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CLOUD

THE VIEW FROM ABOVE

THE LIFE AQUATIC | **ONE TO WATCH** | IF WALLS COULD TALK

Technology built to measure the moon is uncovering the hidden secrets of ancient artefacts, writes James Day

ILLUSTRATION: PETER CROWTHER

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Every year, thousands of visitors file into the Divinity School at the University of Oxford and look in the wrong direction. They have come for Harry Potter. The room was the Hogwarts infirmary, hosted the Goblet of Fire dance lesson Professor McGonagall would rather forget, and the floor above the location for the library. Tourists take photos, maybe admire the architecture, and leave. What almost none of them do is look up, which is a pity, because high above their heads sit 455 carved stone bosses no one had truly studied since masons downed tools in the 1480s.

It has taken a technique first used to study lunar craters to change that. An instrument called Selene, named after the Greek goddess of the moon, uses photometric stereo to gauge depths by reading how shadows fall across objects as the light shifts.

"At the right scale, working out the depth of a lunar crater and the depth of a stylus mark on a medieval manuscript turn out to use the same physics," says John Barrett, Senior Photographer at Oxford's Bodleian Libraries and a lead on its ARCHiOx project, tasked with analysing cultural heritage at the famous college. Light a surface from several directions and the shadows surrender every last pixel – up to four million per square inch – producing a kind of muggle version of the 'Revelio' revealing charm.

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The work is the Factum Foundation's, a Madrid outfit founded by Adam Lowe OBE, who trained in fine art before turning to preservation. "Touch is an essential transmitter of information," he tells *Cloud*. "In a digital space you can now 'handle' objects, zoom in on the surface, control the direction of the light with the movement of your hand, and inspect the surface with and without colour." This, after all, is the foundation whose work runs from the tomb of Tutankhamun and a Renaissance altarpiece reunited across nine collections to a 16th-century samurai helmet detailed enough to drop into the video game *Assassin's Creed Shadows*.

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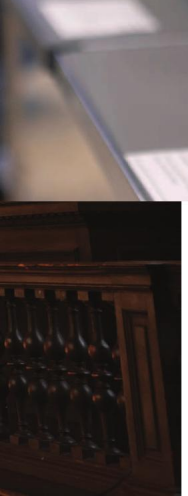

THE RESTRICTED SECTION

What the cameras found at the Divinity School has begun to rewrite the building's history. A boss long catalogued as a 'grazing pony' turned out to have tusks; it is now thought to be a wild boar. Wooden wedges were found holding the structure together, placed by unknown hands at a date nobody can fix. And beside the central boss bearing the arms of King Edward IV, on a carving of the Trinity, researcher Dr Duncan Taylor spotted what six centuries of scholarship had missed: the stigmata in Christ's hands, feet and side, a few millimetres across, never before recorded.

"Recording the greatest English sculptures of the late 15th century was a great privilege," says Lowe, who hints at further discoveries he will not yet reveal. "Seeing the world through the eyes of others who lived at different times, believed in different gods, valued things differently and left their traces for us to read is the main reason why culture is important."

The ceiling is not the only Oxford-held treasure to give up its ghosts. Scanning the Gough Map, drawn in the mid-14th century and among the earliest to show Britain in recognisable form, revealed more than 2,000 minuscule marks. Proof the map was not drawn freehand but copied, every town and coastline pricked

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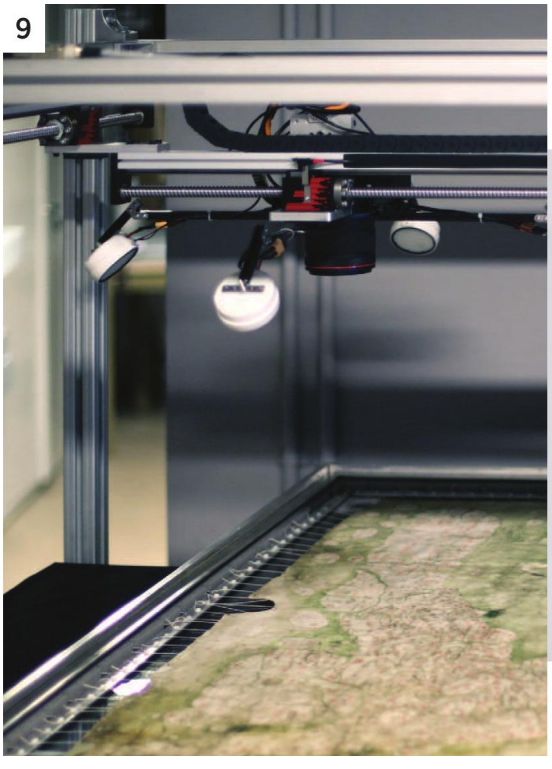

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through from an older, now-lost original. On the back of an 18th-century copper plate, the same technique found a face the size of a fingernail, thought to be the first self-portrait of poet William Blake, invisible to the naked eye until the right light fell across it.

GRINGOTTS ECONOMICS

There is a symmetry to the ceiling giving up its secrets now. Begun in 1427, the building took more than half a century to finish, its progress stalled by money troubles and the Wars of the Roses. It was paid for in part by donors who had their arms and monograms carved into the stone in return – medieval crowdfunding, the receipts cut in limestone. One boss shows an eagle and child, the image that named the Oxford pub where J.R.R. Tolkien and C.S. Lewis read aloud to the Inklings (an informal Oxford literary group in the 1930s and 1940s).

The question of who pays for its preservation has not gone away, only changed shape. "Private patronage is essential today," says Lowe. But, he cautions, in a world where AI and machine learning are growing fast, "we need governments, institutions, academics and philanthropists to ensure knowledge stays in the public domain."

What, though, is being preserved? Factum's stock-in-trade is the facsimile, and Lowe is insistent this is not the same as a fake. "Our aim is to verify not falsify; to reveal not to deceive," he says. He is sceptical, too, of our reverence for originals. "Originality is a process, not a fixed state." A perfect record, he argues, is its own insurance. "When an object is destroyed that has not been properly recorded, documented and archived, it is lost, and all that remains is its reputation."

In July, casts of the bosses travelled to Goodwood's Festival of Speed Future Lab for visitors to handle, the same logic that has put a touchable Gough Map at the Bodleian, which blind and partially sighted visitors can now read with their fingers.

The more places a fragile thing can safely exist, the less the original must bear. Not to mention the cost. The Bayeux Tapestry's recent temporary relocation from France to London cost the British Museum a reported £1.2 million, while British taxpayers inadvertently signed off on an £800 million indemnity to cover the artefact against damage or loss during transfer. Meanwhile, an exact and faithful replica has been on public display at Reading Museum since 1897.

In the end, Factum's technological solution is, well, illuminating. Which is more or less what Professor Dumbledore meant when he said: "Happiness can be found, even in the darkest of times. If one only remembers to turn on the light." ■

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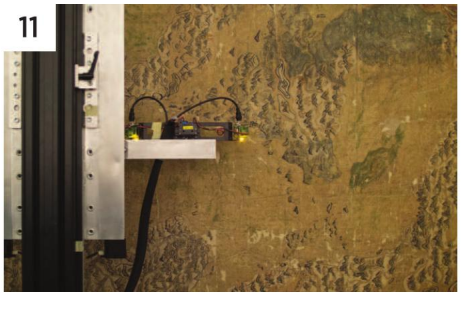


Tutankhamun's tomb

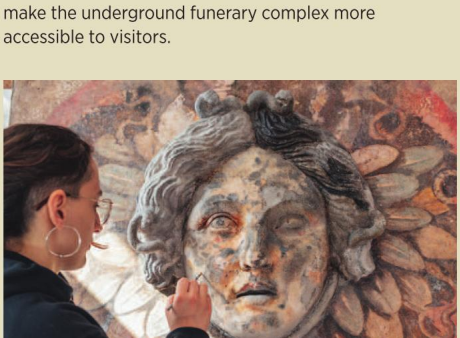
Recording the 3D surface of Tutankhamun's sarcophagus using structured white light scanning. The whole burial chamber, including the sarcophagus, was rematerialised as a facsimile installed in the Valley of the Kings in 2014.

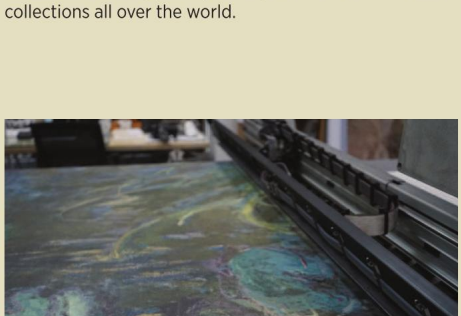
A Renaissance polyptych

Recreation of Francesco del Cossa and Ercole de Roberti's lost *Polittico Griffoni* made using facsimiles of all the 16 surviving panel paintings recorded across nine collections all over the world.

The Ipogeo dei Cristallini

Making the facsimile of the Medusa Head from the Ipogeo dei Cristallini in Naples as part of a project to make the underground funerary complex more accessible to visitors.





Monet's *Water Lilies*

Recreating Monet's *Water Lilies*, originally in the collection of the Museum of Modern Art in New York and heavily damaged in a fire in 1958.

A samurai helmet

The kabuto (helmet) of Phillip II from the Spanish Royal Armory collection, digitised by Factum Arte, inside the Cultural Codex of *Assassin's Creed Shadows*. The helmet was also recreated as an undamaged facsimile that is displayed at the Royal Armory.

1 The Selene Photometric Stereo System, developed by Jorge Cano and Factum Foundation

2 Render of one of the bosses from the ceiling of the Divinity School at the University of Oxford

3 Recording the ceiling of the Divinity School at the University of Oxford as part of a project to digitise in high-resolution all the 455 carved bosses

4 Render of the Divinity School

5 6 Renders of the bosses

7 A recreation of one of the bosses for the ARCHiOx exhibition at the Weston Library

8 At work in the Divinity School

9 The Selene Photometric Stereo System recording the Gough Map at the Bodleian Libraries

10 Facsimile of the Gough Map from the Bodleian Libraries collection, made by Factum Foundation after the high-resolution recording with the Selene PSS

11 The Lucida 3D Scanner recording the Selden Map of China at the Bodleian Libraries