

ES128673

Connecting the Dots: Leveraging Emerging Technologies in Real World Projects

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Learning Objectives

- Exploring industry practice and workflows regarding VR/AR technologies
- Exploring case studies using VR/AR

Description

There's no doubt that augmented reality and virtual reality will play big roles in the future of architectural, engineering and construction industry. Arup has been using a mix of these technologies through its evolution. In this Industry Talk, we'll discuss the process and pitfalls of integrating various emerging technology advances – such as VR head-mounted displays; 3D reality scanning; AR glasses; and CAVE systems with infrastructure, lighting, way finding, and acoustic design – in order to capture and communicate our project plans. Project case studies, like the “1.8” exhibit at the Smithsonian Institute’s Renwick Gallery and Tippet Rise Art Center in Montana, will explain the value of experiential design and collaboration that can lead to making more-informed design decisions.

Speaker(s)

Anthony Cortez is the Arup Visualization Leader in the Americas Region and has been working as a Senior Designer for Arup Lighting for over 18 years. Anthony has worked on numerous AEC projects, including the Fulton Center, YAS Marina Hotel and the Stavros Niarchos Foundation Cultural Center in Athens. He has received lighting awards from the International Associates of Lighting Designers and Illumination Engineering Society. In addition to visualization, he integrates with other disciplines to produce validated lighting studies, acoustic & pedestrian/vehicle simulations, as well as real-time simulations using cutting edge mixed reality. The major benefit of what he provides is to help clients accurately understand and visualize their projects in the development stage as well as generate excitement and wow factor. Anthony has presented at conferences like Augmented World Expo, ESRI UC, AU and enjoys sharing his experience on the evolution of architectural visualization.

Reality Capturing

If you can see it, you can measure it and if you can measure it, you can manage it...

Scanning or point cloud survey is a digital method of capturing an existing space using a point cloud laser scanner. This allows you to capture your space. The accuracy is within 2mm on most scans. The generation of highly accurate point cloud models can be used for feature extraction and desktop surveys. Enabling users to revisit a site virtually via PC and take additional measurements using a site explorer walk-through, we can output surface and 3d models for further design and compare point clouds over different timeframes to monitor structures and features.

Another reason for using scanners and capturing existing buildings is that many projects we work on; the owners have either lost or simply not have any up-to-date documentation either hard copy or digital. Today, with projects being modelled in 3D, it's an enormous time saver to be able to go and simply scan a room space.

Some benefits of reality capture:

- Quick and easy way of attaining as built information and building a 3D model.
- Great to ensure the proposed design fits / coordinates with existing structure and architecture.
- Create visualizations / walkthrough of existing space.



Reality capture devices (Matterport, Faro LiDAR, GoPro Hero 360, Panono)

Seeing is Believing

Virtual, Augmented & Mixed Realities

Increasing use of Virtual Reality, Augmented Reality, and Mixed Reality technology is a growing trend that stems from the digitization of the architectural, engineering and construction industry. The capability of this technology, both hardware and software, is rapidly evolving but has now reached a point where it offers real, valuable, practical usability to engineering professionals. Use of mixed reality offers the potential to experience and share our designs in a totally new way. It lifts the shroud of drawings, diagrams, renders and jargon, to expose the pure reality of the things we design. It makes our information completely transparent so that stakeholders can directly experience the creativity and elegance of what we do as designers.



Virtual Reality in Arup Soundlab

Virtual Reality (VR) is defined as:

“A computer-generated simulation of an image or environment that can be interacted with by the user in a seemingly real way.”

As the definition states, VR requires computationally generated images and so technically every computer screen or mobile phone is a form of VR. However, with the recent releases of VR Head Mounted Displays (HMDs) have given users the ability to be totally immersed in a VR environment in which they can look around and interact with, giving them a sense of being “transported” to another reality.

These types of devices have become commercially available in the past 4 years after heavy investment in the gaming industry. Since their release, several developers have released a number of items of software for use within the engineering and construction industry.

The hardware works by generating two slightly different stereoscopic images within a closed visor that constantly update with any motion of the HMD, to give the perception of being in a 3D environment. Tracking systems and hand controllers allow the user to walk about and interact with the virtual environment.



Augmenting Reality on Mobile

Augmented reality (AR) enhances viewer's perception of reality by seamlessly integrating 3D objects, sounds, and information with the surrounding environment. Augmented Reality can anchor information when and where people need it, through visual displays that help with design data and visualization. This creates a wide range of exciting new learning and communication applications.



BIM overlay



Microsoft HoloLens

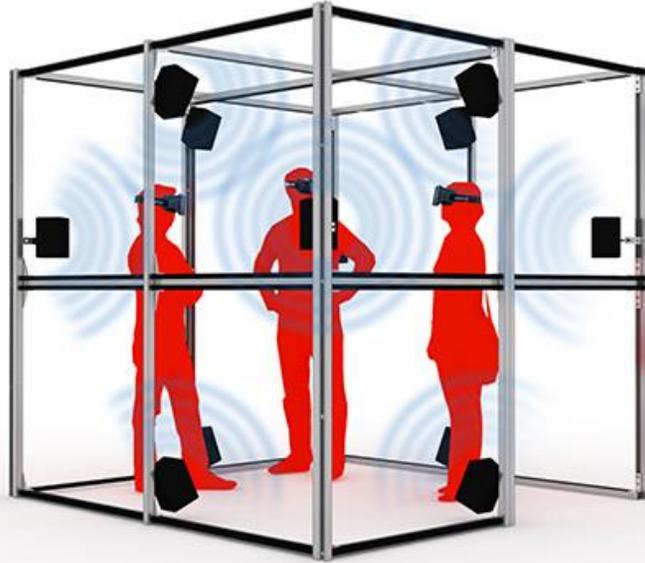
Mixed Reality (MR) aims to combine the best aspects of both virtual reality and augmented reality. In mixed reality environments, users seamlessly navigate through both real and virtual environments at the same time. Virtual objects are anchored into the user's real world space and augment their real world space. This allows the user to interact with virtual models naturally, in context and dynamic perspectives as they move around their environment. HMD's like the Microsoft HoloLens allows for this real-time experience. And now with the release of the new mobile devices that have depth-sensing capabilities, creation of MR applications is put into the hands of more developers.

Hearing is Believing

[The auralization process...](#)

Just as architects can generate renderings of their newly designed spaces or lighting designers can create previsualizations of lighting for new shows, acoustic professionals can create auralizations, or 3D renderings of the sound, for newly designed or existing spaces.

Connecting this technology to a VR application has its benefits. Traditionally, a user would be isolated within the confinement of a VR head mounted display and a set of headphones, this may create an individual experience. By creating an ambisonic sound field, multiple users can unplug from the headphones and share a virtual reality 360 movie with more collaborative dialogue.



Arup m|Lab

Arup's m|Lab achieves this shared environment by combining sound, light and virtual reality using 3D ambisonic sound and head-mounted displays. The concept was to create a transportable modular structure for virtual reality simulations that could be easily assembled while offering different degrees of openness and be adaptable to diverse acoustical environments.

VR is a fast moving market in which most demos are carried out using head mounted displays with headphones. In a group setting, the use of headphones results in sonically isolating individuals and prevents communication from within the VR experience. With the m|Lab, up to four participants can share a VR experience and carry on a design conversation with each other without the obstruction of headphones. This takes us one step closer to a fully seamless collaborative experience of a virtual space, which we believe will be a key part of experiential design environments of the future.

The m|Lab was first launched at the Architecture and Design Film Festival in fall 2015.

Connecting it all together

A Case Study...Hubble Cantata

Arup collaborated with composer Paola Prestini and film director Eliza McNitt to create an immersive sound component to the opera *The Hubble Cantata*, an operatic performance inspired by the writings of an astrophysicist featuring a virtual reality film. The soundtrack was composed in the Arup Soundlab using Wave Field Synthesis technology, allowing to simulate the audio setup on site to optimize the spatial rendering and immersive spectator experience. Arup also provided spatial sound engineering for the recording of the piece at National Sawdust in New York.

Highlights

- The first ever VR demo with 3D sound for a 6000-person audience (worldwide)
- In collaboration with composers and film director
- Very high quality of audio and video



Watch *Fistful of Stars* here:
<http://onefifty.com/items/fistful-of-stars/>



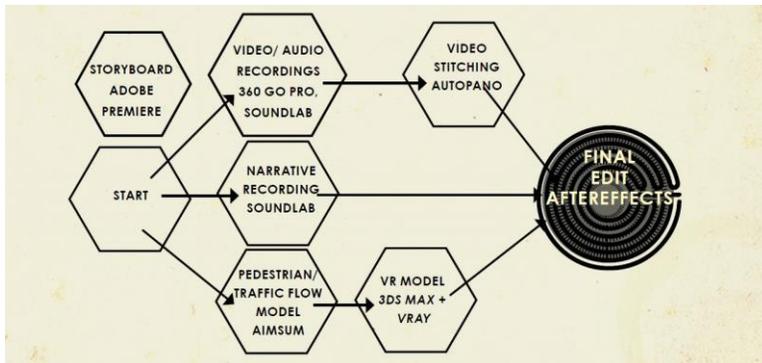
86th and 3rd Street – Transport Planning

Shows 86th & 3rd Avenue street crossing in 360 video, then fades to new possible design of street crossing with safety features built in to street design.



Highlights

- High value for transportation planning
- Potential to show proof of concept for city agencies
- High level of animation and people behavior using pedestrian modelling software



The recordings were done using a 360 camera (Go Pro Hero) and sound field microphone. These are stitched in Autopano. The rendered visuals are monoscopic VR renderings from Revit / 3DSMax / Vray, with included simulations from the traffic flow model in Aimsun. The final edit and addition of narrative were done in Aftereffects.