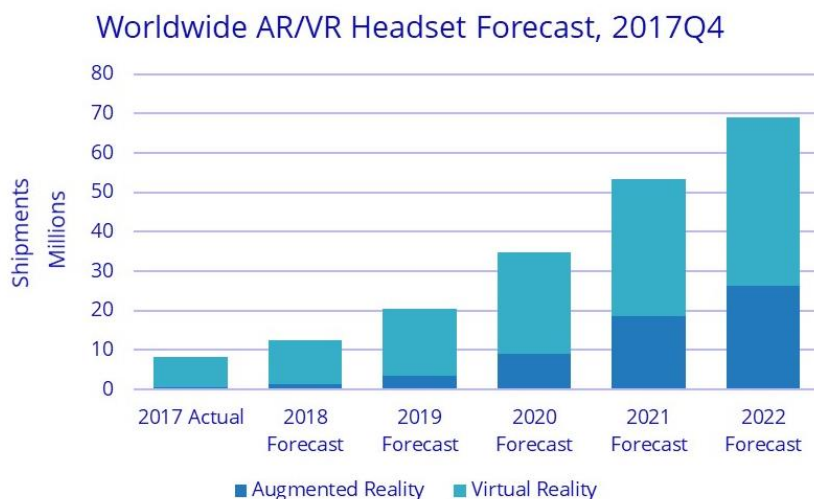
(HMD Market Trends, 2017)
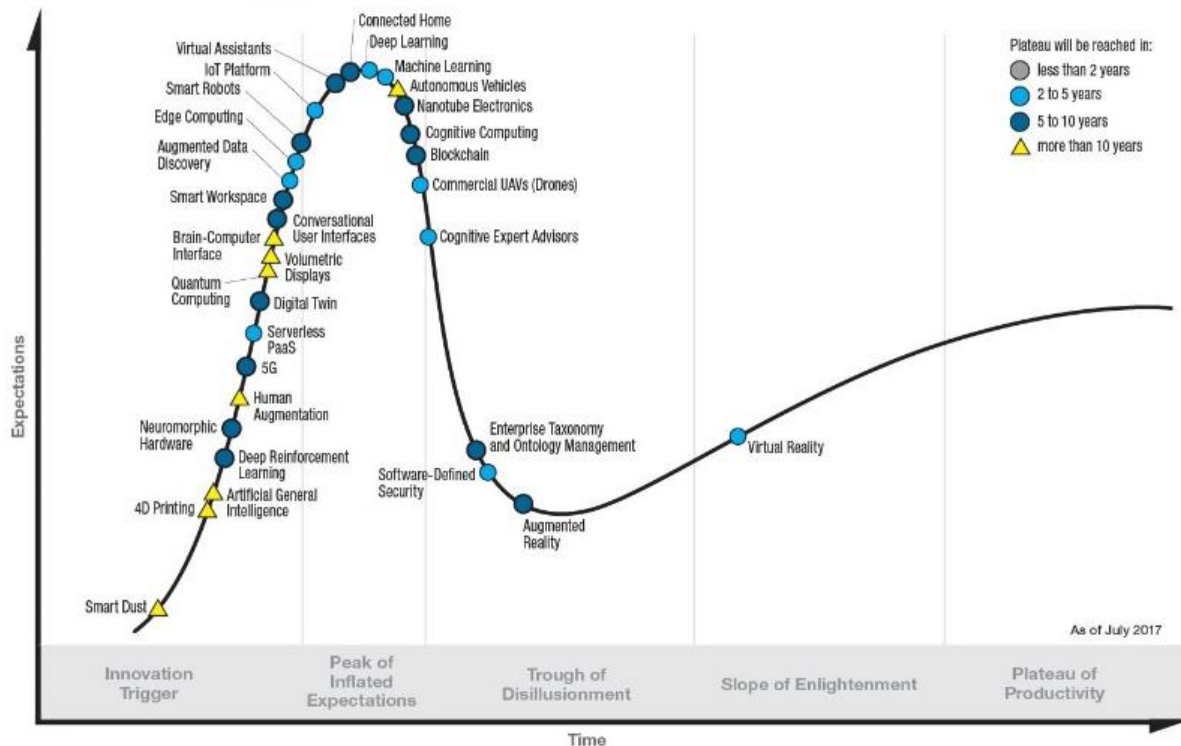
(Hype Curve, 2017)

As HOK currently practices Virtual reality in our daily workflow more, the class will emphasize VR and discuss the potential use of AR, MR, XR in the design world.

Challenges

More and more design firms and individual designers are trying to incorporate immersive technology more in their daily workflow. However, there are a lot of challenges on the path. For instance, due to the technical matters and simulation sickness of virtual reality, many people hesitate to use virtual reality more.

Simulation Sickness:

Users might become disoriented in a purely 'virtual' environment, causing balance issues; computer latency might affect the simulation, providing a less than-satisfactory end-user experience; the complicated nature of head-mounted displays and input systems such as specialized gloves and boots may require specialized training to operate, and navigating the 'real' environment (if the user is not confined to a limited area) might prove dangerous without 'external' sensory information.

Demand
- Client Demand: Many clients do not have clear ideas about immersive technologies and therefore, there may be a lack of demand on AR/VR visualization services.

Costs

- Equipment Cost: Professional VR Heads mounted displays which are the most common form of accessible systems

PISIGHT	XSIGHT	ZSIGHT
$99,000.00	$39,000.00	$10,995.00

| NVISOR ST50	NVISOR SX111	NVISOR SX60
$17,900.00	$36,900.00	$24,900.00

Professional HMD options

VR brand	Features	Price as of March 2018
Oculus VR	• Excellent resolution • Refresh rate of 90 HZ • 360-degree head tracking	$399
Sony Play-Station VR	• 5.7-inch OLED display screen • Refresh rate of 120 HZ	$299 - $399
Samsung Gear VR	• Ultralight design • Wide interface • Touchpad controls	$99
HTC Vive	• 70 sensors • Refresh rate of 90 HZ • 360-degree head tracking	$499

FOVE	• Highly accurate and unique eye-tracking technology • 5.7-inch display screen • 100-degree wide field of view	$599
Google Cardboard	• Large library of free content • Inexpensive	$7.99 - $13.99
Google Daydream View	• Comfortable and easy to use • Chromecast-compatible • Nine-axis IMU sensors for precision tracking	$99
Microsoft HoloLens	• No computer, phone, external camera or wires required • Sensor fusion captures movement and environment information • Spatial sound	$3,000 - $5,000
Meta 2	• 90-degree field of view • High resolution • Works while wearing glasses	$1,495

- Additional Hardware Cost: Depending on the sense of immersion you want to achieve additional hardware may be required with the extra costs.
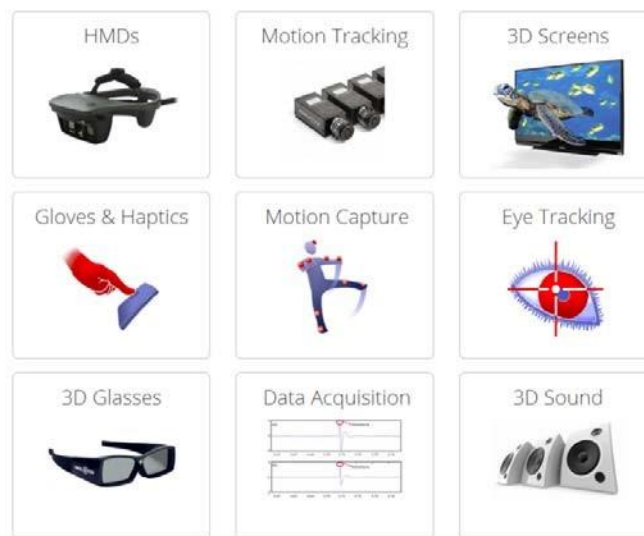
Sample VR Hardware Categories

- Physical Space:
  HMD systems have reduced the workable space but for a full immersive experience additional hardware requires a space beyond just a desk area.

Users

- Passion and Interest:
  Many designers are lack of passion and interest in using more immersive technology in their daily workflow.

- Training:
  Companies as well as users need to spend time and fee on the learning curve.

What We are Doing

Background

In many ways, 2016 was a breakout year for virtual reality in the design professions. After years of speculation and buildup, manufacturers such as HTC, Oculus, and Microsoft released powerful head-mounted displays that gave designers and clients a truly immersive and interactive 3D experience. At the same time, new software such as Lumion, Enscape3D and InsiteVR made it relatively simple for architects and engineers to convert building information modeling (BIM) data into a virtual reality experience.

At HOK, we first began experimenting with VR a couple years earlier, testing early prototype headsets and asking ourselves how this evolving technology would one day enhance the design process. Fast forward to today (entering the second quarter of 2017) and architects and designers in our worldwide offices are now using VR technology on a daily basis to discover new insights into their design ideas.

Given the dizzying speed in which the technology has caught on, it's worth taking a moment to look at what we've learned to date about VR and discuss how it fits into the future of architecture and design.

(SEA Tac Airport)

VR as a Presentation Tool

As architects, we're accustomed to looking at a design—be it a rendering, a sketch or a physical model—and interpreting how a building or landscape would look and feel spatially as a finished project. The same isn't necessarily true of our clients, who aren't creating and interpreting designs on a daily basis. Virtual reality tools give our designers a powerful aid for explaining ideas and concepts to clients and other stakeholders. It's this use—as a presentation or communication tool—that is for now VR's greatest benefit.

Here's an example. A client visiting our Philadelphia office needed additional help interpreting a design after being presented several static renderings of a project. In search of a new tactic, Kevin Hollenbeck, one of our project designers, turned to virtual reality.

"We decided to show the client some 360-degree panorama views that put them in the space with all those materials and the model constructed around them," says Hollenbeck. "The VR experience provided them a clearer understanding of what it would be like in that space. We only had to do the VR demonstration once. Immediately the client got it."

Peter Ruggiero, design principal at our Chicago office, relays a similar story. Last fall his team took plans they're working on for a new police headquarters and generated a VR version to show the police chief and other stakeholders.

"They found the experience to be rewarding in terms of confirming what they thought the building would be like spatially," says Ruggiero.

Now our design professionals at HOK are using VR to aid clients' understanding of projects large and small and across practice types, including interior design, sports arenas, aviation and healthcare.

The Varying Degree of VR

Over the past 18 months, rapid advances in technology have greatly expanded the field of VR hardware and software and lowered the price to get started. VR headsets such as Google Cardboard (and similar devices that incorporate a smartphone as the display) can be had for $20 or less. More advanced head-mounted displays, such as the HTC Vive, start at around $800. The self-contained, head-mounted computer and holographic display of the Microsoft HoloLens offers a head start into augmented reality (AR) development starting at $3,000. The more advanced VR experiences also require investment in computers with powerful graphical processing units to generate realistic shadows, lighting and materials in real time along with advanced gaming-engine software that can render 3D imagery at speed.

At HOK, we've incorporated the use of both simple and sophisticated technology to fashion a sort of small, medium and large approach to deploying virtual reality methods. Here's how that works:

- *"Small" approach*: The easiest, least expensive VR experience requires the quick additional step of rendering a spherical panorama from within our BIM software. This panorama then can be displayed in a VR headset or on a smartphone—via an app like HOK VR—to give users a static view of being inside a rendering. Though the user cannot navigate through this static model, they can get a 360-degree view of the space.
- *"Medium" approach*: This approach takes a 3D-design model and exports it to powerful gaming-engine software. When coupled with a VR headset and joystick, such as the HTC Vive or Oculus Rift, this "medium-size" approach gives designers and clients the ability to navigate their own way through the model. The design team can also create guided steps through the model to aid in navigation.

- *"Large" approach*: This method allows users to not only move throughout the model but also interact with it. They can use a virtual laser pointer or joystick to highlight design details and make annotations about design changes or edits.
- *Group tour*: In addition to the small, medium, and large approaches described above, we also have the ability to generate what is essentially a virtual group tour of the proposed design. Using VR hosting platforms such as InsiteVR, multiple project stakeholders can don head-mounted displays and navigate as a group or independently through the model with an HOK designer as the guide.

VR As a Design Tool

In those early days of 2014, when HOK's design technology team was first testing the development version of Oculus Rift (Oculus was later acquired by Facebook) and other VR equipment, we could clearly see how the technology would benefit our clients. Lately, though, we're seeing a much more powerful use-case for VR as a creative tool for our architects and designers.

In the conceptual design phase, HOK encourages designers to use immersive technology. For instance, some designers in the San Francisco office tried to use tilt brush or medium to create sketches and conceptual design in the virtual world.

(Designer using Google tilt brush)

Below is an example of how VR is playing out inside HOK: On a recent afternoon in our St. Louis office, a team of designers gathered in front of a flat-screen TV in the studio's public workspace. For weeks the team had been working on plans for a proposed MLS soccer stadium. Now it was time to view the project in virtual reality.

Senior Design Professional Andrew Zell strapped on an HTC Vive headset and for the first time "entered" the model as the rest of the team followed his movements through the stadium on the TV screen. Like most everyone who experiences a rendering in virtual reality, Zell was immediately taken by the size of and scale of being immersed in the design model. Soon, though, he was using the VR experience to identify issues—such as the placement of a scoreboard—that he had not readily noticed during the initial stadium design process.

(Use of Design Software at HOK)

What's Next

HOK VR App

HOK VR Version 1 was released in March 2018. It allows users to view project renderings in one of two 360-degree experiences—either in a panoramic view on their phones or tablets or by placing a smart phone in a headset such as Google Cardboard.

For now, HOK VR comes pre-loaded with two HOK projects (one from our Healthcare practice and another from Aviation + Transportation) that anyone who downloads the free app can experience. This spring, HOK buildingSMART plans to release a more robust version of the app that will allow design teams to connect HOK VR to project-specific renderings and descriptions. Clients could then enter an access code within the app to view their private project renderings.
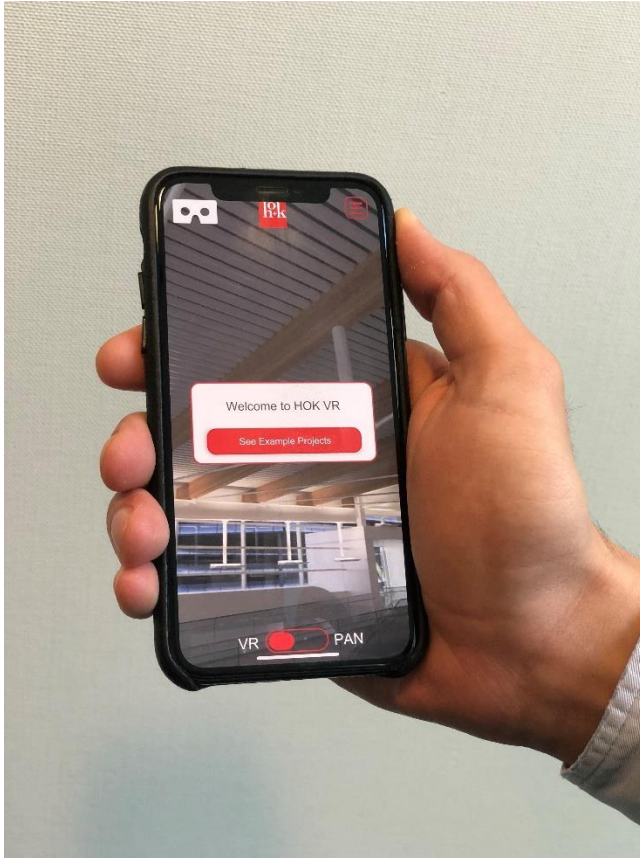
(HOK VR App)

According to Adam Chernick, one of the developers of HOK VR, Version 2 of the app, will allow the firm's designers to upload new architectural visualizations, which clients can view and download by entering a unique access code.

Chernick said, "Our clients will be able to carry their projects in their pockets so they can review and OK a design anywhere." "The app will also support collaborative VR meetings so projects teams and clients can refine a project design in real time."

Better Workflow

HOK aims to use immersive technology more and create a better workflow. According to AJ Taaca, project designer with HOK. "As part of the design process, we integrated a lot of new technologies, using virtual reality as one of our design tools. We tested a lot of our design thinking and organization of the project…with that technology, we created a model where we were able to walk our clients through the actual space," he said.

Besides VR, HOK is planning to practice AR in design projects with its own developed AR tool.

"Our goal is to keep pushing immersive technology forward in our daily workflow," David Ivey, Senior Design Technology Manager at HOK Chicago said.
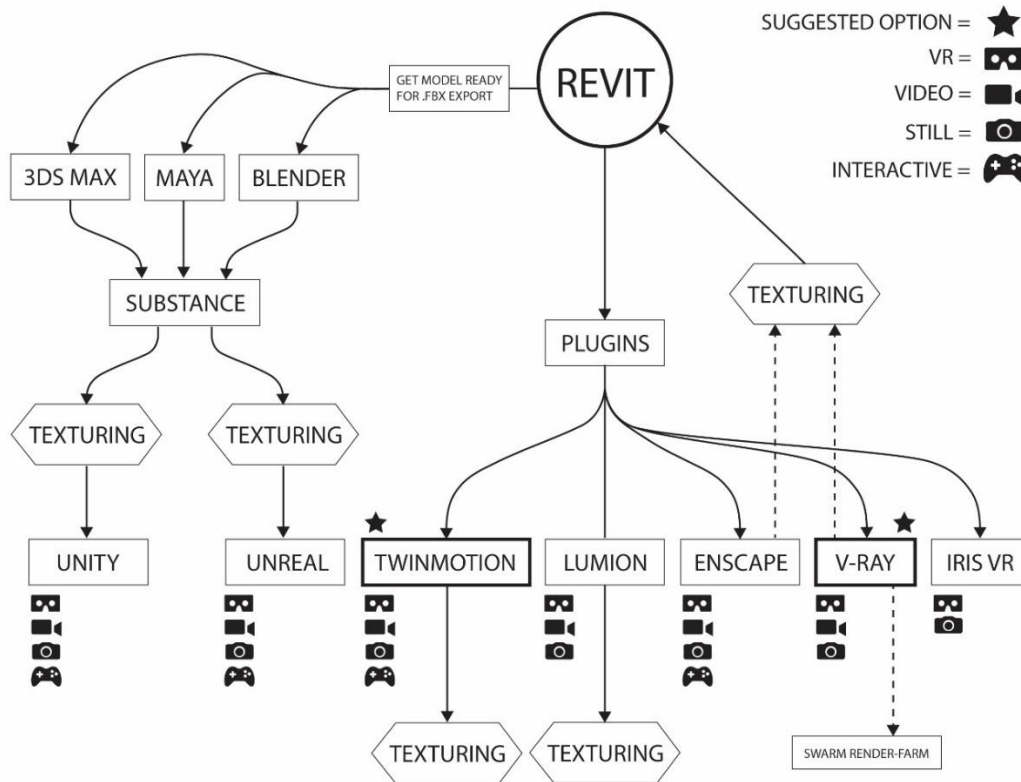
(Workflow Diagram)

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