UNIVERSITY of TASMANIA

ALL BRICK. TASMANIA

Fologram

BRICKWORKS BUILDING PRODUCTS

Augmented Reality:

Bricklaying

Timeline

HOLOLENS RELEASE

2016

Microsoft releases the first generation HoloLens in March 2016, which is made available in Australia in October. The HoloLens is a state of the art mixed-reality headset which offers inside-out tracking, high resolution optics and 3D scanning capabilities.

TECHNOLOGY DEVELOPMENT

2016

Fologram begins development of mixed-reality software tools suited for a wide variety of fabrication and construction tasks, and collaborates with various academic and industrial partners to explore potential techniques and implementations.

Timeline

ARCHITECTURE WORKSHOPS

2016-8

The Architecture & Design (A&D) school were early adopters of AR technologies for visualization and construction applications and one of the first architecture schools in Australia to invest in AR hardware, procuring twelve Microsoft HoloLens AR headsets. Fologram ran an introductory workshop, introducing the school to mixed reality applications in fabrication and visualization.

Colin Barratt worked with the UTAS Architecture & Design studio to include brickwork as a medium within the Architecture course. Later, All Brick Tasmania would work with UTAS to build a feature wall from each of the student's assessments, involving the Architecture students in the construction process.

2017-8

ARCHITECTURE COURSE

Timeline

IMPLEMENTING AUGMENTED REALITY

2018

In 2018, University of Tasmania's Architecture & Design began collaborating with Fologram to practically implement AR technologies in Tasmanian design and construction processes using a series of workshops and studios to test the limits of the technology. This included the construction of, at the time, the world's tallest structure constructed entirely using AR without traditional drawings.

The first real-world application of standalone AR headsets for brick construction was at the residence of the All Brick CEO, in a collaboration between All Brick and Fologram. Inspired by the design of a UTAS Architecture student, it performs a functional role while providing a suitable prototype project for the use of mixed reality templates for brickwork.

2018

PROTOTYPE WALL

Timeline

REAL WORLD BUILD: ROYAL HOBART HOSPITAL

2019

After a number of subsequent prototypes and further software development, work began on the Royal Hobart Hospital, implementing Fologram as mixed reality templates for curved benches spanning up to 15 meters each. Fologram are on site to refine the processes and system, and UTAS are intending to analyze the project in retrospect.

The success of the hospital build and previous engagements was extended to a live demonstration of AR brick construction coordinated and supported by Brickworks Building Products at the Australian Institute of Architecture (Tasmania) awards at Hobart's Odeon Theatre on July 6. All Brick Tasmania and Fologram lead the practical demonstration with UTAS researchers in attendance to support the collaboration.

2019

AUSTRALIAN ARCHITECTURE AWARDS DEMONSTRATION

Timeline

BRICK ARCHITECTURE PIPELINE

2019

All Brick Tasmania has a pipeline of projects featuring more complex brickwork designs. Fologram and All Brick Tasmania remain in collaboration, working to continually improve the technology and are investigating further projects to collaborate with UTAS.

BEYOND

All Brick Tasmania

Protype Wall

In December 2018, All Brick Tasmania and Fologram collaborated in a world first AR bricklaying construction. A feature wall inspired by a UTAS architecture student's design was built at the All Brick CEO's home. The wall captures and filters sun to the room behind throughout the day and year-round.

The complex design, in which no two bricks were placed in the same vertical or horizontal plane, would have taken up to two weeks for experienced bricklayers to construct.

The precision and quality of the end result achieved with use of Fologram's software and Augmented Reality (AR) headsets is outstanding. The build took 2 bricklayers 6.5 hours, resulting in a time saving of approximately 90%.

Image credit: All Brick Tasmania

All Brick Tasmania

Royal Hobart Hospital

All Brick Tasmania and the Australian start-up software developer Fologram collaborated to use AR technology to design and construct a series of curving brick bench seats on several balconies in the new K block of the Royal Hobart Hospital.

The bricklayers wore AR headsets to help guide the cutting and placement of complex brickwork. Using the technology cut the total construction time by 20% (a portion of the build was regular brickwork which didn't require the use of the headsets) and achieved an exceptional level of quality.

This project will be a world-first published use of AR technology for bricklaying on a commercial build of significant scale and complexity. The John Holland Fairbrother Joint Venture - lead contractors for the project - were very supportive of trialling AR onsite. UTAS researchers are analyzing the results and potential impacts on the industry.

Image credit: All Brick Tasmania

AIA Awards Demonstration

The success of the hospital build and previous engagements was extended to a live demonstration (min 5:07) of AR brick building, coordinated and supported by Brickworks Building Products at the Australian Institute of Architecture (Tasmania) awards at Hobart's Odeon Theatre on 6th July 2019.

All Brick Tasmania and Fologram lead the practical demonstration with UTAS researchers attending to support the collaboration.

The complex design would have taken four days for two experienced bricklayers to construct (one to set out and one to lay the bricks). Instead, with use of the software and Augmented Reality (AR) headsets, the beautiful, eye-catching and complex design was expertly constructed by three bricklayers in only three hours.

Image credit: All Brick Tasmania

The Process

01

ARCHITECTURAL MODEL

The architect / designer builds the architectural model in their modelling tool of choice – for example, Rhino, Revit, ArchiCAD or SketchUp.

02

PARAMETRIC MODEL

The region of the model containing the brickwork to be built with AR, is imported into Rhino. Detail such as the position of each brick, the layout of each course of bricks, and cutting templates, is added to the parametric model.

03

INTERACTIONS

Interactions are then defined using Fologram within Grasshopper. Interactions include a spatial button that allows the bricklayer to progress through each course of bricks, and the ability to see the cutting templates with how many of each type of cut is required.

04

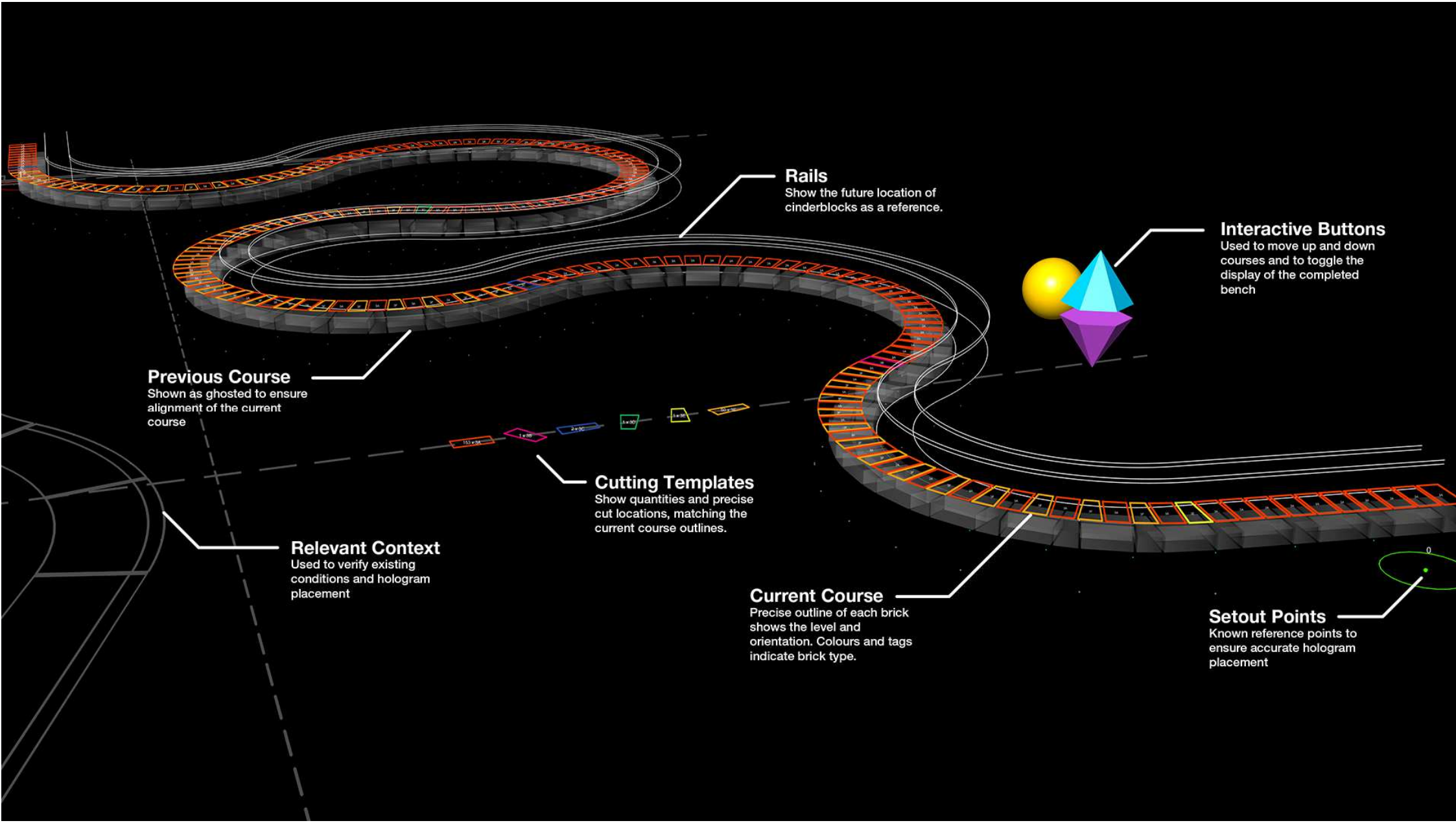
HEADSETS

The detailed model, relevant site data and interactions are hosted onsite via a local WiFi. This provides the opportunity to adapt to unforseen conditions and gather data during the construction process.

Pros & Cons

- QUALITY & PRECISION – close to design perfection can be achieved with regularly skilled bricklayers
- NO SET OUT – set out is essentially built into the parametric model, whereas a typical complex job would have one person supervising and managing the set out process throughout the job
- CUT LISTS – cut patterns and numbers of bricks in each pattern can be seen through the software, making the process of brick-cutting simple and very quick
- FASTER – time savings of between 20% and 90% have already been realised
- AUTONOMY – previously a bricklayer would have to start at one end of each course of bricks and follow through to the other end, and 2nd or 3rd bricklayers could only follow the first's lead; with AR, several bricklayers can be working autonomously anywhere within the model, knowing that their work will fit perfectly when meeting another's
- CREATIVITY – more complex and creative designs can be imagined because the technology is available to build them
- ISSUE RESOLUTION – architects and designers are able to see exactly what the bricklayer can see through the software, so progress can be followed in real time and issues resolved quickly

- IN DEVELOPMENT – as the technology is new, feedback and development to improve the software and process is ongoing
- COMFORT & SAFETY – the goggles are quite heavy and a little cumbersome, affecting safety onsite, though Microsoft are continuously improving the goggles through feedback from users
- CLEANING – the headsets need to be cleaned at the end of each day to maintain good performance


Rails
Show the future location of cinderblocks as a reference.
Interactive Buttons
Used to move up and down courses and to toggle the display of the completed bench
Previous Course
Shown as ghosted to ensure alignment of the current course
Cutting Templates
Show quantities and precise cut locations, matching the current course outlines.
Relevant Context
Used to verify existing conditions and hologram placement
Current Course
Precise outline of each brick shows the level and orientation. Colours and tags indicate brick type.
Setout Points
Known reference points to ensure accurate hologram placement

Cut patterns are colour coded in each course of bricks, to help with placement.

This also allows more than one bricklayer to work on the course at a time, while easily maintaining the precision of the design.

Image credit: Fologram

Image credit for preceding page: Fologram

The layout for each course is easily read from anywhere in the space, and is maintained as people move around the site.

It is immediately evident when there are set out issues from the very beginning of the process – the pipe in this picture appears to be intersecting the brick seat. This issue can be identified and resolved quickly.

Image credit: Fologram

Cut patterns and the numbers of bricks of each pattern are visible at any time through the headsets.

This allows the bricklayers to quickly and easily make a template and start cutting.

Image credit: Fologram

Royal Hobart Hospital balcony seating under construction.

This sort of complex design would take weeks to set out and build without the help of AR technology onsite.

Image credit: Fologram

Royal Hobart Hospital balcony seating under construction. Multiple bricklayers share the same Hologram and can work concurrently on the same or separate regions.

The intricate cut patterns are visible here as the top course of bricks is laid.

Image credit: Fologram

Royal Hobart Hospital balcony seating nearing completion.

Time elapsed between the photo above and the one to the right is only days, as opposed to weeks.

Image credit: Fologram

Contact Us

If you ‘d like to hear more about All Brick Tasmania and our work, please contact us using the details below.

Address:

Unit 1, Ground Floor
85 Macquarie Street
Hobart TAS 7000

Phone Number:

03 6244 2220

Instagram:

@allbricktasmania

Website:

www.allbricktasmania.com.au