UK DIGITAL HERITAGE SYMPOSIUM 2022

LCR4.0
HOLISTIC

European Union
European Regional Development Fund

NORTHERN POWERHOUSE
HM Government

VEC VIRTUAL ENGINEERING CENTRE

ST GEORGE'S HALL

UNIVERSITY OF LIVERPOOL

Liverpool City Council

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INTRODUCTION

St George's Hall

St George's Hall is a Grade I listed building, which has taken pride of place in the heart of Liverpool since opening in 1854. Home to the impressive Great Hall, the splendorous Concert Room and Victorian courts of law, this stunning neoclassical building is an iconic landmark within the city.

Today, St George's Hall attracts thousands of visitors to the city every year through tourists, corporate events, and weddings. The Hall has also played a starring role in numerous Blockbuster films and famous TV shows.

The Virtual Engineering Centre

Part of the University of Liverpool, the Virtual Engineering Centre (VEC) is the first UK leading digital engineering centre, supporting industry in their digital transformation. The VEC has over ten years of experience in combining world-class research and unique capabilities and experience of digital adoption, to hundreds of businesses across industries and sectors

LCR4.0 Holistic

LCR4.0 HOLISTIC is an ERDF project (European Regional Development Fund) that will deliver the first Liverpool City Region wide digital supply chain ecosystem for SMEs, cross-linking traditional supply chains and clusters to create a city region supply chain network offering greater business resilience, growth opportunities and diversification.

Digital Heritage

Digital Heritage focuses on utilising an array of innovative digital tools and technologies for the preservation and promotion of historic assets for future generations. This will generate a sustainable ecosystem for driving resilience and recovery for the Liverpool City Region.

What is Digital Heritage?

The Virtual Engineering Centre, St George's Hall Trust and Liverpool City Council are working collaboratively to develop a new innovative strategy that will bridge the gap between innovation and local digital SMEs who can support the city's digital transformation as they lead the Digital Heritage campaign across the Liverpool City Region.

Focusing on new and emerging digital technologies including AI, advanced sensors, and mixed reality, we aim to raise the city region's heritage and cultural sectors to accelerate recovery from COVID-19 and create a sustainable, inclusive, and innovative heritage ecosystem and economy.

The strategy will focus on the themes of heritage preservation, the promotion of its value, lessons to new generations, and the progression of history as a driver for inclusion, education, and enterprise. Liverpool's approach to Digital Strategy will weave together threads of technology, heritage, social entrepreneurship, and community that will serve as a new pattern for how Digital Heritage Strategies are developed across the world.

The Vision for Liverpool's Heritage

Liverpool is blessed with over 2,500 listed venues, monuments, and sites, second only to London in their quality and scale. It is now intended to create new initiatives to utilise the city's heritage to create "Nodal points of Culture" in every ward of the city.

The proximity the people of Liverpool have to their rich heritage can act as an ongoing catalyst to the city's renaissance. It is hoped to use the cultural nodal points to address the long-standing effects from the Indices of multiple deprivations the city has encountered for decades, and to now move from a position of managed decline towards a position of managed recovery and development. The ambition is to utilise the city's heritage to challenge and address the impacts of health deprivation and disability, crime, barriers to housing and services, the living environment, and subsequently to create localised employment, raise income, and improve education, skills, and training.

Alan Smith
Head of Heritage Preservation and Development

Professor Elizabeth Maitland
St George's Hall Trustee and University of Liverpool

St George's Hall and the Liverpool city region are keen to harness the full potential of opportunities that transformative digital technologies can deliver in support of the preservation and promotion of our unique heritage and valuable assets. Liverpool is home to over 2,500 grade 1, 2* and grade 2 buildings, monuments and green spaces, many of which are not only important to the tourism and appeal of our city but are held in extremely high regard by many of our visitors, local citizens and the general population.

Liverpool is so culturally rich and diverse and St George's Hall is keen to explore how we can preserve and protect our heritage, whilst ensuring we remain as inclusive as possible, as we accelerate our recovery from COVID-19 and create a sustainable, inclusive offering.

We are proud to be working closely with the Virtual Engineering Centre of the University of Liverpool and the dynamic SME community in Liverpool as we lead on what promises to be a transformative campaign for the city, its people, and the Heritage Sector globally.

Our vision is to inspire a digital renaissance in Liverpool. A renaissance that will not only preserve, maintain and re-imagine Liverpool's rich tapestry of heritage assets, but also create an international exemplar for how heritage projects and enterprises can be created and scaled by bringing together cultural and heritage practitioners with technologists, entrepreneurs, investors, and customers.

As a first step, we are establishing, at St George's Hall, the Digital Heritage Foundry: a European and UK first digital incubator that will serve as a port for inward investment of people, ideas and funding in the sector, and the export of market ready innovative solutions, services and enterprises that benefit the heritage sector and its stakeholders. By co-creating, testing, and delivering their products and services within Liverpool's rich heritage eco-system, our aim is for businesses and enterprises to be supported by the Foundry to develop products faster, secure investment and ultimately scale-up, sell and export those innovations nationally and globally.

The Foundry will also provide a venue for educational engagement, where students at all levels of learning can experience cutting edge digital technology and its application to heritage assets. Students will be exposed to a start-up ecosystem and gain insight into entrepreneurial opportunities and employment in digital sectors. The foundry space will be a unique opportunity to bridge generational and other demographic boundaries to build a community for non-conventional career development.

01

BUILDING A LEADING DIGITAL HERITAGE COMMUNITY

A combined approach will connect the city region's heritage assets with the Virtual Engineering Centre's digital transformation expertise and local SME technology providers, to develop a sustainable Digital Heritage ecosystem.

The ecosystem will support the creation of new supply chains and dynamic spaces for collaboration and experimentation to further accommodate working professionals and students. It will also look at the broader community and highlight the significance of building a stronger online cultural network for heritage in the Liverpool region.

Digital Heritage utilises emerging digital technology, including advanced visualisation tools such as virtual and augmented reality, artificial intelligence, blockchain technology, 3D scanning and 3D printing, for improving the understanding and preservation of cultural and natural heritage. Through an engaging community, the digital heritage ecosystem will encourage creative adaption and add new strengths to Liverpool's heritage economy.

Benefits

- Combined approach from across the community and wider economy
- Foster inclusive innovation in the sector
- Enhanced preservation of assets with minimal disruption
- Develop the visitor economy and increase access through improved inclusivity
- Magnify educational engagement through interactive and immersive learning
- Improve historic recordings through data capture
- Provide a driver for inward investment and inclusive prosperity

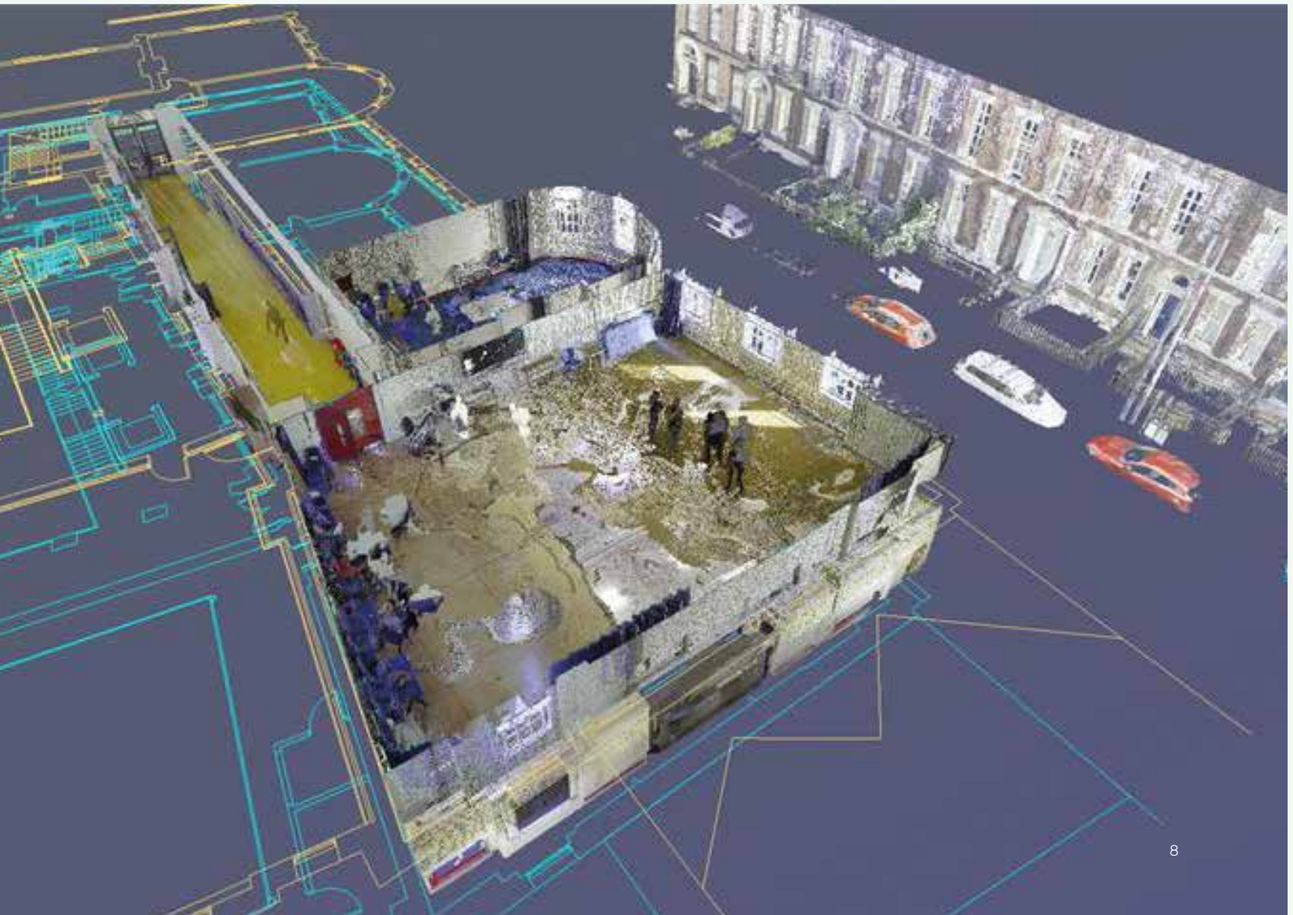
CASE STUDY 01 MMA DESIGN & PROJECT MANAGEMENT LTD

Creative Adaption for Multi-Purpose use of Heritage Sites

MMA were commissioned by the Liverpool Institute of Performing Arts (LIPA) to transform a traditional dance studio, situated in a historic, listed building, into an innovative, fluid space. Here, traditional dance and theatre techniques will come together with the latest digital theatrical tools, including green screens, virtual reality, motion capture and virtual learning.

Crucially, it will accommodate new tools and practices to preserve the fabric of the building and the historic ethos and soul of LIPA's listed building. MMA enlisted the support of the Virtual Engineering Centre (VEC) via LCR4 START, an ERDF funded initiative for supporting SMEs to develop their digital strategy.

Focusing on one of the most challenging structural features of the building, the VEC team used it to extrapolate a complete digital model, minimising the need for costly, destructive, and time-consuming exploratory work. This model has enabled MMA to integrate more digital tools into their assessments and workflow, providing faster outcomes and increased client confidence.



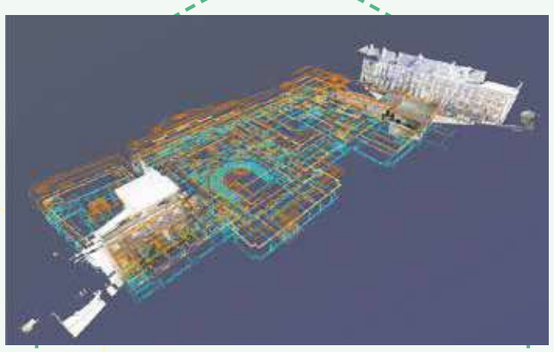
Ongoing work through LCR HOLISTIC expands on the previous collaboration and has introduced further digital techniques (such as photogrammetry and LiDAR) for capturing physical environments. The VEC team is working with MMA Design & Project Management and Auditive Limited to develop a powerful workflow for mapping the spatial audio characteristics of historic spaces and will carry out user evaluations to assess the effect of light, sound, and vibration in virtual twins.

To demonstrate practical methods of digital adoption, the team:

- Accessed laser scanning technology to create a 3D model of the building's interior spaces marked for development
- Modelled performers and equipment to prove the required capacity for the space with spatial considerations
- Scoped an audio acoustics map (alongside the advanced capabilities of Auditive Limited), to allow simulation of acoustics and light for increased understanding of how various internal schemes can be experienced

Impact and value delivered:

- New degrees of precision and cost-savings in historic building renovations using spatial computing
- Faster and more effective decision-making, resulting in a reduction in timescales
- Less destructive and time-consuming survey work
- Early identification of issues and required changes before significant investments
- Reduction in building costs and rectification work
- Ability to compare design alternatives within minutes
- New dimension of client engagement in the design phase
- Allows for user evaluations and assessments of the suitability of spaces for individuals with specific needs



02

FACILITATING REMOTE AWARENESS THROUGH THE CLOUD AND VIRTUAL TOURS

Immersive technology can create engaging experiences for varied audiences and purposes, regardless of location. Realistic digital environments can be created for educational tourism, enabling stakeholders and students to virtually explore remote heritage sights from across the world, bringing history to life for a uniquely remote and immersive learning experience.

Digital and virtual twins of heritage sites promote new interest and understanding behind historic locations. Digital capture of a site can be carried out over periods of time to track any changes to the environment and the layout. A scanned scene not only digitally preserves the physical environment, but also facilitates safe and immersive adventures.

Furthermore, virtual tours offer an engaging way to address varied audiences. Using the power of the Cloud and web technologies, heritage sites can be shared across the globe. Embedded translation tools can cater for multilingual requirements and encourage further collaboration with significant heritage locations.

Benefits

- Interactive remote tourism for greater engagement across the globe
- Safer remote access for reaching broader audiences for enhanced resilience
- Improved customer experience with enriched learning from additional resources
- Increase in detailed historic records and data capture, including experiences from end-users

CASE STUDY 02

Virtual and Immersive Tour of St Patrick's Crypt

An exciting digital capture project recently took place at St Patrick's Church and crypt in Toxteth, one of the most historic, earliest surviving and architecturally significant sites in Liverpool.

The active Catholic parish church in the Archdiocese of Liverpool was built in 1821-27 and is recorded in the National Heritage List for England as a designated Grade II* listed building. Underneath the church lies a crypt with many burial vaults which have recently been uncovered by archaeologists after years of lying dormant and inaccessible to the public. This presented an opportunity for the Virtual Engineering Centre, Vaadhoo Media and the University of Liverpool's department of Archaeology, Classics and Egyptology for capturing the initial state of the project and environment.

Vaadhoo is a local Liverpool SME, which specialises in virtual tour creation, immersive tours and commercial photography. Vaadhoo creates immersive and fully interactive virtual environments for a multitude of markets, from tourism and culture to property sales.

Through the LCR4 START and LCR4.0 Holistic projects (ERDF initiatives), the Virtual Engineering Centre (VEC) was approached by Vaadhoo to explore alternative and additional ways of showcasing their 360-degree environments.

The VEC offered guidance on the integration of 5G and cloud technology to connect with wider remote audiences. This has allowed Vaadhoo to expand their immersive services in the region and beyond.

The VEC and Vaadhoo collaborated further to explore how Vaadhoo could expand their technical offering for sectors, such as heritage, tourism, and culture. Through this assist, the VEC worked with Vaadhoo to improve methods for capturing complex structures, such as St Patrick's crypt. The teams demonstrated their combined capabilities through a variety of 360 capture, 3D scanning and photogrammetry tools, allowing audiences to explore an area of Liverpool which would otherwise be inaccessible.

This project has allowed the crypt to be captured using three innovative scanning and capture workflows, each with its own critical advantages that could support long-term excavation projects for uncovering the mysteries of the crypt.

In summary, the LCR4 projects have enabled Vaadhoo to explore new and alternative avenues at a pace and in shorter time periods than expected, providing additional expertise and technical capabilities that would not have otherwise been available, which is critical for an SME. These projects have encouraged and enabled collaboration with other businesses in LCR supply chains, including Active AV (AV supplier) and Chataway (language and translation services), providing further enhancements to the final solution and demonstration.

Local author Michael O'Neil is also writing a book about the history of St Patrick's along with the cultural roots of people within Liverpool at the time that the crypt was operational.

03

ENHANCED ACCESSIBILITY AND INCLUSIVITY FOR THE HERITAGE COMMUNITY

An important role of Digital Heritage is to encourage cultural democracy and improve inclusivity and accessibility. By improving the accessibility of these historic sites and assets, we can continue to facilitate audiences with different mental and physical needs.

Leveraging digital technology leads to opportunities for new audiences who would otherwise be unable to participate in some activities. The use of digital tools can ensure increased audience engagement, including those who experience visual impairment, hearing difficulties, autism, neurodivergence and dementia.

Digital tools can also be adopted to create entirely unique experiences for visitors with specific needs. One example is the creation of 'Wellness rooms' for heightened personal experiences, enriched well-being, and mental health. Virtual and multisensory experiences can allow for a comfortable encounter with technology and heritage surroundings, within a safe and controlled environment.

Benefits

- Enhanced accessibility through immersive technologies and digital tools
- Greater inclusivity for a wide range of communities
- Creation of safe, secure and controlled learning environments
- Improved social and economic growth through the promotion of greater inclusivity
- Increase in access to education and learning materials

CASE STUDY 03

Immersive Virtual Reality and Multi-Sensory Technology for Enhanced Experiences and Inclusivity

Vizbox Sensory is a Wirral based developer of virtual reality (VR) experiences. The company is a leader in the use of VR to address mental health challenges and is actively developing tailored programs to complement existing therapies for behaviour management.

Having started a multisensory development journey, Vizbox Sensory wanted to explore how to incorporate smells into a virtual environment. Through the LCR Holistic programme, the SME began working with the Virtual Engineering Centre to gain unique access to the specialist and immersive laboratories within the Digital Innovation Facility at the University of Liverpool. This project has allowed them to rapidly explore methods for incorporating different smells and haptics to enhance immersive experiences and accessibility for people and communities from an array of disadvantaged backgrounds.

Vizbox has already been working with AgeUK to investigate and support individuals with memory-related disabilities. However, this collaboration has identified more ways in which Vizbox Sensory could deploy multi-sensory tools for the benefit of the heritage community and supply chain, as future ambitions are for these solutions to be deployed at heritage organisations in the forms of wellness rooms and multi-sensory experiences.

04

IMPROVING DIGITAL PRESERVATION AND INTERACTIVITY

Laser scanning statues, assets and historic landscapes can offer a wide range of benefits for architectures, historians, academics and beyond.

This scanning process can generate detailed data sets to ensure historic records are more accurate and remain as updated as possible. This data can be used as part of the safeguarding and preservation of historic locations as we create virtual demonstrations for visitors to explore these hard-to-reach locations, whilst minimising damage due to regular high footfall from tourists.

Artificial Intelligence (AI) and 3D Asset Reconstruction can develop physical assets from 2D images including portraits through photogrammetry technology. These can be used for creating life-like 3D and physical models to highlight significant individuals throughout history for statues and even objects collected through archaeology.

Museums and other institutions can also utilise crowdsourcing to encourage visitors to become more involved by sharing photos of these assets that can be collectively scanned and distributed for the wider collection of additional data and information from an array of sources.

Benefits

- Preservation and safeguarding of real-life assets and heritage sites whilst improving the rate of exploration
- Improved accuracy across data sets for updating records
- Creation of 3D modelling and assets from 2D portraits and drawings
- 3D printing of scalable historic landscapes and assets for education
- Digitalisation and classification of historic material with AI

CASE STUDY 04

Innovative Mixed Reality Archaeology Collaboration

The Virtual Engineering Centre and the University of Liverpool's Archaeology team have collaborated to explore new and exciting ways to capture, visualise and interact with heritage content, utilising unique expertise and advanced capabilities in the scanning and construction of physical assets, such as statues and historic assets.

This collaboration has combined these capabilities with the Virtual Engineering Centre's expertise involving mixed reality and advanced visualisation to test and identify new, engaging ways of interacting with scanned and visual content.

The department of Archaeology, Classics and Egyptology digitally captured various historic materials using photogrammetry techniques. Working with the VEC, a virtual gallery was then created to be displayed on a multitude of devices and platforms, including a mixed reality HoloLens II application. This offers a new and innovative way of engaging with 3D captured content.

CASE STUDY 04

Safeguarding of Heritage Assets Through Scanning Technology

Born in London in 1798, John Weightman was a pioneer working on large projects, such as the Grand Junction Railway, connecting Liverpool with Birmingham. In 1848, as a corporation surveyor, John Weightman was appointed to oversee and support the building of St George's Hall, where he worked closely with architect Charles Cockerell.

The majestic bust of John Weightman sits within St George's Hall as homage to his contribution to the completion of the Grade I listed building in 1854. The Virtual Engineering Centre used light hand-held 3D image scanning devices for capturing realistic 360-degree images of the statue, which has enabled St George's Hall to:

- Easily share these interactive images with more audiences than before
- Contribute to the safeguarding of historical assets, using non-intrusive technology for collating data for more detailed records
- Use these datasets for 3D printing and photogrammetry purposes
- Digitise and classify historic material with AI
- Crowdsource and capture audience interest through the sharing of photos and scans, collating new data and information from an array of sources

05

THE ADVANTAGES OF DIGITAL TWIN TECHNOLOGY FOR HERITAGE

A digital twin is a functional digital representation of a real-world entity. Using scanning, photography, modelling and information of a physical entity, a digital copy can be created for multiple purposes.

Heritage organisations can benefit from the use of digital twinning techniques through scanning and recreation of assets including statues, points of interest and even entire buildings, developing 3D models and replicas to virtually and digitally promote and interact with heritage assets, whilst preserving the original objects.

Digital twins can also support the collection and creation of more detailed and accurate data. This proves useful when handling historic records, updating, and digitising these to facilitate greater understanding and analysis of otherwise physical files.

Pairing digital twins with advanced sensor technology can also provide critical insights on the behaviours and conditions of certain real-world buildings. By connecting this with data monitoring tools, the digital asset allows organisations to monitor key indicators, such as vibrations, movement, energy usage, temperature, and humidity.

Digital twins are fast becoming a recognised initial step in heritage digitalisation processes, enabling rapid visualisation of key sites. However, once they are unified with sensor data, they become critical tools for long term building maintenance, monitoring, and preservation.

CASE STUDY 05

Digital Twin For Preservation and Promotion

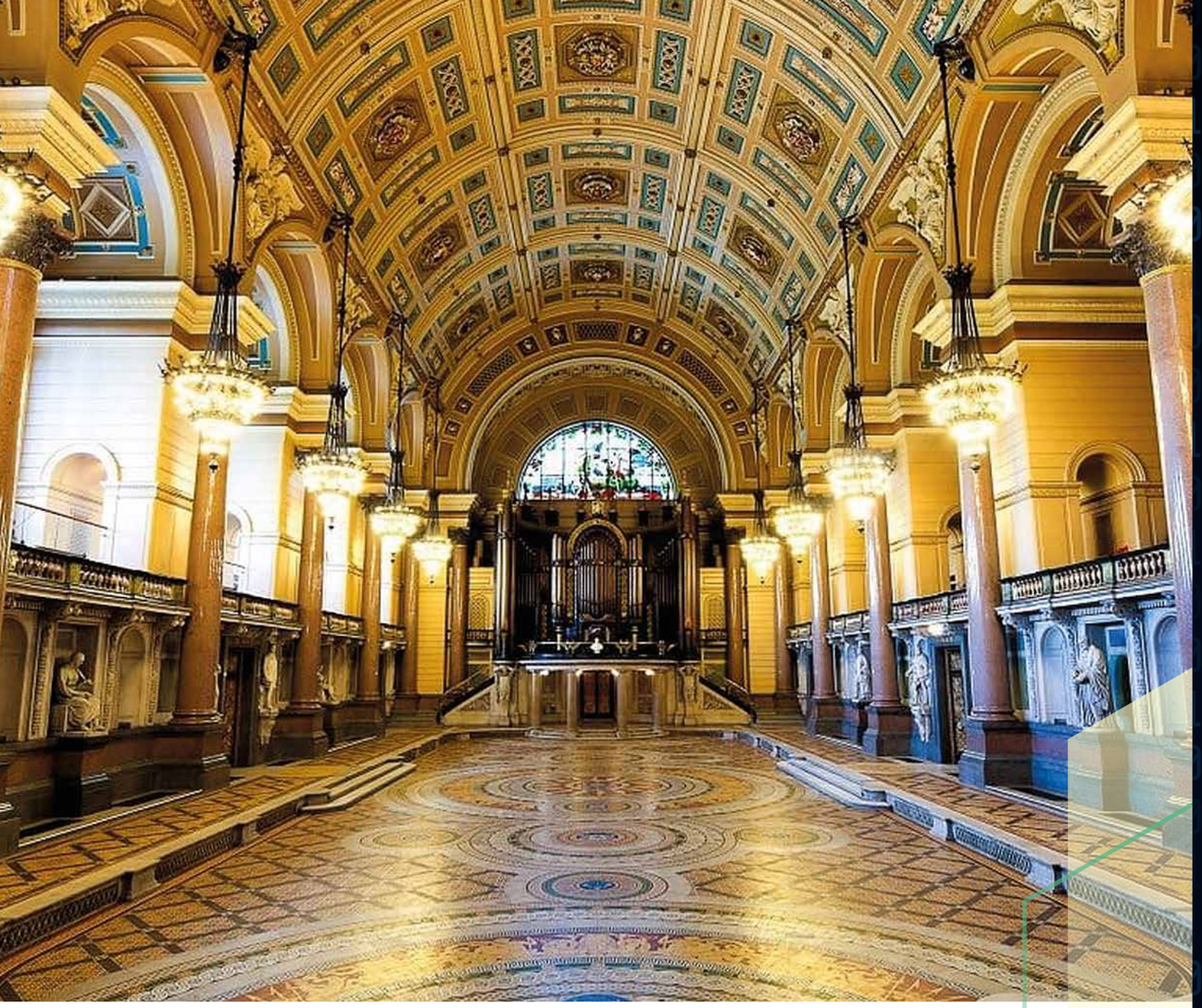
The Virtual Engineering Centre and St George's Hall have created a life-like digital copy of the historic and beautifully preserved Minton floor. The project is a powerful demonstration of the potential for Digital Heritage in the Liverpool City Region, to help our museums and galleries innovate in a post-COVID world.

The support meant St. George's Hall could:

- Safely capture 30,000 handcrafted Minton tiles with minimum disruption to the Hall's activities and visitors using innovative digital tools
- Develop a clear and concise digital scan of the flooring, within 1mm scales that can contribute toward detailed historic records
- Create a 3D digital model of the room and Minton flooring that can be used to remotely showcase the tiles through simulation technologies

The Benefits

- Creation of digital twinning through different periods to highlight changes over time and the need for preservation and support
- Enable more visitors through digital demonstrations to remotely enjoy the beautiful and hidden tiles which are only revealed to the public once a year
- Digital assets can be used on digital platforms, such as websites, for audiences to interact and engage with
- Realistic simulation can be projected over a thick wooden covering for more visitors and tourists to enjoy a realistic representation of the tiles in-situ
- Save on costs compared to alternative procedures for digitising the flooring



"This digitisation of the Minton floor will enable us to present the floor digitally to visitors whenever the opportunities arise – thereby, significantly increasing the opportunity visitors can have to see the Minton floor in its normal surroundings. The cost of digitising the floor can be up to £20,000 and the support in kind St George's Hall has received from the University of Liverpool has been outstanding.

Our aim is to develop the necessary infrastructure to digitally present the floor soon, enabling modern technology to be used to interpret a classical historical venue."

- Alan Smith, Head of Heritage Preservation and Development for Liverpool City Region

06

IMPROVING PUBLIC ENGAGEMENT AND INTERACTIVITY

Artificial Intelligence and other digital tools including motion capture can be used for creating a more interactive experience for visitors by adding a layer of engagement.

Using mesh reconstruction tools, we can transform statues into realistic avatars, bringing them to life as they speak directly with visitors. Significant and historic figures can talk in detail about their own experiences, educating engaged visitors whilst offering a real-time conservational experience.

This can be controlled in real-time to ensure avatars respond to live questioning to generate further interest from students, in comparison to alternative methods for learning.

Augmented Reality (AR) can allow the use of mainstream smart devices to scan QR codes for accessing additional information, such as interactive videos, engaging photos, and informative websites for furthering the educational reach and depth of understanding.

Immersive and interactive applications also enable visitor contribution, allowing guests to create online posts or 'digital stamps' for the sites they visit. There are many ways that institutions can share and capture the unique stories from local visitors, learning more about the rich history upon which the city was built and allowing the public themselves to contribute to the history of the sites.

Benefits

- Improve engagement and interest levels for educational purposes through enhanced interactivity and engagement of new and existing exhibitions
- Avatar technology can help draw visitors in through marketing and wider interest
- Augmented reality and web applications give visitors an easy route to immersion and engagement, using devices which are readily available to all
- 'Digital Stamping' through online media, surveys, photos, and bespoke AR apps can leave a lasting personal print of a visit

Engaging Education with Conversational Statues and Avatars

Through an exciting combination of performing arts, digital capture and processing technology, St George's Hall and the Virtual Engineering Centre has produced a responsive virtual avatar experience. Through innovative new methods, this partnership has helped to pave the way for bringing significant historical figures to life.

Utilising digital technologies such as photogrammetry, AI, image detection and mesh generation, a life-like virtual character can be created which opens up opportunities for heritage organisations to engage with tools and performers. Having a virtual character provides more flexibility for public interaction and can further support visitor engagement.

The latest technology can enhance and replicate historic material, which is particularly useful when there are limited records and imagery of individuals from the past. By combining the use of a virtual avatar and facial tracking technology, a performance can be integrated with the virtual world, through a recorded session or demonstrated through real-time live tracking for a more dynamic result.

Engaging Education with Conversational Statues and Avatars continued

The Virtual Engineering Centre has initiated a pilot project, placing famous Nurse, businesswoman and role model, Mary Seacole as the central subject. Born in 1806, Mary was a Jamaican immigrant who moved to England aged 12 and practised European and traditional Caribbean methods of medicine.

Following the tragic death of her husband and mother, Mary travelled all over the world and became famous for treating patients suffering from Cholera and Yellow fever. Mary went on to treat fallen soldiers of the Crimean War, a military conflict fought from October 1853 to February 1856. Mary set up a British Hotel during the war that would act as a 'safe place' for the sick. Mary's nurturing stance and determination in her work, saw soldiers and the men she helped, award her the nickname 'Mother Seacole' as they recognised her working closely on the front line of battlefields.

Bea Freeman, an Independent Film Producer introduced the VEC to local Musical Director, Jennifer John to offer a realistic voice-over to accompany the virtual avatar which would give Mary a truly authentic voice as well as further draw in audiences to her story and experiences.

The next steps for this pilot project involves the integration of further AI to enable verbal cues and realistic conversations between real humans and responsive virtual avatars.

CASE STUDY 06

Enabling Public Interaction Through Interactive Applications and Augmented Reality

Draw & Code are immersive experts, using cutting-edge technologies such as virtual, augmented, and mixed reality technologies for creating awe-inspiring experiences. The Liverpool-based studio has completed over 140 projects for a wide variety of clients including supporting the creation of immersive content that brought to life the sold-out Terracotta Warriors immersive exhibition in Liverpool.

In 2020 Draw & Code once again partnered with National Museums Liverpool to explore how emerging technologies and the museum group's ongoing digitisation programme can be used for bringing exhibitions to life for an array of audiences.

Already exponents of the benefits of virtual reality and other metaverse technologies, Draw & Code have taken advantage of the LCR4.0 Holistic project (ERDF) to boost the teams' collective and multidisciplinary capabilities.

Despite the ending of national lockdowns as part of the UK's path of recovery from COVID-19, Draw & Code still feel that virtual and remote accessibility to events will play a role in society, well beyond COVID-19.

The team developed a digital platform called Serendipity to enable exhibitions and global events to be virtually explored and attended. Draw & Code saw this as vital during periods of time where museums and galleries for example were closed or not able to allow visitors to physically support.

The Industrial Digitalisation teams from across the LCR4.0 Holistic project explored how to adopt Draw & Code's VR work into events to allow for greater interest and engagement with target audiences.

07

FOSTERING GREATER PROFITABILITY AND HERITAGE INVESTMENT

Blockchain technology is rapidly becoming a usable tool across various sectors and supply chains. Blockchain is a new, secure, and improved way of handling, tracing, and collaborating with physical assets and digital data. These techniques can enable heritage institutions to develop a system for recording information to improve the security surrounding exceptional data, and tracking uses and locations of assets for enhanced preservation.

Furthermore, we can foster greater profitability and investment through blockchain-enabled fractional ownership of non-tangible, digital assets including non-fungible-tokens (NFTs). The city region can work together in creating an investment community of collectors, at the frontier of promoting specific assets across the region for encouraging engagement and preservational support, whilst financially building a profile through well-publicised launches.

Benefits

- Supports the preservation of Digital Heritage across the Liverpool City Region
- Introduces tracking of unique assets and artefacts including valuable paintings through a digital collection footprint
- Documenting the exact locations of historic locations, buildings, and venues through expanded collection visibility
- Encourages collaboration between different institutions
- Further raises awareness of assets to online audiences whilst building a financial portfolio of non-tangible replicas
- Fostering greater profitability and heritage investment whilst accommodating new online audiences

CASE STUDY 07

Blockchain for Heritage

Bbloock delivered an exciting collaboration and knowledge transfer workshop in the Liverpool City Region hosted by the Virtual Engineering Centre and the University of Liverpool Management School, where the teams jointly discussed and explored the uses and opportunities of blockchain technology and how it can be applied to supporting digital heritage.

The workshop and co-operative sandpit sessions allowed the two organisations to explore, plan and conceptualise powerful use cases for blockchain technology. One of the biggest outcomes of the event was the recognition of many practical use cases for heritage, tourism, and culture, which at the time had very little blockchain integration.

The Virtual Engineering Centre has since worked with St George's Hall to formulate an action plan for developing and launching a Digital Heritage Chain platform. Heritage Blocks will be an open-access architecture, co-created with interested SMEs, galleries, museums, and charities. The team's ambitions are to create an international standard for the digitisation of heritage assets, enabling the creation of new value and supply chains through technologies including NFTs (Non-fungible tokens).

A proof-of-concept has been developed, which includes an NFT minting service using the Hedera blockchain platform and a front-end portal to allow the public or heritage organisations to buy, sell and share Digital Heritage content. This concept application is the start of an exciting new era of heritage preservation, protection and online visitor economy.

08

BUILDING MONITORING AND DATA MAPPING FOR GREATER SUSTAINABILITY

Sensors, Cameras, and Internet of Things technology have become much more integrated with industrial supply chains over recent years. The Virtual Engineering Centre and the LCR 4.0 projects have been key drivers of the adoption of these tools in the region, across various sectors, such as manufacturing and logistics. However, there are clear benefits for heritage sites to also adopt the technology to support facility management, data mapping and sustainability.

Non-intrusive technologies and building sensors can be placed around visitor experiences to capture vision algorithms and live visitor movement mapping for identifying popular areas of interest and streamlining the visitor experience for improved satisfaction.

Open-source data can also be used towards creating a Data mapping interface that can visually highlight on a regional and national map, the exact location of heritage assets and locations. Combined with several variables that can be simultaneously altered, the digital interface can highlight a number of contributing factors towards the differing causes of popular use and neglect of assets across Liverpool.

Purpose

- Supports the preservation of digital heritage
- Enhances collaboration between different institutions toward the promotion of heritage assets to improve interactivity and community support
- Provides a tool for policy makers and businesses to identify, plan and execute new ideas

Benefits

- Document the exact locations of historic locations, buildings and venues
- Map and visualise heritage impact areas across the Liverpool City Region
- Interface with heritage sites through IoT and Sensors
- Enhance data collection for improved decision making and visitor experience
- Identify areas of concern or areas of need for improvement, altering and modifying through variables for multi-purpose and use
- Clear and visual communication tool, which can make quick and easy recommendations for further action and impact
- Expand the map beyond the Liverpool City region for wider comparisons

CASE STUDY 08

Digital Heritage as the Driving Factor for Change Across Areas of Deprivation In Liverpool

St George's Hall approached the Virtual Engineering Centre and their industrial Digitalisation Team regarding a previous data mapping exercise they had undertaken through the University of Liverpool's Centre of Excellence for Sustainable Food Systems, which explored and visualised readily available regional data for categorising access to healthy food for residents across the City of Liverpool.

Using this concept, the VEC adapted the existing digital interface and inputted additional open-source data regarding the location and information of heritage assets and locations across the city. Renowned for being 'England's finest Victorian City', Liverpool's heritage dataset included over 2,500 listed buildings, which could be plotted against geographic information.

Other data that was inputted into the system included deprivation variables that were directly linked to income, employment, education and skills, health and disability, crime, living environment, and barriers to housing and services. According to the Indices of Deprivation 2019, for average rank, Liverpool is considered the 4th most deprived local authority in England.

This interactive map can help to identify the heritage sites across more deprived neighbourhoods as part of the Managed Development of the Liverpool City Region. The digital tool can then place these assets against the deprivation factors within the area and sub-regions of the city, offering and indicating specific scores that can be used for generating benchmarks and comparisons of levelling up endeavours.

This can highlight the potential for promotion, but also areas and sub-regions for preservation and what improvements can be met in the region for residents, local communities and even visitors, as part of a wider digital strategy. Analytical tools like this help to showcase Liverpool's unique history and significance and outline how digital heritage can be a driving factor for change and a key pillar for new, innovative, and digital supply chains in the age of Web 3.0.

09

HERITAGE AS A TOOL FOR EDUCATION THROUGH ENGAGING IMMERSIVE EXPERIENCES FOR IMPROVED LEARNING

Creating an exhibition that connects to audiences through immersive material and content can massively improve the levels of engagement from and for audiences.

Using technology that utilises tools for showcasing realistic visuals, a range of sounds and even immersive environments can help in bringing an exhibition to the forefront of the audience's imagination and can appeal to a wide range of visitors across generations, backgrounds, and interests.

Immersive exhibitions can support Heritage leaders and visionaries to bring exhibitions to life using technologies such as virtual reality, augmented reality, photography, film, soundbites and more. Here, we can become moved by local architecture, see cities come to life through time, experience and heritage as art, helping re-imagine physical spaces as the hosts to history and future stories.

Bringing the History of Liverpool to Life

St George's Hall is considered as one of the finest neoclassical buildings in the world. It is iconic to the Liverpool landscape and ecosystem and is steeped in history and historical significance. St George's Hall prides itself on sharing the stories of not only Liverpool, but of the people who have created the city.

In addition to the stunning Great Hall and famous Concert Room, St George's Hall is also home to historic courts and prisoner holding cells for those awaiting their fate at the hands of justice.

The St George's Hall Experience: The History Whisperer brings together expertise and capabilities from Gazooky Studios, Music in Mind and Immersive Interactive. It is a truly unique journey allowing audiences to submerge themselves within 1850's Liverpool as they experience the harsh realities of the Victorian Justice System.

The History Whisperer™ is funded by the Department of Culture, Media & Sport and commissioned by the Liverpool City Council. The exhibition provides a mixed reality experience, capturing and sharing some of the unique stories from Liverpool, the residents and those who have passed through, leaving their legacy forever.

The exhibition is set deep beneath the 'public' spaces of the hall, in the cells and courtroom. Exploring Liverpool's unique social history, it allows audiences to follow a 'Livie', a twelve-year-old girl, giving audiences an immersive experience of what it was like to live through prison life. Audiences follow Livie and her family as they face a crucial trial that will change their lives forever. The story is told through the use of interactive walls which come to life as you touch them, animated photos, immersive music, videos projection-mapped onto walls and ceilings, and Augmented Reality – characters walking out of walls to stand next to you. All experienced in the exact locations where they would have spent their time.

It's a unique visitor attraction, which marries the architecture of an iconic building with BAFTA award-winning storytelling and cutting-edge technology.

The History Whisperer has proven to be extremely popular with nearly 2,000 tickets being sold within the first 24 hours of the attraction being launched, suggesting the huge popularity and interest in an innovative experience, offering something different to audiences which brings the exhibition to life.

LCR4.0 Holistic can support creative SMEs and heritage practitioners within the Liverpool City Region to collaborate with museums, galleries, libraries and exhibit spaces to create digitally immersive visitor experiences, like The History Whisperer.

Andrew Borland, Head Of Commercialisation

Virtual Engineering Centre

The Virtual Engineering Centre is thrilled to be working so closely with St George's Hall in bridging the gap between cultural sectors and digital, adopting our unique experience and knowledge to the preservation of such unique and valuable assets, which really are a part of our history.

It has been a privilege to work with SMEs and Heritage Practitioners to sow the seeds of a truly novel approach to the sector and see a new supply chain and innovation ecosystem begin to form. The uptake and interest from businesses large and small across the Liverpool City Region for exploring how we can create and develop a new supply chain that provides a new paradigm for inclusive economic growth within our community has been inspirational.

Emerging digital technologies including AI, advanced sensors, visualisation, and immersive tools truly are helping us to level up and increase interest and visitor access to these areas which can only benefit the ecosystem for educational and financial gain.

The University of Liverpool is helping to develop a digital strategy for the future of this city's heritage ecosystem to ensure we remain as connected as ever to not only these sites, but the history we have seen unfold and those people connected to it.

LCR4.0
HOLISTIC

European Union
European Regional Development Fund

NORTHERN POWERHOUSE

Delivering the first Liverpool City Region wide digital supply chain ecosystem for SMEs

LCR4.0 HOLISTIC is delivering the first city region-wide digital supply chain ecosystem; cross-linking traditional supply chains and clusters to create a city region supply chain network offering greater business resilience, growth opportunities and diversification that will facilitate greater innovation in products and services and a unique proposition for inward investment and export post-COVID & Brexit.

Our team will help your business to overcome industry challenges and barriers by improving visibility with analytical insight to enhance productivity, efficiencies, confidence and drive practical and cost-effective solutions.

Next steps

With funding from the Liverpool City Region Combined Authority, Liverpool's iconic St George's Hall and innovative Virtual Engineering Centre (VEC) will pioneer a new approach to preserving, promoting and progressing cultural heritage through technologies such as AI, Blockchain and the Metaverse.

A Digital Heritage Foundry

Located at St George's Hall, a first of its kind, hub to fast-track R&D in the heritage sector and grow a dynamic new supply chain with the help of the ERDF-funded LCR Holistic project. The Foundry, which replicates an established model of collaboration from Silicon Valley, will offer access to immersive, sensor, robotic, and simulation technologies and support from VEC's digital engineers.

Digital Heritage Strategy

Finally, the partners will be working together to develop a Digital Heritage Strategy for the City Region. The Strategy will focus on the themes of heritage preservation, the promotion of its value, lessons for new generations, and the progression of history as a driver of inclusion, education and enterprise.

Pioneers of the Digital Heritage supply chain...

- ActiveAV
- Bbloock
- Capture VR
- Chataway
- Draw and Code
- Gazooky Studios
- Immersive Interactive
- MMA Design & Project Management
- MSP Global AV
- Music in Mind
- RFIDiom
- The Brain Charity
- University of Liverpool, Department of Archaeology, Classics and Egyptology
- University of Liverpool, Management School
- Vaadhoo Media
- Viz Box Sensory

Notes

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ST GEORGE'S HALL

UNIVERSITY OF LIVERPOOL

Liverpool City Council