



# Q&A

## DIGITAL CONSTRUCTION



**Q1:** Did you pick out the pack of pyramid planners? They're using smart glasses and **augmented reality (AR)** to 'see' their plans come to life! But what is AR, and why is it better than a simple screen?

**A1:** Augmented reality is the combining of computer generated content and real-life environments. Have you ever used a smart phone to make it look like there's a dinosaur walking around your living room!? If so - you've used augmented reality! (And if you haven't, try out the 'View in 3D' feature in the Google mobile app; you can use it to laze around with a lion, buddy-up with a ball python, or kick it with a kangaroo - all from the comfort of your sofa!)

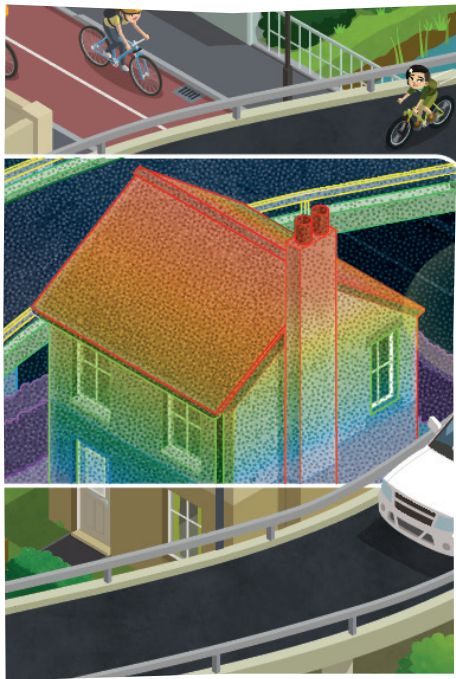
GeoSurveyors use augmented reality to allow them to 'see' new structures and objects within a real environment. For example, in B,3 you can see a team admiring their planned pyramid - right where it's going to be built. Using AR smart glasses, they can explore it from all angles in real time, and check that their plans work with the actual surrounding environment. It's a great way to see it in 3d rather than 2d objects like pictures, paper engineering plans and computer screens.



**Q2:** Next to the digital pyramid there are some real-life ruins - which are being carefully studied by a pair of virtual explorers. But what is the difference between **virtual reality** and **augmented reality**?

**A2:** As we know from our pyramid-planning pals, augmented reality is an interactive experience that enhances the real world with computer-generated imagery. **Virtual reality**, on the other hand, is used to create a completely new, immersive virtual environment. You might have had some experience with VR - maybe through gaming headsets. They let you inhabit a new world, and navigate it with the movement of your head/eyes and a set of hand controls. Technology is bringing virtual reality into people's homes - but what would a surveyor need it for?

Well, as you can see in D,3, surveyors can use virtual reality to explore structures or places without being in them - particularly when combined with photogrammetry. This involves using cameras to capture a space from all angles (can you see the photographer with the multi-camera rig making his way round the ruins in the same grid reference?). The images are then sewn together with special software to recreate the space digitally in 3D. Now, the surveyors can take a good look around the environment without moving from where they are! They could even send the digital data to someone on the other side of the world, and all the person on the other end would need to do was put on a VR headset, feed in the same virtual data, and they could take a stroll round the ruins too! Handy for sharing and developing building plans - even across continents!



**Q3:** The building in F,2 looks like it has had a rainbow-coloured paint job! In actual fact, this house is being scanned by a vehicle-mounted LiDAR scanner to create a 'digital twin'. Why might a surveyor do this?

**A:** LiDAR stands for Light Detection And Ranging. The cool-looking device on the top of the car is sending out laser light beams and detecting their reflections from surrounding objects. The time this takes (called time of flight, or TOF) is used to make a distance map of the objects in a scene - in this case, the house! Each measurement the LiDAR device makes creates a 'point' (those little blue dots - each with an x, y and z coordinate) and by the time the scan is finished, millions of these points will form a 'point cloud' the same size and shape as the scanned object - which can then be used to recreate it in a 3D model as building information modelling (BIM) and digital twins!

But why would a surveyor need to make an exact digital replica of a building? Well, it might help them if they wanted to plan changes to the building - like an extension or a new roof. They could use the computer model to try out ideas and decide what the best solution would be without having to touch the real house! They could also use the model for safety checks. For example, they could compare digital models of the same building over time to see if the structure is starting to lean or 'subside', which could cause a serious hazard for the homeowners!

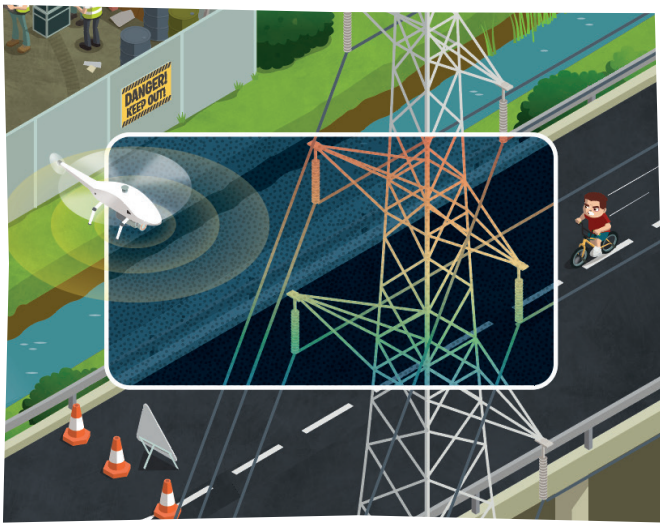
Digital twins can preserve history in the case of a natural disaster like, hurricanes, fires, flood, tornadoes.

**Q4:** The derelict development in F,5 looks like a dangerous place to be. Fortunately, surveyors have several super solutions for exploring hazardous areas. Can you spot the two they're using here?

**A:** Hovering high above the structure is a drone - you can see its pilot standing at a safe distance by the corner wall. This drone has a laser scanner mounted to it, allowing it to scan the site in order to create a digital model of the outside of the structure. As for the inside, did you spot the robodog in G,5? Surveyors use these four-legged explorers to allow them to scan hard-to-reach or potentially dangerous places; like the drone, it has a LiDAR scanner mounted to its back that collects physical data as it moves around. Between the drone and the dog, the surveyors can collect enough measurements to create a digital twin of this unsteady structure without having to go anywhere near it! Phew! Safety first!







**Q5: The drone in H,4 is having a good look at those power lines. They don't seem dodgy or damaged, so why might a surveyor be so interested in them?**

**A:** Surveyors are a big part of all stages of building development. Before these powerlines were first put up, surveyors would have been there to perform a full site investigation and make sure it was a safe place for powerlines to go. Once the structures were completed, surveyors would monitor them for safety. This drone will collect measurements that can be compared to earlier readings, to make sure that the structure isn't showing signs of damage. Early identification of any problems could be crucial in ensuring that people don't go without power, or even more importantly, that no-one be harmed by any faulty structures. Surveyors allow us to sleep a little easier at night - knowing they're keeping an eye on the world around us!

**Q6: Can you count how many surveyors are busy working 'in the field' in this scene? Although data collection is important, it's only part of a surveyors job. What else might they be up to?**

**A:** While there are many busy surveyors working with all kinds of tech around this scene, there will be many more working in offices and other places to turn the data that is collected 'in the field' to something that is actually useful to their clients. Surveyors are hardy folk, expected to work outside in all weathers - but that's only a part of their job. They might start off in the office, doing an investigation (checking existing maps, records and anything else that will help them build previous knowledge), before venturing out to the site. Sometimes surveyors work in large teams, and sometimes they work alone! Once all the data collection is done, it's back to the office to process it and turn it into whatever the client has asked for - like building information modelling (BIM) or a fly-through in 3D!



**Q7: The GeoSquad are famed for using their tricked-out virtual reality headsets to help save a world without surveyors! They're on the run from the school bully here - can you spot the hazard lying ahead?**

**A:** While The Diamondback survey team has set up right in the middle of the road - and the GeoSquad are heading straight for them! Will they be able to dodge the Diamondback Dogs and lose the big, bad bully so that they can continue their mission to save the future? You can find out how the squad use super survey tech - fitted to awesome flying mechs - to rescue a world on the brink of collapse after the disappearance of all the surveyors!

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