

REPORT ON THE CURRENT STATE OF

IMMERSIVE ENVIRONMENTS

FOR DESIGN

**XL: Experiments in Landscape
and Urbanism**

This report was produced by XL: Experiments in Landscape and Urbanism, SWA Group's innovation lab. It began as an internal document for the firm's designers and was later shared as an open source resource to further accelerate exploration and experimentation in the AEC industry. The report is part of a larger project, Immersive Environments, that explored new advances in visualization and simulation for design. It sought to experiment with, push, and “break” emerging technologies to discover strengths, limitations, and opportunities. The approach was critical and evaluative, leading towards an understanding of the role these new tools could play in the future of design. The project and report were led by Emily Schlickman and Anya Domlesky and funded by the Patrick T. Curran Fellowship.

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WHY IMMERSIVE ENVIRONMENTS?

Immersive environments are beginning to come widely into personal use with faster software built for gaming and new hardware options. Technological improvements have recently made it possible to consider these tools for use in design. Some architecture firms are using Virtual Reality in limited ways. Here are some reasons to go further.

WOW FACTOR

Immersive environments produce impressive visuals for those who are not accustomed.

BETTER DESIGN

Designers can test their models at scale. Viewing designs immersively often brings up questions earlier in the process.

BETTER SITE UNDERSTANDING

Designers can view the site in more detail and assess conditions like natural light. This is

especially relevant for international sites.

ON THE CUTTING EDGE

The firm can bring the latest and greatest technologies to bear on a client's project.

CAPTURES ATTENTION

Exploration lengthens attention spans.

MORE REAL

Versus a flat rendering, built projects and unrealized ones appear more spatially real when you can virtually inhabit the space.

CHEAP-ISH

Design firms already produce 3D models for projects. The “assets” are already in place.

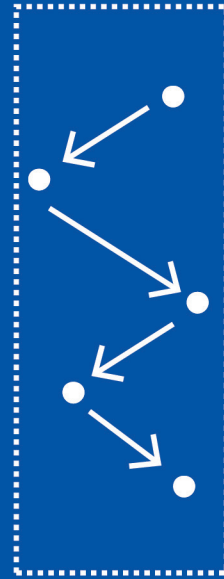
BETTER QUALITY CONTROL

During construction, it is easier to catch contractor mistakes with a design overlay.

TYPES OF IMMERSIVE ENVIRONMENTS

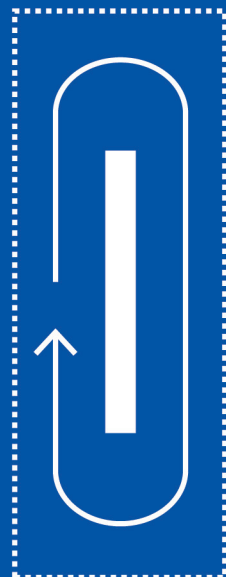


SPHERICAL PANORAMA



VIRTUAL REALITY

MIXED REALITY



360 VIDEO



Immersive environments is a term we use in this report to include several emerging technologies with similar perceptual qualities. These vary in the type of space you can inhabit and how mobile the viewer is within that space.

SPHERICAL PANORAMA

This environment will be familiar to most. An example, Google Street View, uses a series of stitched spherical images that you move through to create the illusion of real space.

VIRTUAL REALITY (VR)

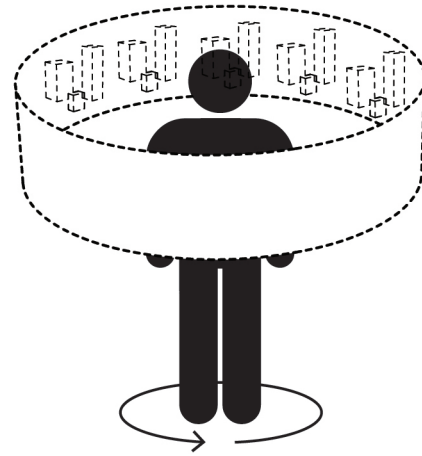
The gaming and real estate industries have invested heavily in VR. A modeled space is created and textured and can then be moved through by the user. Key words include: **Oculus Rift**, **Head Mounted Display (HMD)**, **empathy machine**.

MIXED REALITY (MR)

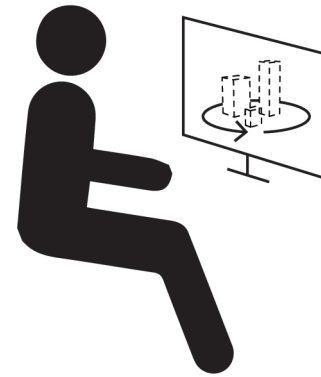
Often also interchangeably called **augmented reality**, MR overlays 3D models or animations onto existing conditions. Key words include: **Pokemon Go**, **Snapchat filters**, and **Microsoft Hololens**.

360 VIDEO

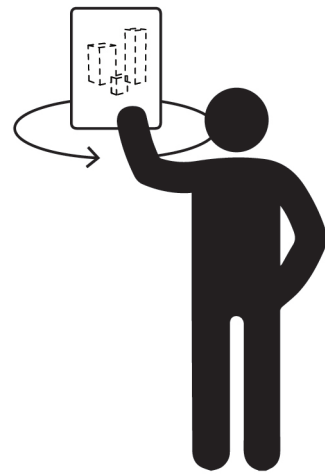
This is a video format where the camera captures a sphere. Videos tend to record real places and events, and the viewer can look all around during playback. YouTube, Facebook, *New York Times*, and other major media outlets already have platforms. They see this medium as the new way to deliver journalism. Filmmakers are making short narrative films. Key words include: **spherical**, **nadir**, and **Ryot**.



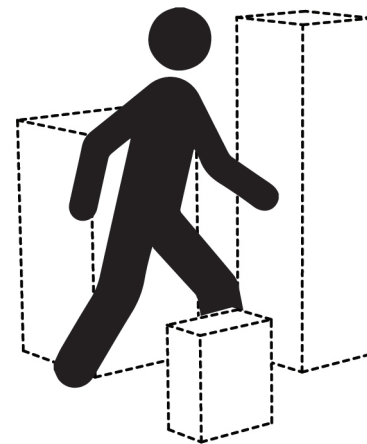
ROTATE HEAD



PAN WITH MOUSE



ROTATE DEVICE



MOVE FREELY

EXPERIENCING IMMERSIVE ENVIRONMENTS

The perceptual space of immersive environments is different for each set up combination. Your freedom of movement is also constrained in different ways with each.

ROTATE HEAD

Rotating one's head allows the user to see the sphere around them. This could be a static image or a video. This requires a headset (Head Mounted Display) or smartphone holder such as a **Google Cardboard**, or a free app.

PAN WITH MOUSE

Although not as immersive, one can use a mouse or touch screen to pan around a spherical image to get a similar effect. This requires only a browser, it does not require a headset.

ROTATE DEVICE

Held at arms length, a device such as a

smartphone or iPad can be used to view a static panorama, a 360 video, or overlay a model onto existing conditions. This requires a smartphone that can sense its position such as an iPhone, or iPad, plus a free app.

MOVE FREELY

You can have the experience of moving through a space with a headset. This could be enabled by **wand controllers**, a more traditional game controller with forward/back buttons, and by walking small distances. There is also the ability to **teleport** distances by pointing the wand forward and clicking. This moves you virtually to the position you point at. Sometimes there can be **gaze input** or **gesture input** or **voice input** that allows you to navigate, interact, or select in the environment.

SOFTWARE

Google Street View

LUMION



AUGMENT

irisVR



360VID

unity

UNREAL
ENGINE

HARDWARE

EASY
\$

CARDBOARD VIEWER

SMART PHONE



TABLET



360 CAMERA

MONITOR



TETHERED HEADSET

COMPUTER



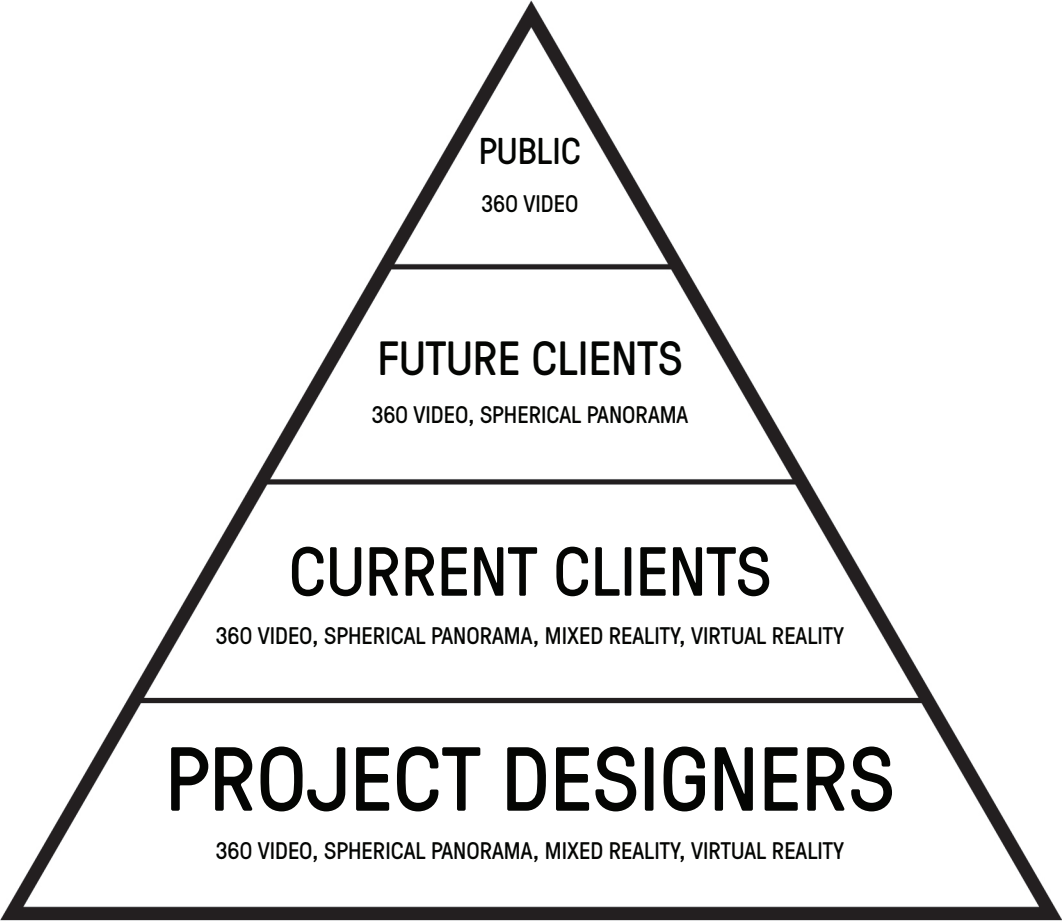
HOLOLENS



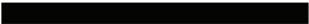
HARD
\$\$\$\$

GEAR OPTIONS FOR IMMERSIVE ENVIRONMENTS

SOFTWARE	
In ascending order of difficulty to learn and troubleshoot (ballpark time investment) for design professionals, these are simplified software options for immersive environments.	
Google Street View - 10min Lumion panorama export - 15min	Google Cardboard viewer + smartphone \$15 (assuming a personal smartphone) Untethered
Augment - 5 hours IrisVR Prospect - 6 hours 360 video, production quality - 10 hours	Tablet (iPad) \$300-500 Untethered
Unity (game engine) - 1-2 weeks + Unreal Engine (game engine) - 1-2 weeks +	360 camera + monitor (desktop, laptop, iPad, smartphone) \$500-1,200 for camera (assuming a monitor) Tethered / Untethered
Hololens Apps - (in development)	Headset (HMD) + powerful computer \$800-2,500 Tethered, in-office
HARDWARE	
In ascending order of price these are simplified hardware options for immersive environments.	
	Microsoft Hololens \$3,000 Untethered, in-office



USERS OF IMMERSIVE ENVIRONMENTS



PROJECT DESIGNERS

In the studio, designers could utilize all categories of immersive environments to help them design better.

- Virtual Reality (IrisVR Prospect for massing)
- Mixed Reality (Augment for sun study, etc.)
- 360 video (more complete info from site visit)
- Spherical Panorama (Google Street View)

CURRENT CLIENTS

Immersive environments could help speed decision making for clients, whether they are architects, owners, or owner’s reps.

- Virtual Reality (Unity for impressive, fully rendered, immersive spaces)
- Mixed Reality (showing options onsite)
- 360 video (precedent collection of an element such as a fountain, seating, paving)
- Spherical Panorama (Lumion panorama)

FUTURE CLIENTS

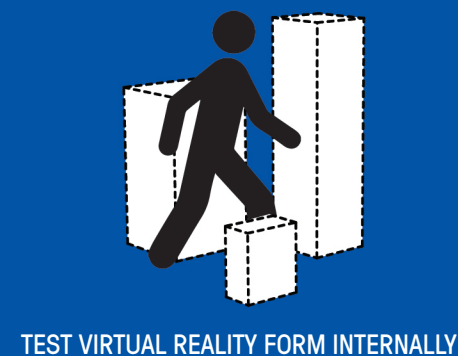
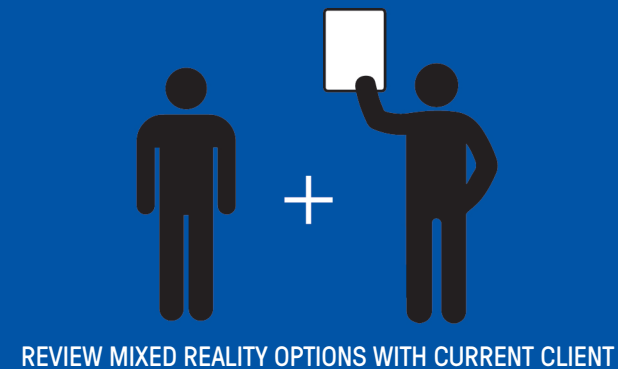
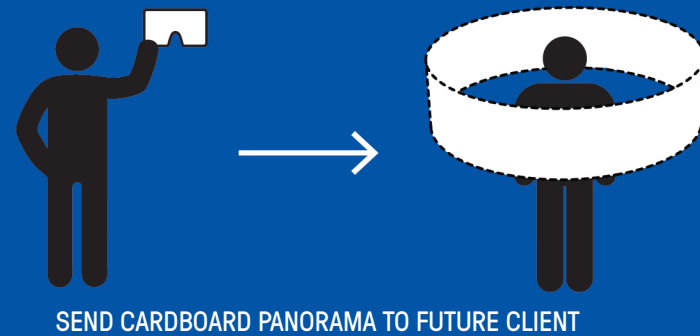
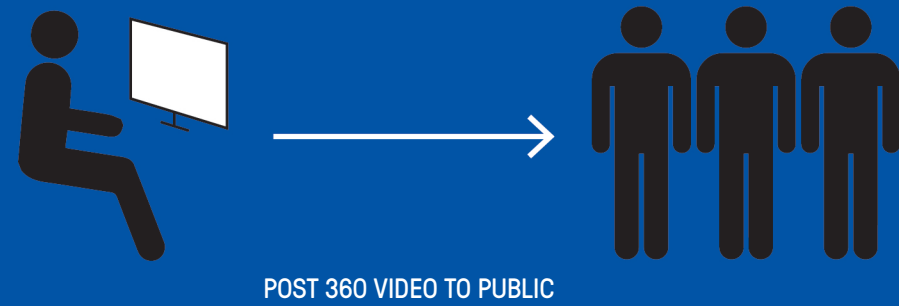
Immersive environments are a key tool for pitching to potential clients. These tools could be used in a competition setting or RFP process. Products could depict existing spaces or proposed ones.

- 360 video (showing site conditions, diagramming opportunities and constraints, approach to the project)
- 360 video (replacing tear sheets to describe built projects)
- Spherical Panorama (Lumion panorama)

PUBLIC

More detail about built projects can be shown in immersive environments and allow for exploration of the space.

- 360 video (replacing tear sheets to describe built projects)



SOME APPLICATION SCENARIOS FOR IMMERSIVE ENVIRONMENTS

360 VIDEO

Posting 360 video on a firm website allows easy access to a more immersive experience of projects, even with limited gear on the user's end. Cost: \$

For a competition or invited RFP for a key project, a 360 video could be shot of the existing conditions showing our perspective on the main issues, opportunities, and constraints. This could be annotated and have a voiceover. The video could be presented in person with a portable headset, via projector and mouse pan, or sent as a link to the jury. Cost: \$\$

SPHERICAL PANORAMA

For phase completion such as Concept, SD, or DD, a package could be sent via mail to a remote client. The client would scan a QR code

that would be on a sticker mounted on a Google Cardboard, and view a lumion panorama with their phone. Cost: \$

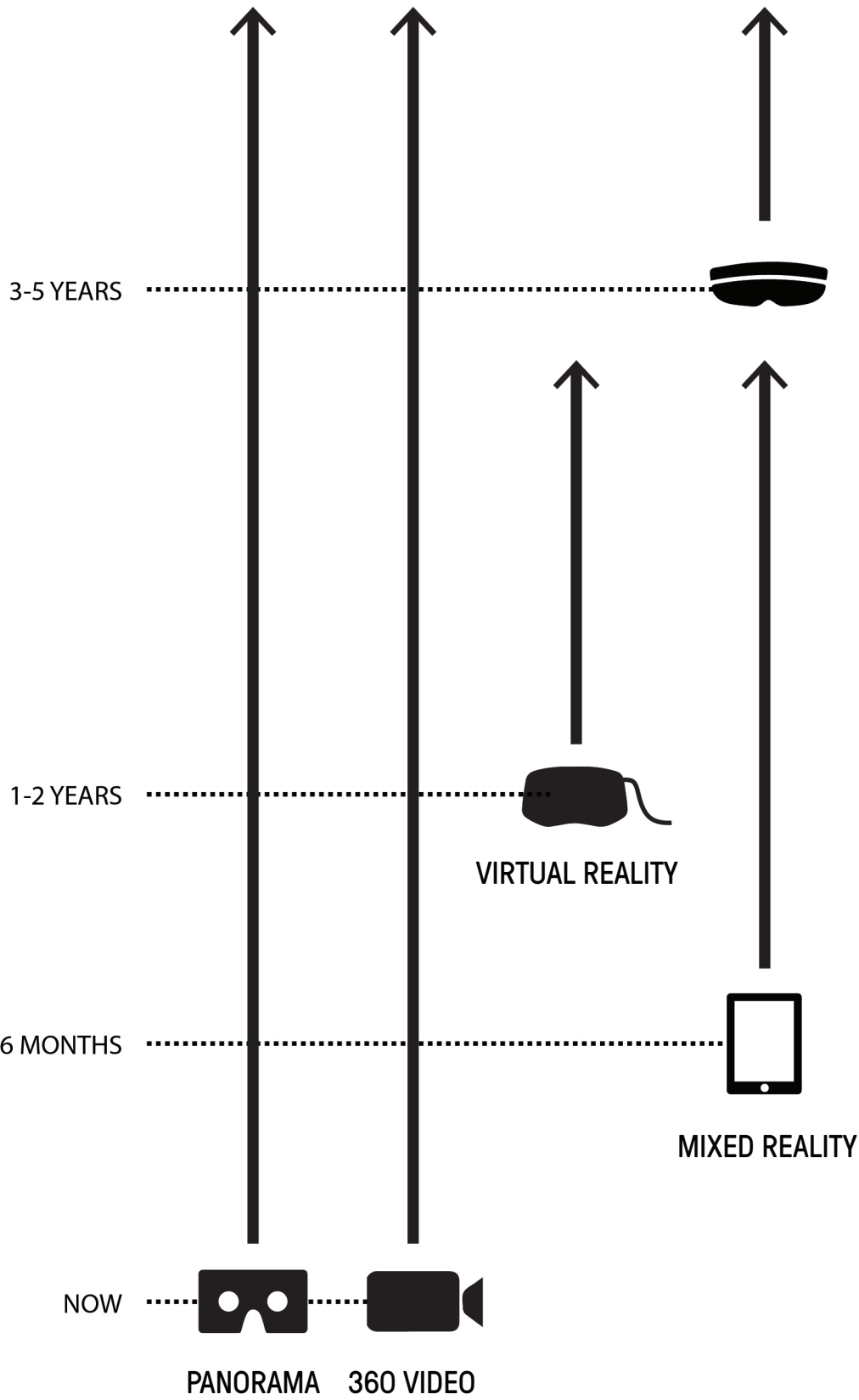
MIXED REALITY

For clients to see virtual models on a table, one could print a plan, and overlay a virtual model that can be viewed via phone. Cost: \$

VIRTUAL REALITY

For clients based near firm offices, a more complete build out of a model environment in Unity might wow them with the design viewed in a headset. Cost: \$\$\$

For designers in house, a head mounted system could help test designs. Software would translate 3D models to VR environments. Cost: \$\$



RECOMMENDATIONS FOR TECHNOLOGY ADOPTION

NOW: There are some high quality immersive technologies that have high hardware functionality and low time investment in learning software that designers could adopt now. These can be taken advantage of immediately. 360 video is an easy entry with “wow” potential. As workflows through Lumion are common, exporting a spherical panorama and sending with a viewer is recommended now. Street View is an easy tool to use with Google Cardboard in the studio.

6 MONTHS: There will be future improvements in graphic quality, fidelity, and/or resolution in the hardware. Refinements of existing MR apps such as Augment will improve and add functionality for the AEC industry. These can be added into presentations in the near future.

1-2 YEARS: Although usable now, future developments in software could make design work-

flows easier in VR. Products like IrisVR’s Prospect and InsiteVR could add small, but key functionalities such as being able to simultaneously view on a headset and monitor. A few years out, more software and apps are likely to become more design-centric. They might be better able to tackle issues specific to design such as: accurate scale, improved textures, vegetation modeling, and geolocation for accurate sun studies. Unreal Engine and Unity may also adapt, or existing design renderers like Lumion could be translated into a headset.

3-5 YEARS: Developments in mixed reality hardware like Hololens are predicted in 3-8 years to surpass the existing virtual reality hardware, as it doubles as both a VR and MR headset.



As the nature of our cities and environments become more complex and face unprecedented challenges, we think it is no longer sufficient to design for aesthetics alone. It requires advocacy, research, collaboration outside of design fields, and experimentation. The XL innovation lab at SWA Group aims to meet these challenges.