DV21960

Viewing a Space Before it's a Space – Virtual Reality for Design Verification

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Learning Objectives

- Discover possible uses for VR in MEP applications
- Understand why VR can be a powerful tool for designers and engineers
- Learn which software and hardware worked for the team at MCW Consultants
- Understand the workflow used for optimal VR and presentation of the intended spaces

Description

Virtual reality (VR) isn't always for architects to show off their pretty designs! Viewing mechanical and electrical rooms before they're constructed, and before equipment is purchased, is important from a constructability standpoint. Just because an object fits in a space, doesn't mean the design works. Having a contractor, operations manager, or client walk-through, experiencing the space well before construction, can help clarify the design intent. They can give insight on design "flaws" and layout preferences, which will help the designer to produce an efficient and clean design. This class will showcase case studies in which a design team at MCW Consultants Ltd. used VR to enhance and validate their design intent in a number of mechanical spaces.

Your AU Experts

Laura-Lee Moran

Laura-Lee graduated from Ryerson University in Toronto, Ontario with a Bachelors of Architectural Science. Having found a job at a Mechanical and Electrical Engineering firm out of school, she quickly acquired experience in the mechanical design field. Applying her knowledge and design experience, Laura-Lee become well versed in Revit, using her skills and knowledge of the program to further MCW's Revit and BIM production.

Laura-Lee is MCW's National Manager of BIM Services, with more than 8 years of Revit experience and nearly 20 years with AutoCAD. She is responsible for developing and implementing companywide BIM standards, and also plays a key role in creating project workflows and strategies for coordinating with other MCW offices and outside consultants.

With the assistance of BIM Leads positioned in each of the main offices, Laura-Lee has implemented companywide training sessions to ensure all offices are developing BIM to a consistent level of quality and detail. Training covers new users as well as custom courses for

experienced modelers. The group also creates and manages all of the BIM content and is in charge of creating and maintaining the companies BIM standards.
Laura-Lee received her Revit Architecture, Mechanical and Electrical certified professional accreditations at Autodesk University in 2015.
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Denis Hebert

After graduating as a Building Systems Technologist from the New Brunswick Community College in 2008, Mr. Hebert joined MCW and began working with engineers to design and draft MEP systems using AutoCAD.

Over the course of the last 8 years Mr. Hebert has acquired design experience in systems such as Ventilation, Heating and Cooling, Fire Protection, Plumbing, Lighting, Power Distribution and Communications.

In the past 5 years Mr. Hebert has taken a key role in implementing Revit in MCW's Atlantic offices and has become a BIM leader, helping develop MCW's national BIM standards. He has also provided MCW's Atlantic offices with local training sessions to ensure users are developing BIM models to a consistent level of quality and detail.

Mr. Hebert received his Revit Architecture, Mechanical and Electrical certified professional accreditations at Autodesk University in 2015.
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About MCW Consultants Ltd.

The MCW Group of Companies was established in 1964 and has built a solid reputation for the delivery of Professional Consulting and Engineering Services, Energy Management Services, and Engineering Development Services. Our work helps create and improve environments for our clients where thousands of Canadians live, learn, work, play, and heal.

Made up of three primary privately-held Corporations: MCW Consultants Ltd., MCW Custom Energy Solutions Ltd, and MCW AGE Power Ltd, the MCW Group of Companies are managed collaboratively by 23 active Partners and employs over 450 people across Canada, and the United Kingdom, maintaining Canadian offices in Toronto, Ottawa, Halifax, Truro, Moncton, Saint John, Winnipeg, Dauphin, Edmonton, Calgary, Vancouver, and Kelowna, as well as an office in London, England.

MCW Consultants Ltd.

Uses for VR in MEP Applications

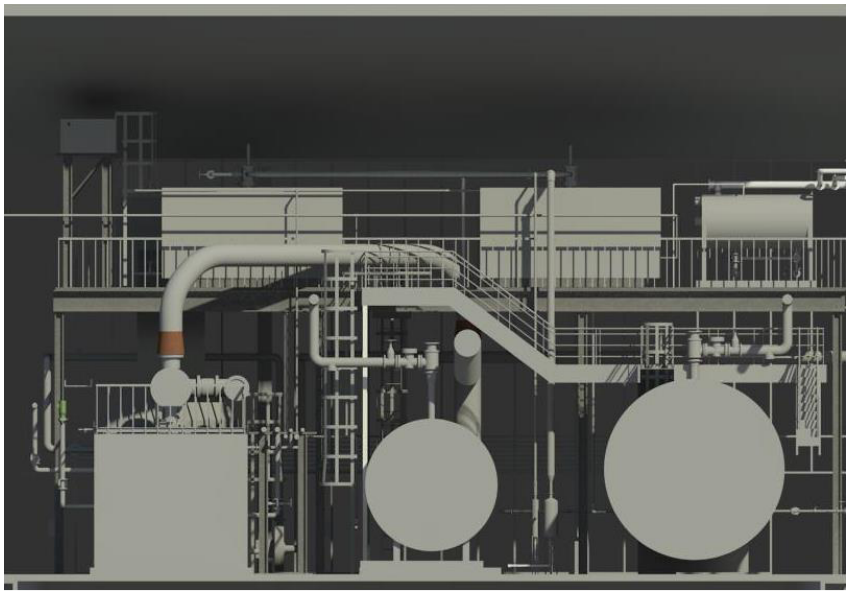
As BIM software becomes more evolved, so do the designs of buildings and the systems that keep them running. We have seen a rise of expectations from owners and architects for more optimized and compact MEP designs that take up smaller footprints and less ceiling space. Having the ability to visualize and walk through these MEP spaces has immense value, such as the ability to validate or fine-tune our designs. It gives us a different perspective, allowing us to experience the design from a building operator's point of view to identify maintenance issues, an architect's or owner's point of view for aesthetics, or from an installer's point of view for constructability.

Design Verification – Maintenance & Constructability

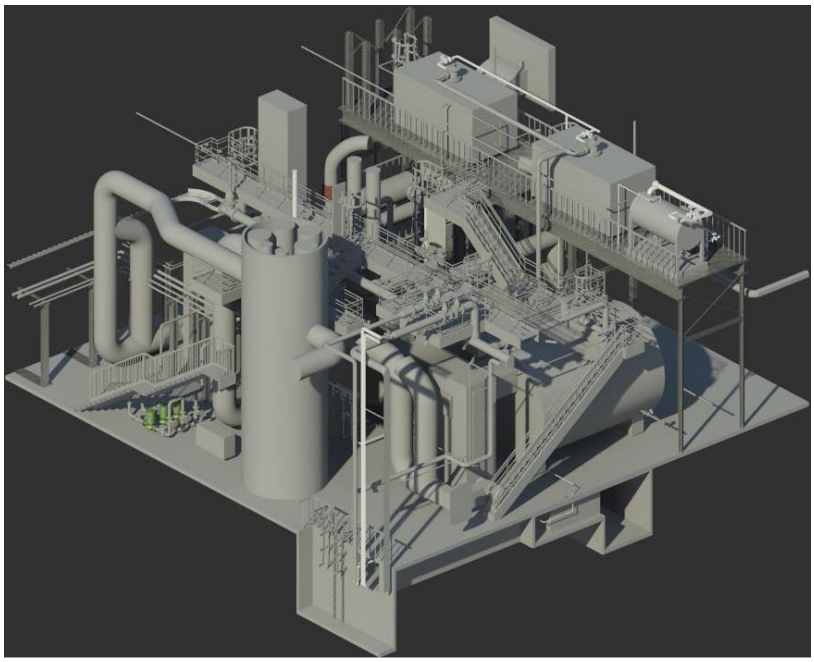
We are often asked to prove our MEP space requirements early in the design process, either it be a new build or existing build that's being retrofitted. In both cases, large pieces of equipment are usually being installed with ductwork and piping coming in all directions.

Case Study: Hospital Central Plant

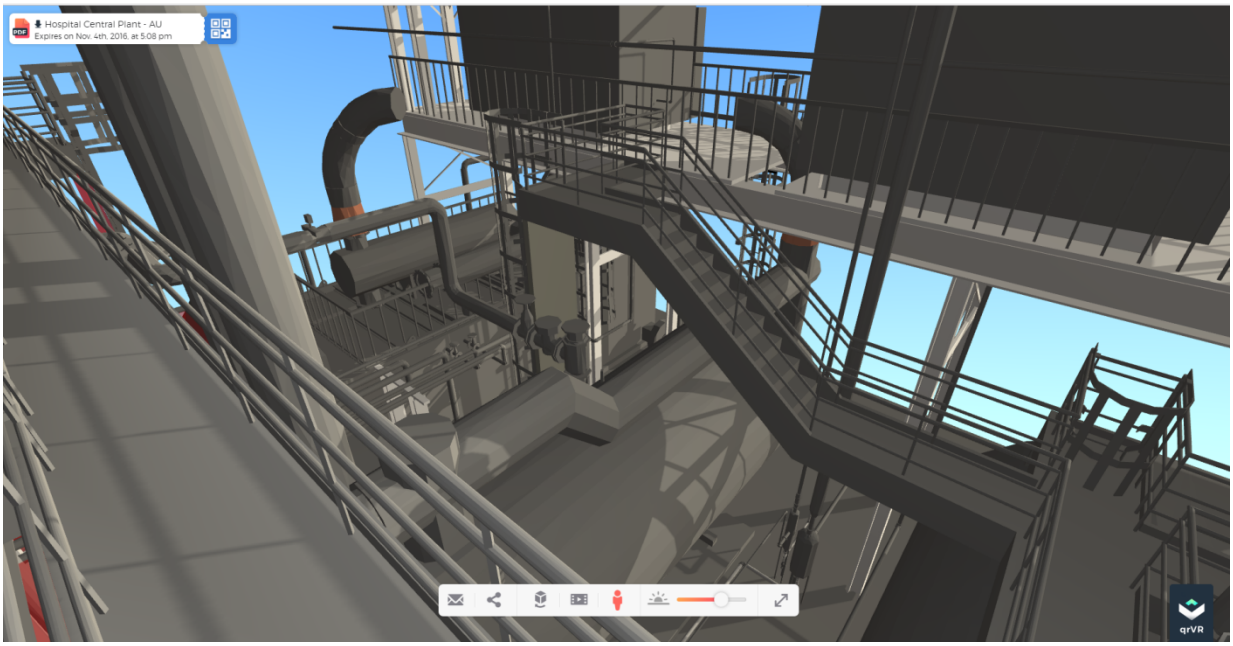
MCW won its first major project in Manchester, UK. It was a dated central plant for a hospital that needed their three steam boilers removed for a more environmentally friendly solution. We decided the best way to design this project was using Revit as we needed to ensure as much of the existing building, including catwalks and other interior support members would not need demolishing to remove the boilers or to put the new CHP boiler (combined heat and power) into the space.



ELEVATION VIEW IN REVIT OF TWO STEAM BOILERS & ONE NEW CHP



REVIT ISOMETRIC VIEW OF THE CENTRAL PLANT



VIEW FROM A CATWALK IN THE CENTRAL PLANT, REVIT EXPORTED TO QRVR

Throughout the design phase, we sent the UK based client numerous 3D models to orbit and walk around. This gave him the confidence that the existing building will be large enough to house the new CHP boilers. Once the project was tendered, our team sat with the winning bidder to discuss their construction workflows and the manufacture that they were planning to purchase the boilers from. We replaced the Revit families with the updated selections to verify the space and systems layout would still work.

Design Verification – Engineering

Often times with the amount and size of equipment needed in one space, engineers might find themselves wondering if it will all fit. Sure it fits on a computer screen, but once you are inside the room, will it all fit as intended? Verifying the design pre-construction allows the engineer that last minute check and reassurance of their design.

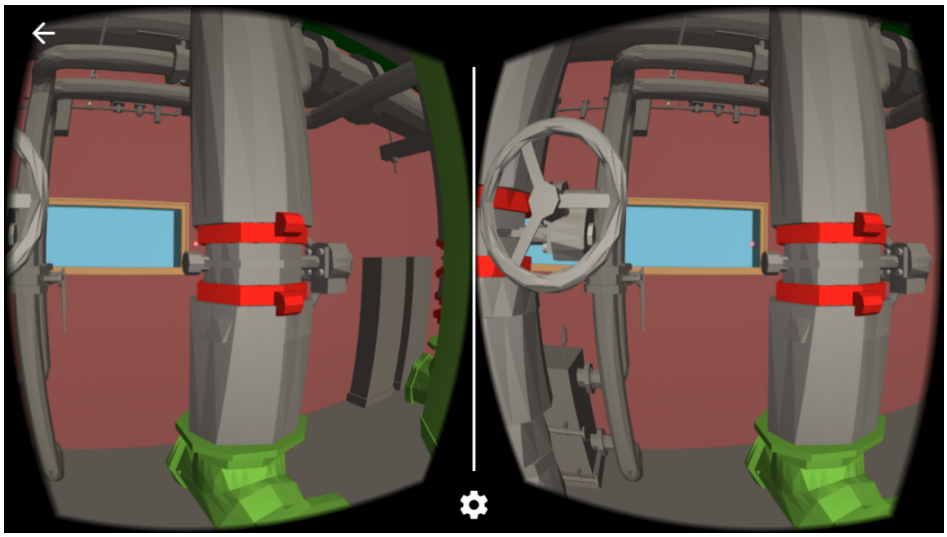
Case Study: University Chilled Water Pump House

A major Toronto university was getting an upgrade to their central chilled water system, and a team at MCW was tasked with designing the pump house for this system. The intended design of the building was a simple box with trenches on either side of the building for the incoming and exiting pipes. Numerous pumps that are significantly taller than the average human were then placed inline along one of the walls. When it came time to review the project however, the two project managers disagreed on whether the layout of the space would actually work once constructed.

INTERIOR VIEW OF THE PUMP HOUSE, USING THE QRVR APP ON A SMARTPHONE

One project manager thought the layout was acceptable, the other did not think the space was large enough, having to place the pumps closer to each other than acceptable. We exported the model to Revizto and used the Oculus goggles, allowing both project managers the opportunity to view the model in VR.

Once they were able to walk around the pump room virtually, it was determined that the space between the pumps was adequate; there was enough clearance for installation and regular maintenance. Being able to view the design intent virtually allowed the team to view all equipment in perspective, verifying the initial size of the space and the layout of the pipes and pumps would work.



SMARTPHONE SCREEN SHOT OF THE PUMP ROOM WHEN USED IN GOOGLE CARDBOARD VIEWER

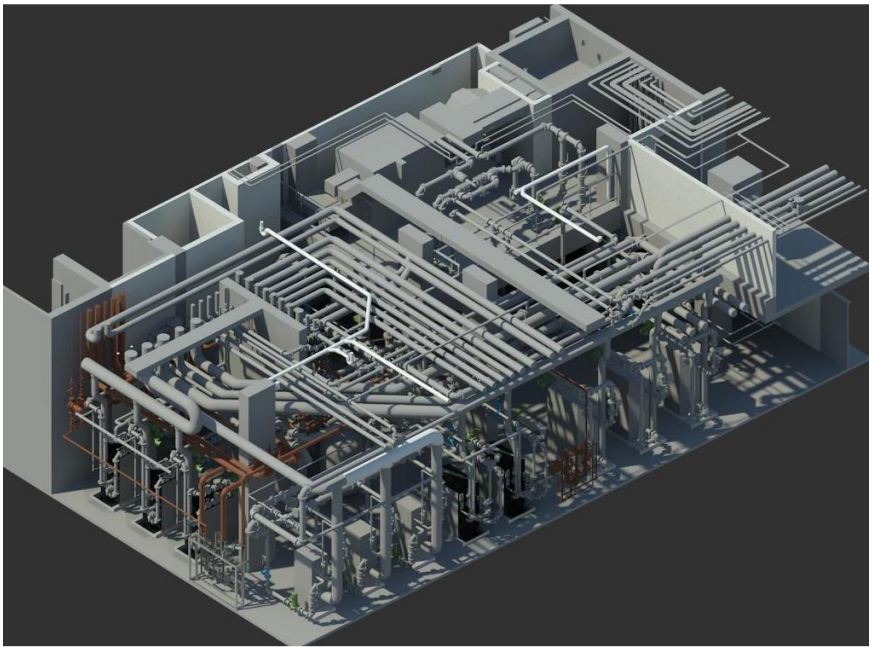
INTERIOR VIEW OF THE PUMP ROOM THROUGH OCULUS

VR Can Be a Powerful Tool for Designers & Engineers

Being able to walk through a virtual MEP space, hopefully catching design issues that might not be apparent during the design phase is a powerful ability. Even when modelling in 3D, some design ‘flaws’ may not be apparent until you have a more realistic perspective and understanding of the design intent.

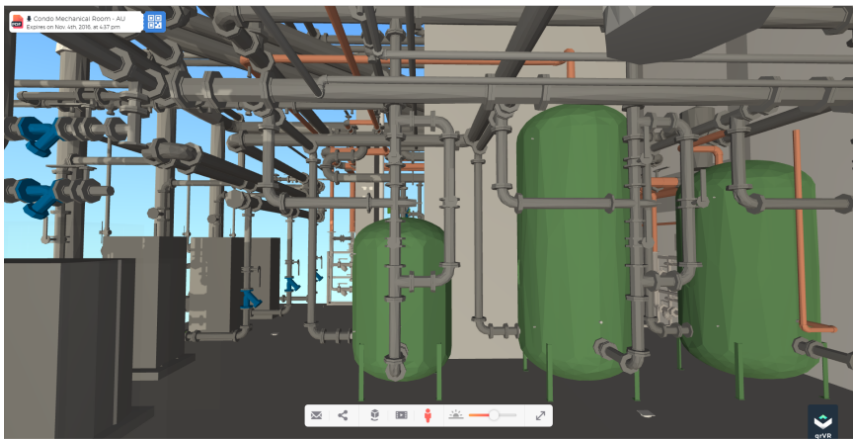
Case Study: Condo Mechanical Room

The team was a few weeks away from issuing a large condo project for construction when we decided to have a little fun with our internal design review. MCW in Toronto just received the Oculus DK2 goggles and wanted to show off their creative and complex design of a two-story mechanical room in the buildings underground parking garage. The engineer assigned to the review was virtually placed into the space and was soon ‘walking’ around boilers, air handling units, and chillers. It didn’t take long to realize that various valves that would need regular attending to were positioned in such a way that was too high for a ladder, and in too congested of an area for a scissor lift.



REVIT ISOMETRIC VIEW OF THE MECHANICAL ROOM

INTERIOR VIEW OF THE MECHANICAL ROOM, REVIT EXPORTED TO QRVR



INTERIOR VIEW OF THE MECHANICAL ROOM, REVIT EXPORTED TO QRVR

Being able to virtually walk around this space as if it were built allowed the designers to get a more scaled perspective of the room, getting a better understanding of how the current design of the mechanical systems would impact the daily operations of the building. Seeing the design in 3D on a computer screen is important, but seeing the space before it became a space allowed the team to modify the layout before it became an installation and cost issue.

Software & Hardware That Worked for the Team at MCW Consultants

Disclaimer! There are numerous products and programs out there. We are by no means listing what we think is the best, cheapest, or easiest to use, we are simply letting you know what we have found works for us.

After trying a few different options, we have adopted the following two VR strategies: Oculus Rift DK2 with Revizto software and Google's VR Cardboard Viewer with Kubity software and a smartphone. Both have their pros and cons, and as previously stated are in no way the only options available. We would love to hear what others are using too!

Oculus Rift DK2 Head Mounted Display with Revizto BIM Integration Software

The combination of the Oculus Rift HMD with a high end computer and Revizto's BIM Integration software gives a very good overall user experience. The Oculus Rift will create a very immersive, high detailed environment for users to explore and analyze. It also gives the user a good sense of depth-perception and a grasp on the physical size of the rooms and equipment, which is critical in evaluating the effectiveness and validating the design of MEP spaces.

Oculus allows the user to go hands free if they simply want to walk around a virtual space – you just can't walk too far, as the Oculus goggles are not wireless (although they are currently under development). Or the user can sit at the computer, with the goggles, and a keyboard and mouse, and go into a more in depth analysis of the space. If a piece of equipment or pipe, etc. had parametric data associated with it in Revit, that data would be exported with the geometry and is viewable in VR by the simple click of the mouse.

OCULUS RIFT DEVELOPMENT KIT 2 (DK2)

Pros

Very immersive
Stable and smooth operation
Higher level of detail
Can handle large models (file size)
Intuitive to navigate within the VR environment
Displays parametric data associated with the geometry in the models

Cons

Higher cost of hardware and software (high-end PC with a good graphics card + Oculus Rift + Revizto)
Limitation of portability
Not wireless, limits range of motion
Only one user in VR at a time

Google's VR Cardboard Viewer with a Smartphone and Kubity Software

Considering the cost of these viewers, you get a pretty neat VR experience. They don't display as much detail as the Oculus, but they still give the user a good viewing experience, being moderately immersive. Navigating large models or complex spaces can be tricky though. This method is very portable and cost effective as many of us already have the latest smartphone (right!?). And qrVR, powered by Kubity, is user friendly software that works on your computer on via an app on your Apple or Android phones.

GOOGLE CARDBOARD VIEWER

Pros

Cost effective way to get a sense of VR
Very portable
Provided users have a smartphone and VR cardboard headset, multiple people can be exploring the same VR environment at the same time, at their own pace.
Requires a smartphone, not a high-powered computer

Cons

Requires a smartphone (a con only if you don't have one!?)
Stability and smoothness will vary greatly depending on the device used.
Moderately Immersive
Limitation of model size

Workflow Used for Optimal VR & Presentation of the Spaces

In very simple terms, to view a model in VR you need a Revit model, an export add-in, a third party program to view the model, and the goggles themselves. Is it really that easy?

Workflow Used to View Models Using Revizto

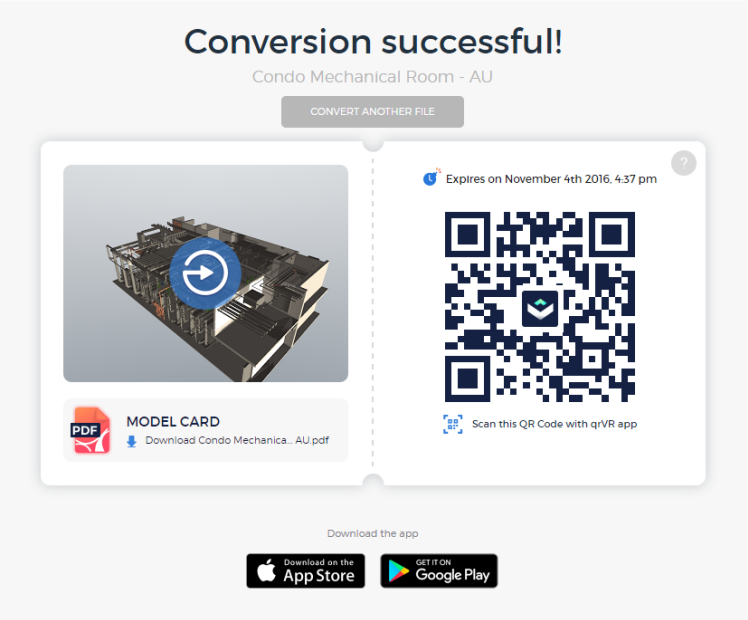
Once you purchase, download, and install Revizto on your computer, it creates an export icon under your Add-Ins ribbon in Revit. With a 3D view open, click on the export button and your 3D model is then thrown into the cloud environment, with options to create a new project or update an existing one. Once your model is in the Revizto cloud, you have the option to orbit, walk through, or fly though your model while viewing it on the computer screen. This allows you to get close to that VR experience if you don't have the goggles handy. The MCW team also found this program useful in that you can send a link to a non-Revit user (i.e. your client), allowing them to view their project in 3D via a free viewer.

Using plug and play technology and the Revizto viewer, it takes no time at all to transform your Revizto model into VR for use with Oculus.

https://revizto.com/en/
https://www.oculus.com/

Workflow Used to View Models Using qrVR, Powered by Kubity

On your PC, you will need to download and install the qrVR Exporter app from the Autodesk App Store. This will create an export icon under your Add-Ins ribbon in Revit. With a 3D view open, click on the export button and your 3D model is then converted to a SketchUp (.skp) file. You will then need to drag-and-drop the file onto the qrVR webpage. Once you rename the file, enter your email address, and click convert, the webpage will display a QR code such as the one below. It will also email you a pdf with the same information and code.



SCREENSHOT OF A SUCCESSFUL .SKP FILE CONVERSION

On your smartphone, you will need to download the qrVR app or a QR code scanner. You can then scan the QR code and view your model virtually on your phone. Don't have a smartphone? You can also view the model on a tablet, or click the left box that displays your model and view it on your computer.

When you have the model open on your phone, there is an options button that will change the view settings to VR mode, where you can then insert your smartphone into the Google Cardboard Viewer.

https://qrvr.io/
https://store.google.com/product/google_cardboard

**Make sure to download the qrVR app to your smartphones before AU, there will be QR codes in the presentation and we will have a number of Google Cardboard Viewers to try out!