



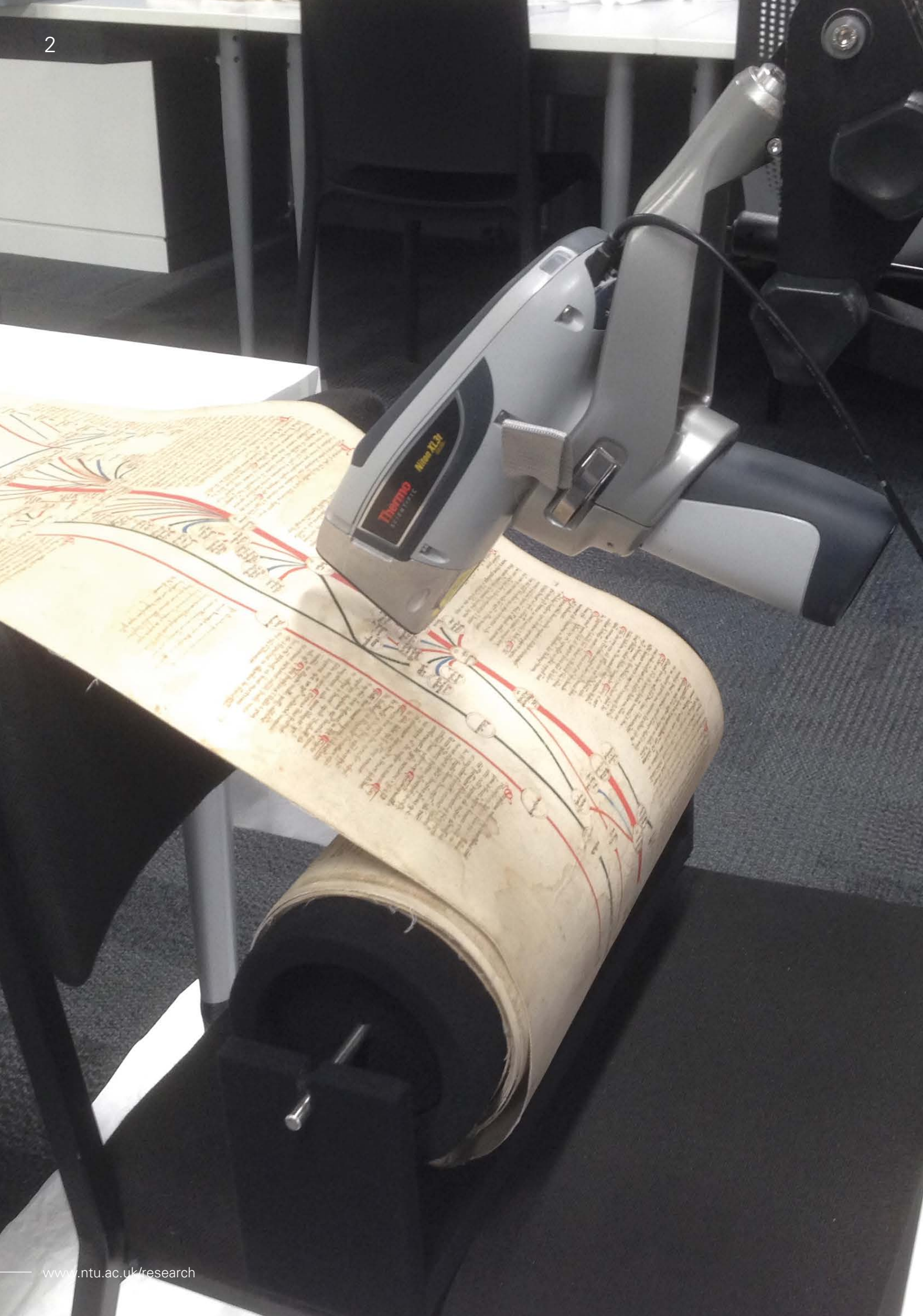
Nottingham Trent  
University

# Cultural Heritage Research Peak

Impact Report  
Spring 2023







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## Cultural Heritage Research Peak

At Nottingham Trent University, the term ‘Research Peak’ is given to established research areas that drive forward NTU’s vision to be the university of the future by delivering transformative global impact.

As NTU’s first Research Peak, Cultural Heritage demonstrates significant disciplinary breadth, bringing together scientific methods for analysing and preserving heritage with an understanding of the cultural context. Research within the Cultural Heritage Peak spans archaeology, art history, architecture, literature, history, art conservation, social sciences, art and design, and science and technology disciplines. Researchers in these areas are transforming policies, pioneering new methods and technologies, and working side by side with governments and the public to protect and restore endangered communities and cultural heritage sites.

The Cultural Heritage Research Peak tackles research problems by collaborating with researchers and professionals across cultural institutions and academia. Recognised by the UK Government’s Research and Innovation body (UKRI) as an integral element of the UK’s research infrastructure, NTU is developing scientific and technological innovations and cutting-edge research to maintain and improve cultural heritage in the UK and beyond.

There are two main research areas affiliated with the Cultural Heritage Research Peak.

These include:

### Science and Heritage

Science and Heritage research at the School of Science and Technology (SST) has a 30 year history, starting with **Professor Mike Baxter** in statistics (Department of Physics and Maths) who was influential in statistics applications in archaeology, and **Professor Brian Pyatt** (Department of Biosciences) who applied toxicology methods to the study of human history.

Current research in this area includes:

- The development of advanced optical imaging, spectroscopic and remote sensing instruments for non-invasive investigation of cultural heritage materials
- The development of advanced data science methods for complex and large heritage science datasets
- Applications of physical sciences to answer history, art history, conservation and archaeology research questions
- Demonstrating impact through collaboration with cultural institutions, utilising our in-house developed ISAAC Mobile Lab and ISAAC DigiLab research infrastructure.

The **Imaging and Sensing for Archaeology, Art History and Conservation (ISAAC)** research lab is central to research in this area. ISAAC has led over 50 externally funded projects involving over 50 global partners spanning cultural organisations, research institutions and academia. Our research in advanced optical imaging and Heritage Science is widely regarded as world-leading and achieved a 4\* rating in the 2021 Research Excellence Framework, under the B12 Engineering unit of assessment. ISAAC is currently the only UK lab providing advanced mobile lab provision to the European Research Infrastructure for Heritage Science.

ISAAC has collaborated on cultural heritage related projects with the Schools of Arts and Humanities, Nottingham School of Art and Design, the School of Architecture, Design and the Built Environment, and the School of Animal Rural and Environmental Sciences. Heritage Science led research has also generated impact in other fields, including industrial asset monitoring in the energy and civil engineering industries, quality control in the chemical and pharmaceutical industries, medical applications and fundamental research in soft matter physics.

Investment from the Cultural Heritage Research Peak has strengthened our reputation and profile in these areas. We are applying innovative science to a diverse range of problems of significant relevance, whilst deepening understanding of cultural heritage and its conservation.

### Architecture and Global Heritage

#### The Centre for Architecture, Urbanism and Global Heritage (CAUGH)

The Centre for Architecture, Urbanism and Global Heritage (CAUGH) focuses on the investigation of human aspects of architecture, spatial practices, urban heritage, material culture and the built environment within the ever-changing urban and social structures of contemporary cities. Our research, development, and consultancy provide cutting-edge innovation, creativity, and analysis of historic centres, buildings and heritage sites in the UK, Europe, and across the world.

Based at NTU’s **School of Architecture, Design, and the Built Environment**, our architectural, urban planning and heritage preservation work is world-leading, with several pioneering projects taking place on virtual and interactive environments for heritage preservation, virtual museums, and novel models of urban conservation and regeneration.

At CAUGH, we approach design as a comprehensive and inclusive process that takes into account the influence of human actors, either as individuals, groups, or communities, and recognise their impact on the shaping of architecture, urban design, and the preservation and development of heritage sites. The Centre is a global research hub of creative thinking and leads scientific innovations in partnership with world-leading institutions in China, India, and Egypt, alongside regional collaborative hubs in Iraq, Tunisia, and India.



# How are we doing?

Generated  
**£3M+**  
external grant income  
since the launch of the  
Peak in 2020

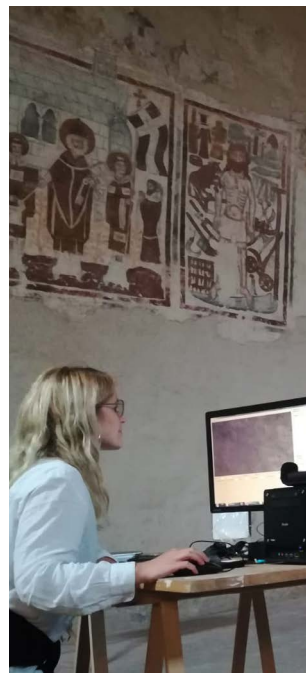


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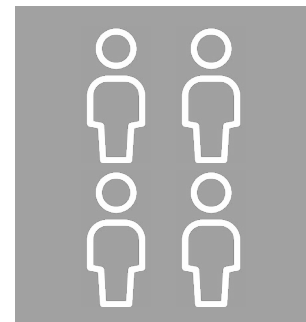
Led and contributed  
to research across  
**five continents**

2



**4 architecture  
and heritage  
specialists**  
appointed to the AHRC  
Peer Review panel –  
more than any other  
research centre in the  
UK (CAUGH)

3

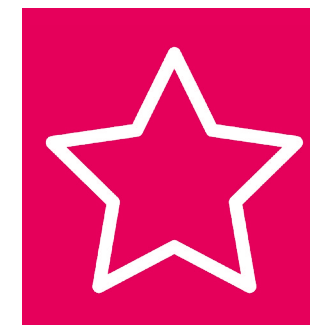
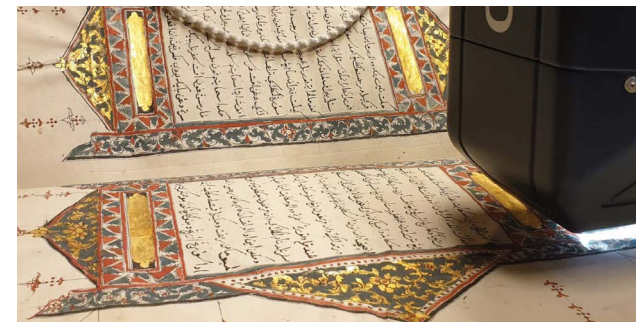


Engaged with  
**20+** cultural  
organisations  
worldwide, including  
the Library of Congress,  
the National Library  
of Naples, the National  
Museum of China,  
the British Museum,  
The National Archives,  
and the British  
Library (ISAAC)

4

The  
**only UK lab**  
to contribute to the  
European Research  
Infrastructure for  
Heritage Science  
mobile lab (ISAAC)

5



Achieved 4\* rating in the 2021  
Research Excellence Framework,  
under the B12 Engineering unit of  
assessment (ISAAC)

6



# Awards and achievements

Research by the Peak has supported NTU to develop a proven track record of distinctive international and national research awards, leading to the highest national research honour in 2022: the Queen's Anniversary Prize.

## 2023

UKRI REF 2021 Best Practice Impact Case Study [UoA C13 Architecture (CAUGH)]: in Impact of International Development research.  
UK Collaborative on Development Research (UKCDR).

## 2022



Queen's Anniversary Prizes for Higher and Further Education (2020-2021), the highest national honour for research in the UK, for advancing cultural heritage science and developing world-leading digitisation and imaging technology applied to the preservation and conservation of iconic cultural heritage sites and assets in the UK and around the world.

## 2021

REF 2021 UoA B12 Engineering 4\* Impact Case Study: New optical instruments have transformed conservation and curatorial practices of dating, displaying and conserving priceless and irreplaceable cultural heritage assets.

## 2020

Newton Prize 2020, Shortlisted, UNESCO-UK on behalf of Newton Fund, UK's Department for Business, Energy, and Industrial Strategy, for the international and transformational impact of our (CAUGH) research in virtual heritage technology on the creative industry, SMEs and global heritage tourism in Egypt. [\[Prize Publication\]](#)

This award recognises the impact our innovative research has across the globe. It redefines the science that preserves and restores our shared cultural heritage around the world and for generations to come.

NTU Vice-Chancellor and President, Professor Edward Peck, on the Queen's Anniversary Prize

### Spotlight: Queen's Anniversary Prize

Our cultural heritage research gained national recognition in 2022 by receiving a Queen's Anniversary Prize (QAP) for Higher and Further Education: the highest national honour for a UK university.

The research includes the use of cutting-edge imaging and remote sensing technologies and data science to preserve and protect iconic heritage and cultural artefacts.

Large-scale scientific surveys and analyses of iconic heritage sites have included the Mogao Caves in China (a UNESCO world heritage temple complex on the ancient Silk Road) and the Hawara Pyramid in Egypt. Closer to home, the work informed the virtual reconstruction of Nottingham Castle and its galleries. Other pioneering solutions include humanities approaches to preserving intangible heritage, which mitigates the threats to culture and heritage through digital preservation techniques in conflict zones. In response to UNESCO's 'Revive the Spirit of Mosul', researchers helped to preserve endangered heritage, connect communities, and reduce inequalities in post-war Mosul.

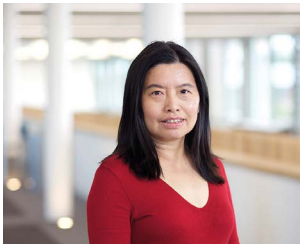
The university's advanced non-invasive imaging instruments and data science methods have been adopted by partners such as the Louvre, the National Gallery, the British Museum, the British Library, Dunhuang Research Academy in China, the Brooklyn Museum and Getty Conservation Institute in the USA.

NTU Vice-Chancellor and President, Professor Edward Peck, said: *"This award recognises the impact our innovative research has across the globe. It redefines the science that preserves and restores our shared cultural heritage around the world and for generations to come."*



# Meet the team

## Core academics funded by the Peak



### Professor Haida Liang

Haida is Professor of Physics and Distinguished Professor at NTU. Professor Liang is also the Head of the 'Imaging and Sensing for Archaeology, Art history and Conservation' (ISAAC) research team and Director of the Imaging, Materials and Engineering Research Centre in the School of Science and Technology at NTU. Her main research interest is in cross-disciplinary research between the physical sciences and heritage related topics such as history, archaeology and conservation.

[View Professor Liang's profile](#)



### Professor Gamal Abdelmonem

Professor Mohamed Gamal Abdelmonem is Chair in Architecture at the School of Architecture, Design and Built Environment at NTU, and he leads the University's Research Theme: 'Global Heritage: Science, Management and Development'. Professor Abdelmonem's research focuses on the investigation of socio-spatial practice of urban environments, virtual heritage technology, the architecture of home, spatial memory, digital urban heritage, and the pedagogy of architectural studio.

[View Professor Abdelmonem's profile](#)



### Professor Mike Robinson

Mike is Professor of Cultural Heritage, working to develop the University's international, cross-disciplinary research portfolio in the cultural heritage field. With over 30 years' experience at the interface between heritage, tourism and culture, Professor Robinson's focus is upon research that makes a difference to communities and businesses across the world. Working across disciplinary boundaries to generate new thinking, he seeks to translate research and examples of best practice to share with the heritage and tourism sectors.

[View Professor Robinson's profile](#)



### Professor Ceri Ashley

Ceri is Professor of Cultural Heritage, and is responsible for developing new heritage-based research across the University, supporting collaborations within NTU and internationally, and supervising research projects and students. Professor Ashley is also the Head of the Endangered Material Knowledge Programme at the British Museum. Launched in 2018, this programme supports global research and documentation of material practices and knowledge systems, that are available through an open access digital repository.

[View Professor Ashley's profile](#)

## Academic Fellows funded by the Peak



### Dr Majdi Faleh

Dr Faleh's research focuses on architectural and cultural heritage in marginalised communities, the interaction between globalisation and architecture in twenty-first century Arab cities, migration, cultural heritage and architecture in Western countries, the philosophy of ethics and aesthetics in Islamic architecture, and social justice in Australian cities. At Nottingham Trent University, Dr Faleh is leading the development of the Tunisia ENGAGE Hub Network for Humanitarian Heritage activities and research.

[View Majdi's staff profile](#)



### Dr Joshua Hill

Dr Hill's research interests lie in art conservation and conservation science. Current interests include the characterisation and conservation of historic plasters, evidence in conservation decision-making, wall painting technologies with tertiary supports, mitigation and monitoring of salt-related deterioration, the development of non-invasive x-ray diffraction techniques for cultural heritage, and wall painting technologies of East Asia. He has active collaborations with Georgia and Bhutan.

[View Joshua's staff profile](#)



### Dr Sotiria Kogou

Sotiria's research includes the application of advanced optical imaging, spectroscopic and remote sensing instruments for non-invasive and non-destructive investigation of materials, and applications of physical sciences to history, art conservation and archaeology. Current interests include machine learning based methods for analysing large spectral imaging data and the analysis of historical dyes. She has active collaborations with partners in Greece, Italy, China and the USA.

[View Sotiria's staff profile](#)

## Other academics connected to the Peak

- Dr Lucas Goehring, Director of Studies for Peak-funded PhD student, Fatima-Zohra Sahraoui
- Dr Ian Shuttleworth, Director of Studies for Peak-funded PhD student, Florence Gadsby
- Dr Golnaz Shahtahmassebi, Director of Studies for Peak-funded PhD student, Jake Hollis

## Other Research Fellows / Assistants connected to the Peak:

- Dr Sammy Cheung
- Dr Florence Liggins
- Luke Butler
- John Page
- Dr Mixon Faluwiki
- Dr Felipe Lanuza
- Dr Sara Mahdizadeh
- Dr Khairi Abdulla
- Antony Pidduck
- Yousif Al-Daffaie

# Doctoral researchers

## Rebecca Mitchell

A study of Enamels: conservation and history of global transfer of technology

**Supervisors:** Professor Liang, Dr Kogou and externals from British Museum and Victoria and Albert Museum

**Start date:** January 2022

Rebecca’s background is in History and Archaeology (BA in Anthropology and History, MPhil in Archaeology: Heritage and Museums, and MSc in Archaeological Science). Taking an interdisciplinary approach to the study of enamels in the British Museum and V&A Museum collections, her PhD project aims to better understand the technological relations between historical enamels, and identify the state, or risk, of deterioration of enamels within the collections to aid conservation decisions.

## Fatima-Zohra Sahraoui

Salt and Heritage: prediction and remediation of salt-induced damage to cultural heritage

**Supervisors:** Dr Goehring, Professor Liang and externals from Coventry and the English Heritage

**Start date:** October 2022

Fatima double majored in a MEng degree with a MSc in Civil Engineering from Algeria. Her PhD project theme is about preventive measures for salt induced damage on cultural sites, revolving around the study of the key parameters that lead to such damage, causing the expansion of salts in porous building materials, and the analysis of the behaviour of salts in historical sites considering the various influencing factors.

Research within the Cultural Heritage Peak spans archaeology, art history, architecture, literature, history, art conservation, social sciences, art and design, and science and technology disciplines.

## Jake Hollis

An automated approach for identification, authentication and classification of historical artworks

**Supervisors:** Dr Shahtahmassebi, Professor Liang and external from the British Museum

**Start date:** October 2022

Jake obtained his BSc and MRes in Mathematics in 2021 and 2022 respectively. His Master’s project involved the application of statistical methods to analyse multimodal spectral imaging data of paintings. His PhD project is focused on developing statistical and machine learning techniques to analyse and classify images (both simple colour images and complex scientific images) of cultural heritage objects to aid art historical, conservation and archaeology research.

## Florence Gadsby

The development of ab-initio and force-field models to analyse the fading of historical artists’ paint

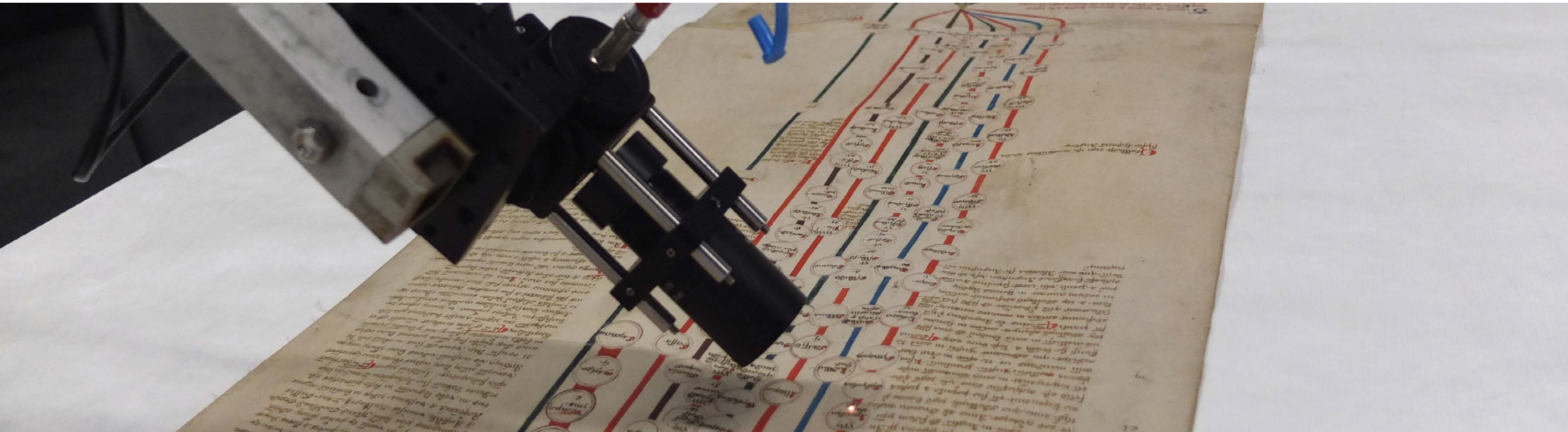
**Supervisors:** Dr Shuttleworth and Professor Liang

**Start date:** October 2022

Florence completed an integrated Master’s degree in Physics, which involved investigating the light induced fading rate of materials with an aim to prevent pigments degrading. The focus of her PhD project is to investigate how defects contribute to the reactivity and aging of pigment nanoparticles, building models to predict how degradation proceeds based on the structure and the type of defects.

## Other PhD students that are researching Cultural Heritage-related topics include:

- Amelia Suzuki (ISAAC)
- Patrick Atkinson (ISAAC)
- Makiko Tsunoda (ISAAC)
- Anthony Pidduck (CAUGH)
- Yousif Al-Daffaie (CAUGH)
- Noha Hussein (CAUGH)
- Simona Cosentino (CAUGH)
- Maryam Pourzakarya (CAUGH)
- Nourelhoda Hussein (CAUGH)





# Research infrastructure

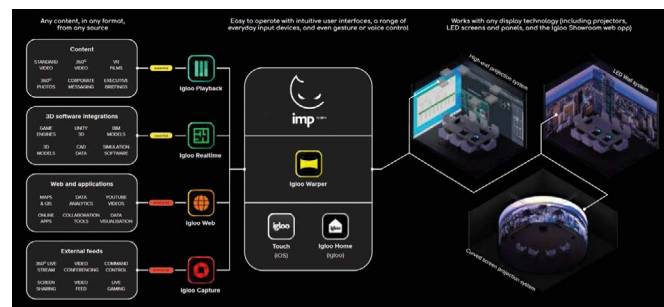


**SIMULATION**  
Immerse your teams in any scenario - ideal for training, education and familiarisation.

**VISUALISATION**  
Bring your designs to life - with a fully immersive, highly engaging, surprisingly affordable visualisation platform.

**COLLABORATION**  
Make meetings more productive - enable project teams to see, share, discuss, and update all of their data and documents.

**EXPERIENCES**  
Engage, inspire and entertain - use wraparound sound and vision to create unforgettable events and experiences.



The HeritageCAVE  
VR Virtual Centre  
brings unique  
capabilities to NTU

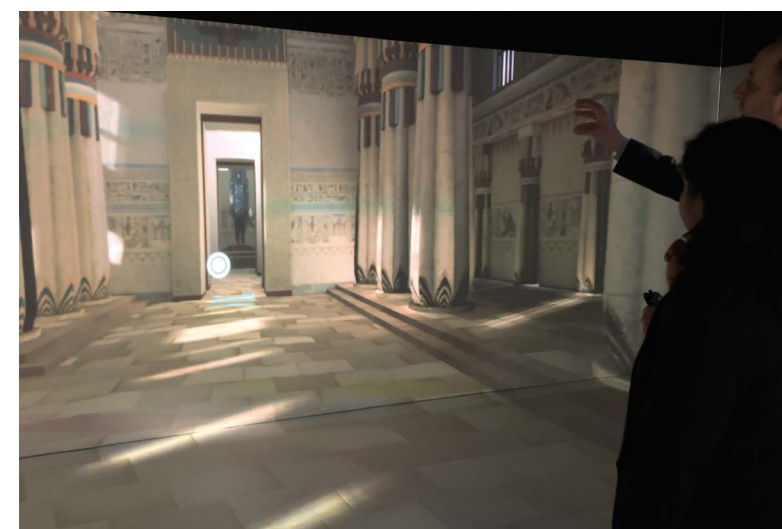
## Research infrastructure

### HeritageCAVE Virtual Centre and Portal

Our innovative and technology-enabled research goes beyond the physical remains of historic sites and seeks to understand human experience, rituals and social history that add meaningful narratives to physical objects, structures, and artefacts. To achieve virtual fidelity and accurate reproductions of historic environments, Professor Abdelmonem developed the 'HeritageCAVE' framework as an interactive heritage site documentation, narration and digital preservation tool, which uses virtual heritage technologies to explore the hidden stories and meanings of heritage sites.

The HeritageCAVE VR Virtual Centre is a response to an urgent need to document and diagnose an existing condition and use the latest Virtual Heritage Technologies to produce engaging environments for the public, provide diagnostic analysis for conservation, and develop recovery models for heritage sites subject to the risk of destruction or severe deterioration. This initial prototype offers a breakthrough in the development of a state-of-the-art virtual reality interface and repository platform that not only records and documents existing site conditions for interactive visualisation, but more importantly will incorporate structural and environmental data within the computerised virtual environment.

The HeritageCAVE VR Virtual Centre brings unique capabilities to NTU that include:



- Centre and Immersive Workspace – including Immersive Environment and operational space for displays, demonstrations and exhibitions. The site is currently under construction in the Maudsley Building, City Campus.
- Cloud-based Portal and Virtual Datacentre – in collaboration with Microsoft and Hevolus. The software is currently in development.

Using the HeritageCAVE VR Centre facilities at NTU, Professor Abdelmonem guides a visitor through a real-life walkthrough of the virtually reconstructed, 4500-old Sobek Temple (top) and Roman mortuary village (above) at Hawara Pyramid (Fayoum, Egypt). The tour highlights the ancient structures that disappeared over two millennia and artefacts that are displayed across 36 museums worldwide. This is birthplace of the infamous Fayoum portraits, and is part of a pioneering joint-funded project by AHRC in the UK and STDF in Egypt. More details can be found on the project website: [virtualhawara.com](http://virtualhawara.com).

## ISAAC Mobile Lab

<https://www.isaac-lab.com/isaac-mobile-lab>

Running for well over a decade, the ISAAC mobile laboratory provides heritage institutions with access to:

- unique in-house developed cutting-edge mobile imaging and spectroscopy instruments (funded by UK Research Council grants);
- state-of-the-art commercial and bespoke instruments for in situ analysis in art conservation, history and archaeology;
- advanced data science methodologies for interpretation of results;
- expertise in interdisciplinary research at the interface between science and heritage

ISAAC Mobile Lab has provided access to over 40 cultural heritage organisations over 4 continents. It is the only UK mobile lab for heritage science selected as part of the European Research Infrastructure for Heritage Science offering unique expertise and specialist instruments to the European and global heritage research community through the IPERION HS project (see IPERION HS website <https://www.iperionhs.eu/provider/188/>). In collaboration with mobile labs from other European countries, we provide access to our cutting edge in-house developed instruments. Applications for IPERION HS MOLAB access is in high demand and only 30% of these are approved by an independent scientific committee.

Further information available at [www.isaac-lab.com/isaac-mobile-lab](http://www.isaac-lab.com/isaac-mobile-lab)

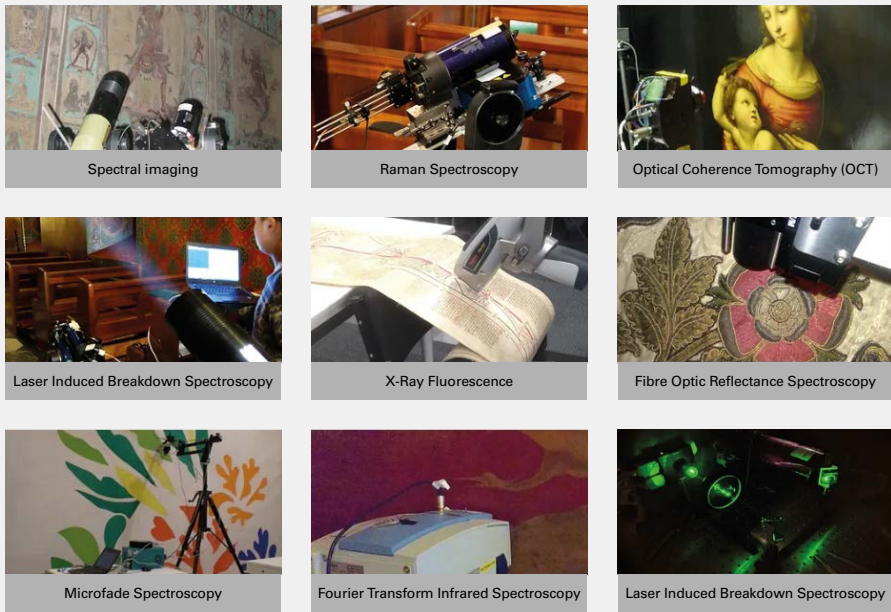
The ISAAC Mobile Lab has received numerous access applications either directly or through the pan-European research infrastructure for Heritage Science. The following campaigns have been conducted in June-October 2022 as some examples:



- 1. UNESCO site of the Benedictine Convent of St John at Münstair, Switzerland: to study the various schemes of wall paintings and restorations over the centuries to inform conservation decisions.
- 2. Biblioteca Nacional de Nápoles to examine the famed Herculaneum Papyri which contains the works of the philosopher Philodemus that was carbonised by the eruption of Vesuvius in 79 CE. This work is funded by the Royal Society UK-Italy exchange and is in collaboration with the ERC project “The Greek philosophical schools according to Europe’s earliest ‘History of Philosophy’: Towards a new pioneering critical edition of Philodemus’ Arrangement of the Philosophers”. We provide the cutting-edge spectral imaging and OCT systems to reveal the writings.
- 3. Monitoring salt problems in the famous Santa Maria Novella Cathedral in Florence in collaboration with the Italian National Research Council (CNR) Institute of Heritage Science.
- 4. Remote spectral imaging of the newly conserved Leonardo da Vinci’s wall paintings in Sale delle Asse in Sforza Castle Milan to determine areas that are Leonardo’s original and later addition. This is again in collaboration with CNR and funded by the Royal Society UK-Italy grant.
- 5. Royal Museum of Fine Arts Antwerp: Examination of paintings by two Belgium Modernists, James Ensor and Paul Delvaux, to inform their painting techniques and conservation strategy
- 6. WW II aircraft at the ArcAntique – Grand Patrimoine Laboratory in Nantes: monitoring conservation treatment to reduce corrosion of heritage aircrafts as part of the EU project “Protection and Conservation of Heritage Aircraft”. The applicants are a consortium of French, Italian and Czech research organisations and the objects examined include Supermarine Spitfire and P-38 Lightning.

- 7. To analyse the Nash Papyrus (<https://cudl.lib.cam.ac.uk/view/MS-OR-00233/1>), an ancient manuscript fragment containing the text of the Ten Commandments, dated to the second or third century BCE, to reveal the faded writings crucial in establishing the difference between it and all known biblical versions. It is among the oldest known manuscripts containing a text from the Hebrew Bible. This is in collaboration with University of Potsdam School of Jewish Theology and the Cambridge University Library.
- 8. Rietberg Museum in Zurich: mobile lab analysis of their collection of Indian miniatures from Gujarati in collaboration with the Swiss Institute for Art Research (SIK-ISEA), which complements our two AHRC funded projects related to global connections.
- 9. Whole church remote spectral imaging of badly degraded 8th century Carolingian wall painting in the St Peter’s Church Mistail in the Swiss Alps as part of the Swiss National Science Foundation funded project “Forgotten colours”
- 10. The over 12m long 15th century Roll Chronicle of royal genealogy from the Society of Antiquaries in London was brought over to Clifton campus to be imaged by ISAAC Lab’s spectral imaging system. The imaging system was modified, and a cylindrical wall was constructed by the physics technical team to demonstrate an ‘advanced digitisation’ method for large roll-like manuscripts. This is a project in collaboration with Natasha Hodgson in History. The event was reported by BBC Nottingham and Notts TV. An AHRC grant is in preparation.

For the latest projects and updates, please follow the ISAAC lab blog: <https://www.isaac-lab.com/blog>



Hydration map derived from hyperspectral imaging data in the near infrared for the British Museum collection of Limoges enamels used for preventive conservation

Producing material maps for a collection of watercolours from the Getty Conservation Institute

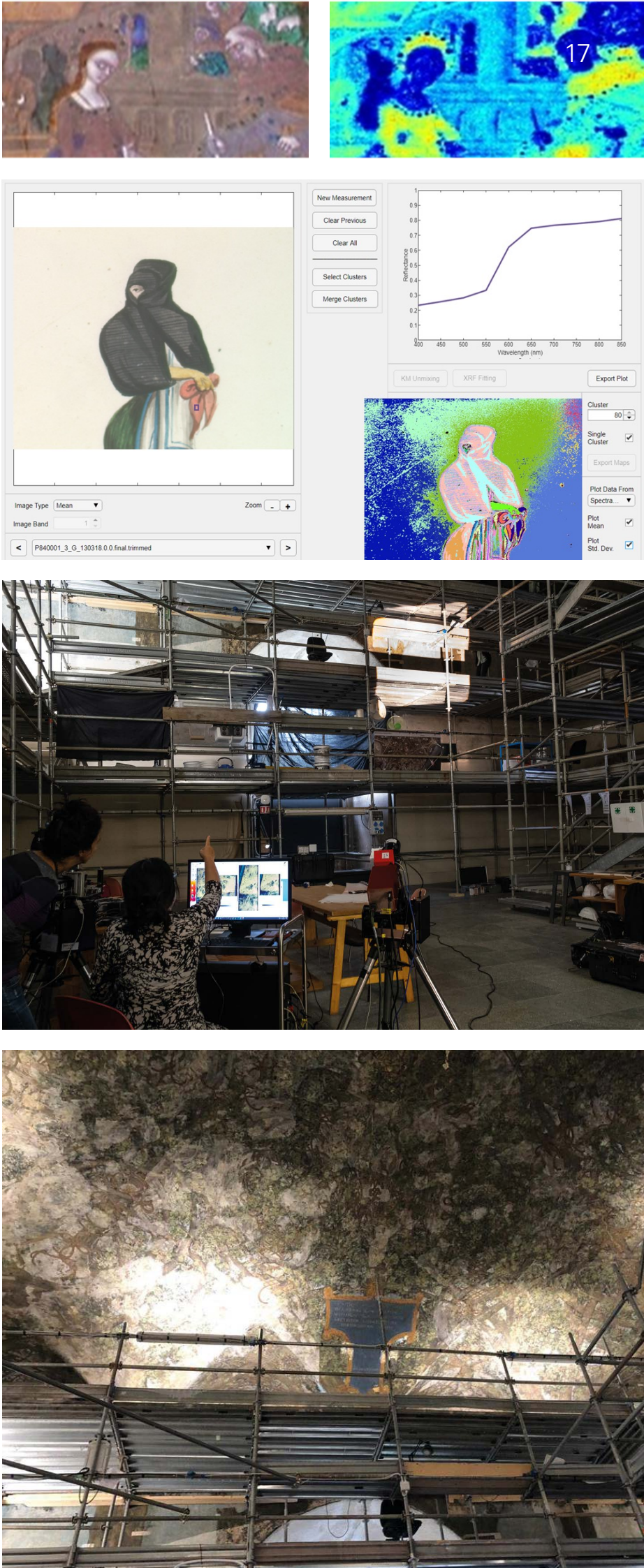
### ISAAC DigiLab

ISAAC DigiLab provides data science tools developed by ISAAC and supported by three AHRC grants, such as new methods to analyse spectral imaging data, to the Heritage Science community.

### ISAAC Mobile Lab Analysis of Leonardo da Vinci murals at La Sala delle Asse, Milan

Sala delle Asse in Milan’s Sforza Castle, was commissioned by Duke Ludovico il Moro, who entrusted its decoration to Leonardo da Vinci. Leonardo covered the walls and vault of the room in complex interlaced branches and coats of arms, but the room was later whitewashed and forgotten.

Conservation work involving the removal of past overpaint to reveal the original started in 2013, alongside an in-depth study of the paintings. Last summer an advanced non-invasive approach, combining micro-XRF mapping, Raman spectroscopy and ISAAC’s long range hyperspectral imaging systems, allowed investigation of inaccessible areas to differentiate between original paintings and subsequent overpaints, and to assess the cleaning procedures.





# External grants and funded projects

## CAUGH

CAUGH has been active in leading global partnerships in Cultural Heritage Research, with over 15 externally-funded research projects that span five continents. The sources of this research funding are diverse and have come from Research Councils such as the Australian Research Council, Arts and Humanities Research Council, British Academy, British Council, Arcadia, Arts Council England, amongst others.

Led by Professor Abdelmonem, alongside seven academic staff and research fellows, CAUGH has generated in excess of £1.5M external grant income over the past five years with an average grant income of £300-400K per year (excluding internal grants). Below are samples of active Cultural Heritage projects, partners, and key outputs since the launch of the Peak in 2020.

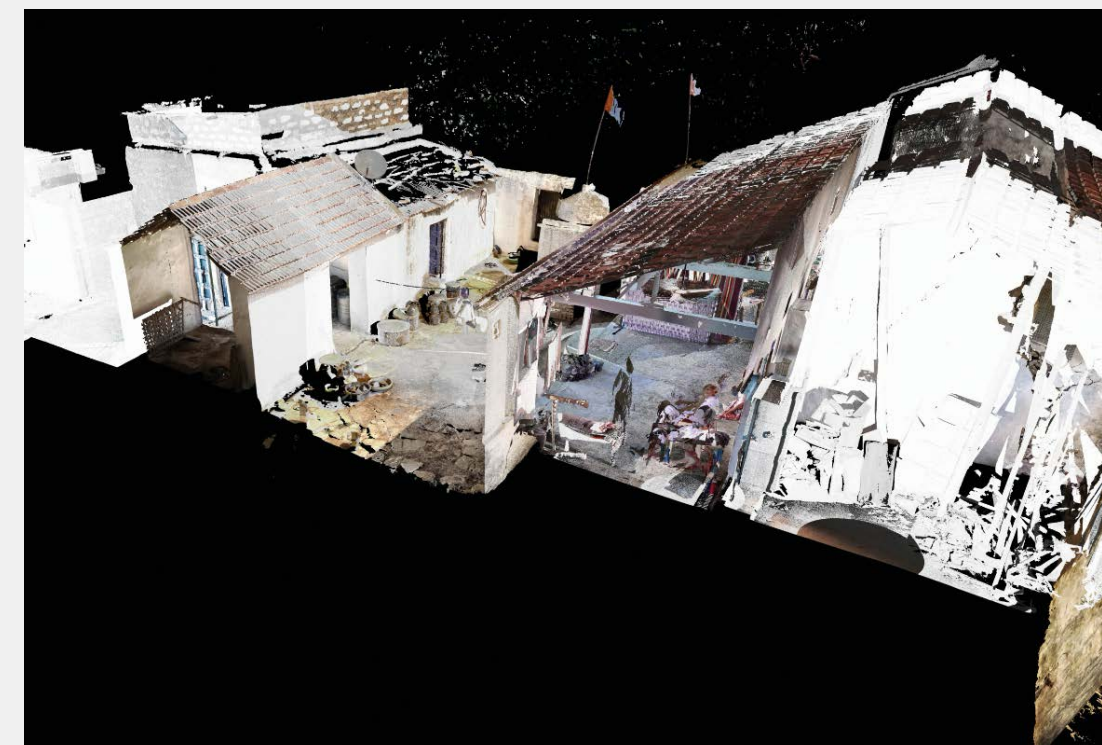
- 1. Rethinking Heritage Futures: Building competencies, synergies, and knowledge exchange between UK and China on heritage management, digitalization, and creative economy, (2023-2025).** Funders: British Council, UK-China Institutional Partnerships; Funding Value: £49,888. PI: Professor Abdelmonem, Co-I: Professor Robinson.
- 2. Curating Heritage Legacies: Mobilising youth engagement for co-creation of cultural diversity and urban memory of post-conflict Mosul, (2023-2024).** Funders: British Academy, Funding Value: £49,555. PI: Professor Abdelmonem.
- 3. Virtual Heritage Futures: Navigating virtual technologies, creative industries and AI for Cultural Heritage in the UK & China, (2022-2023).** Funders: Arts & Humanities Research Council (AHRC), UK-Shanghai Special Funding Programme; Funding Value: £79,970. PI: Professor Abdelmonem, Co-I: Professor Robinson.
- 4. Preserving the Disappearing Cultural Heritage of Post-War Mosul, Iraq: Valuing Diversity in the Urban Recovery of Mosul's Old Districts, (2020-2023).** Funders: British Academy, Funding Value: £300,000. PI: Professor Abdelmonem.
- 5. LABYRINTH: Conservation, Analysis and Virtual Reconstruction of Archaeological SITE of Hawara Pyramid and Labyrinth (El Fayoum), (2019-2022).** Funder: Arts & Humanities Research Council (AHRC), Funding Value: £385,051. PI: Professor Abdelmonem.
- 6. A Sustainable Reconstruction Method for Seismic-Prone Heritage areas of India based on advanced recording technologies", (2021-2022).** Funders: Arts and Humanities Research Council (AHRC); Grant Value: £203,200. PI: Dr Devilat (University of Nottingham), Co-I: Professor Abdelmonem.
- 7. The Living Museum of Umm Qais: Sustainable preservation, analysis and virtual reconstruction of Gadara's ancient site and village", (2019-2022).** Funders: Arts and Humanities Research Council (AHRC); Grant Value: £200,718. Co-I: Professor Abdelmonem.
- 8. Heritage Borders of Engagement Network – ENGAGE: Building Humanitarian Heritage Partnership and Knowledge Exchange Framework for Displaced Communities in India and Iraq", (2019-2023).** Funders: Arts and Humanities Research Council (AHRC), Global Challenges Research Fund (Collective Network Plus Programme); Grant Value: £59,900 + £60K GCRF Internal Funding. PI: Professor Abdelmonem.



- 9. Documenting the UNESCO World Heritage 'Churches of Chiloé': recording as a knowledge transfer for conservation, (2022-2024).** Funders: Endangered Wood Architecture Programme (EWAP) & ARCADIA: Oxford Brookes University; Funding Value: £150K.
- 10. Applicability and scalability of a sustainable re-construction framework for seismic-prone heritage areas of Gujarat, India. (2022-2023).** Funders: Arts and Humanities Research Council (AHRC), Grant Value: £85,845. PI: Dr Devilat (University of Nottingham), Co-I: Professor Abdelmonem.

The virtual reconstruction of **Nottingham Castle's** main gallery. This interactive and walk-through experience enables visitors to interact with paintings and listen to the narratives. This project led by CAUGH and Anthony Pidduck, enabled the development of a digital twin for the Castle for the first time, before its latest renovation.

Led by Dr Devilat, **CAUGH** has used Laser scanning technology to document and virtually reconstruct historic buildings and the residential streets of Ahmadabad in Gujarat - a World Heritage Site. The novel methodology is used for protection and potential use in post-Earthquake reconstruction and recovery plans. This is a 3-Phase AHRC-funded project under Global Challenges Responsive Mode.





ISAAC

ISAAC has received over £2.2M external grants mostly from UKRI since 2020, the year the Peak was launched, which translates to £750k p.a:

1. **Maintaining the cutting-edge research capability of ISAAC Lab.** Funders: AHRC; Funding value: £1.7M, PI: Professor Liang

2. **AI for DIGILAB: A New Concept in Digital Infrastructure for Heritage Materials Research.** Funder: AHRC; Funding value: £80,612, PI: Professor Liang, Co-I: Dr Shahtahmassebi

3. **Integrating Platforms for the European Research Infrastructure ON Heritage Science (IPERION HS).** Funder: European Union; Funding: €140,000, PI: Professor Liang
4. **From Lima to Canton and Beyond: An AI-aided heritage materials research platform for studying globalisation through art.** Funding value: AHRC-NEH; Funding value: £203,201 (80% FEC) + US\$150,000 from NEH (USA), PI: Professor Liang

5. **Non-invasive micro-scale depth resolved imaging and sensing of materials in cultural heritage.** Funder: Royal Society; Funding value: £12,000, PI: Professor Liang

6. **Capturing the Materiality of the Prize Papers. A set of 19th century textile samples from Canton and Batavia as a case study.** Funder: AHRC; Fund value: £29k, Co-I: Dr Kogou

7. **Art, soft matter and SANS: combining optical coherence tomography and scattering methods for art conservation applications.** Funder: STFC; Fund value: £52,952, PI: Dr Goehring, Co-I: Professor Liang

8. **CNR’s Institute of Heritage Science provided match funding for a PhD studentship: “Laser-material interaction: A Study of Laser Induced Degradation on Cultural Heritage Materials”.** Funding value: £56,000

In addition, Northwest University in China was awarded a grant from the International Science and Technology Cooperation Research Plan in Shaanxi Province of China from January 2022 to December 2023. The research will be delivered in collaboration with Professor Liang and ISAAC.

Some external funding was achieved from providing access to the **ISAAC Mobile Lab and expertise**. Examples include:

- Re-analysing the Nash Papyrus, **University of Potsdam** in collaboration with the Cambridge University Library. Funding value: €6,000
- Analysis of the 8th Century Carolingian wall painting, St Peter’s Church Mistail, Switzerland as part of a Swiss Science Foundation funded project. Funding value: 10,000 CHF





# Case study

## From Lima to Canton and Beyond: An AI-aided Heritage Materials Research Platform for Studying Globalisation through Art. (AHRC/NEH Funded UK/US Collaboration Project)

From the late 18th century, European colonial powers including Britain and Spain collected information from around the world. Pigments, dyes and paper were traded commodities; analysis and dating of these materials helps us to understand international trade and cultural exchange in the 18th and 19th Century. This project focuses on “export paintings”, made by local artists in north-western Latin America and Asia catering for the European and North American demands between 1780 and 1850. These are now found in public collections throughout the US and UK.

The ISAAC Mobile Lab has collected data from paintings at the National Archives, the Royal Geographical Society and Kew Gardens in the UK, and Yale, the Library of Congress, NMAA (Smithsonian) and the Lilly Library in the US. Data is analysed by our in-house developed AI-aided heritage materials platform. The combination of mobile lab and data science tools for analysis and visualisation helps to address the balance in accessing research infrastructure between resource-rich and resource-poor cultural institutions through an expert-assisted data analysis digital platform linked with associated physical research infrastructure.



Royal Geographic Society, UK



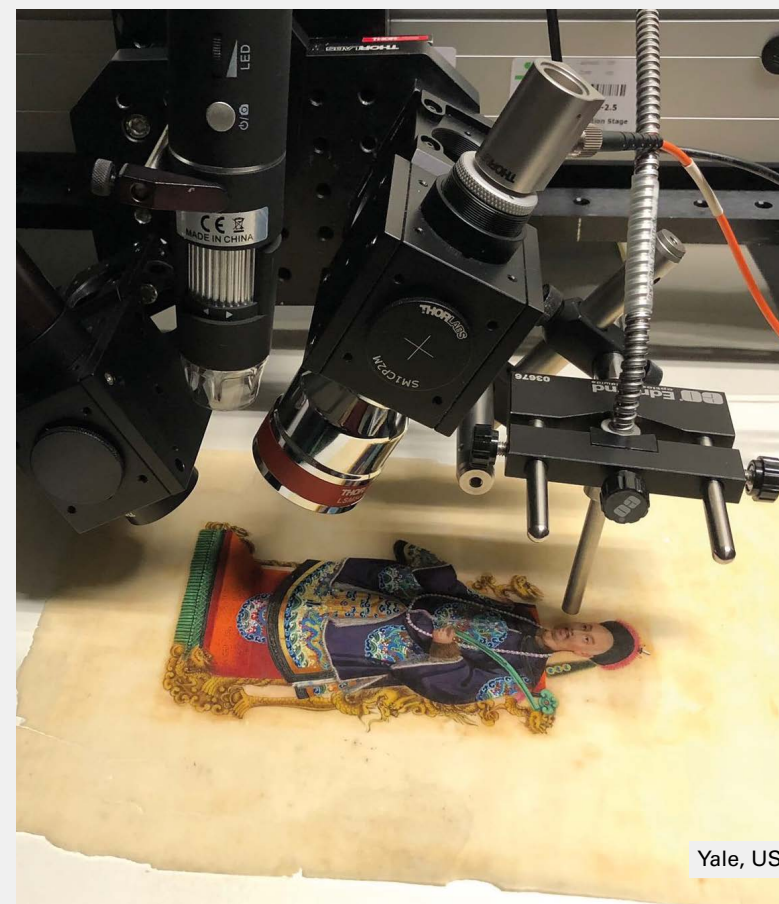
Royal Botanical Gardens Kew, UK



The National Archives, UK



Library of Congress, US



Yale, US



Lilly Library, University of Indiana, US





Professor Cillian Ryan and Professor Gamal Abdelmonem address the National University Museums Directors Forum in Beijing, China, on 12 May 2023, as part of the Sino-British University Museums Alliance.



# Partnerships

CAUGH has been pivotal in leading and establishing key international partnerships around Cultural Heritage Research with joint research centres, alliance, and strategic research partnerships. Professor Abdelmonem and Professor Robinson have led Memorandum of Understanding (MoU) with world leading institutions and international organisations, granting NTU membership in the UNESCO/UNITWIN and becoming partners with the Council of Europe's European Institute of Cultural Routes (EICR).

Examples include:

- Sino-British University Museums Alliance (2021-Present)**  
 A UK-China Network Joint-Collaboration between Nottingham Trent University, UK and Communications University of China on the application of advanced digital and virtual technologies to museums and heritage sites.  
 NTU lead – Professor Abdelmonem
- UNESCO-UNITWIN International Network on Culture, Tourism and Development; University of Paris 1 (2021-present)**  
 This strategic partnership brought UNESCO support to our heritage research and attracted international attention and collaboration on several projects and initiatives.  
 NTU lead – Professor Robinson
- European Institute of Cultural Routes, Council of Europe (2021, present)**  
 NTU was appointed as the only UK member of the Institute and was tasked with developing a series of co-funded workshops, activities, and projects.  
 NTU lead – Professor Robinson
- Joint Centre for Cultural Heritage Technology. (2019-present)**  
 This is a strategic partnership with the most prestigious Architecture and Heritage School in India, based at the Ahmedabad World Heritage Site.  
 NTU lead – Professor Abdelmonem

In the Science and Heritage area, ISAAC has recently been developing more links with the USA through two AHRC funded UK-US bilateral projects involving over a dozen US and UK cultural organisations. In addition, as part of a large European project, IPERION HS, linked to European research infrastructure for heritage science, we are partnering with over 20 research organisations in heritage science across Europe to provide mobile lab access to heritage in Europe along with joint research projects.

In addition, the new academic fellows in SST have brought in their own international partners such as Tbilisi State Academy of Arts, Department of Culture (Ministry of Home & Cultural Affairs), Kingdom of Bhutan, University of Ioannina and the Byzantine Museum of Ioannina in Greece. This year, ISAAC is also hosting two year-long visiting research fellows, one from the University of Science and Technology of Beijing and another from the Central Academy of Fine Arts in Beijing.

CAUGH has been pivotal in leading and establishing key international partnerships around Cultural Heritage Research with joint research centres, alliance, and strategic research partnerships.



# Recognition

## Keynote addresses and talks

Professor Abdelmonem has delivered the following keynote addresses and talks –

- **United Nations Department of Economic and Social Affairs (DESA)** – “Technological Change and the Family in the MENA Region” 2-3 June 2022, Egypt.
- **UK-Shanghai Creative Industries** – “The Arts & Humanities Research Council Virtual Event” 21-25 March 2022, online.
- **UNESCO Chair, ‘Culture, Tourism and Development’ seminar** – “Tourism and World Heritage Sites in Africa: Challenges and Perspectives” 30 Nov 2021, Paris.
- **China University Museums Alliance conference** – “HeritageCAVE: Cloud-based Intelligence in Cultural Heritage” 3rd Dec 2021, Beijing.
- **The Living Digital Heritage Conference** – “Touching the Untouchable in Global Heritage: From Hawara Pyramid in Egypt to Nottingham Castle, UK” 5 Nov 2021, Sydney.
- **Malaysia-Tunisia Cultural Heritage Studies** – “Cultural Heritage Symposium” 10 September 2021, Kuala Lumpur.
- **MONFORTE Winter Solstice Seminar** – “Heritage Intervention” 13 December 2021, Porto.
- **British Museum** - “Ancient Iraq’ Public Lectures Series” 12 May 2022, Nottingham.

Professor Liang has delivered the following keynote addresses and talks –

- **6th International Congress** – “Chemistry for Cultural Heritage” July 2022, Bologna
- **MIT International symposium** – “Crossroads: Data-driven talks on ancient materiality at the interface of archaeology, science and engineering” June 2022, Turin
- **Computational approaches for technical imaging in cultural heritage conference** – April 2022, online
- **The Royal Academy of Engineering** - “East Midlands Annual Lecture” October 2022, Nottingham
- **Institute of Conservation (ICON)** – “Heritage Science Annual Lecture”, November 2022, London
- **University of Cambridge** – “Pitt-River Seminar in Archaeology” October 2022, Cambridge
- **4th International conference on Smart NanoMaterials: Advances, Innovation and Applications** – December 2021, France/online
- **University of Bologna Doctoral Summer School** – “Excellence in Heritage Science for Conservation and Collection Care Research and Access”, July 2021
- **Yale University** – Institute for the Preservation of Cultural Heritage Seminar, May 2021
- **Shandong University** – Archaeology Seminar, April 2021, China
- **Royal Society of Chemistry** – Analytical Bioscience Group Early Career Researcher meeting, March 2021
- **Cambridge University Festival** – March 2021



Virtual Hawara- Virtual Exhibition; 28th March 2022, Grand Nile Tower Hotel, Cairo, Egypt

## Articles

- The Royal Geographical Society Spring Bulletin featured an article “From Lima to Canton and beyond – studying globalisation through art” on our AHRC-NEH funded UK-US collaborative project that involves a dozen UK and US partners <https://www.rgs.org/about/the-society/bulletin/summer-2022/> (ISAAC)
- The Institute of Conservation (ICON) News featured an article on the ISAAC research centre and NTU winning QAP for Advancing Heritage Science (<https://www.icon.org.uk/static/16255760-2d14-4d28-acd714e739bfc3ce/ICONnews-100-JUNE-2022-WEB.pdf> p. 10-11) which is inspiring for those working in Heritage Science to hear that QAP is giving prizes to the field (ISAAC)

## Public exhibitions

- **The Afterlife of War: Capturing the Everyday of Life and Culture in Old Mosul, Iraq**; 11th May – 21st June Oct 2022, Djanogly Gallery 1A, Lakeside Museum, University of Nottingham, UK (CAUGH)
- **Digital Bela: Architectural Heritage under a new light**; 14-30 June 2022, Level One, Newton Building, Nottingham Trent University, Nottingham, UK (CAUGH)
- **Strata – layered histories, imaginary futures**; 2nd Sep -10 Oct 2021, Nottingham Castle, Nottingham, UK (CAUGH)
- **Virtual Hawara- Virtual Exhibition**; 28th March 2022, Grand Nile Tower Hotel, Cairo, Egypt (CAUGH)
- **Touching the Untouchable**; 5th Nov 2021, The Living Digital Heritage Conference, Virtual Exhibition, Macquarie University, Sydney, Australia (CAUGH)
- **Lace Market Heritage & Architectural History**; St Mary’s Church, Nottingham; Public Exhibition (Sep-Nov 2019) (CAUGH)



Strata – layered histories, imaginary futures; 2nd Sep - 10 Oct 2021, Nottingham Castle

The Afterlife of War: Capturing the Everyday of Life and Culture in Old Mosul; Iraq; 11th May – 21st June Oct 2022, Djanogly Gallery 1A, Lakeside Museum





Nottingham Trent University  
Cultural Heritage Research Peak  
Impact Report  
Spring 2023

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