Living Digital Heritage Conference 2021

Integrating the Past into the Present and Future

Friday 5 November – Sunday 7 November

Paper Abstracts

Contents

Convenor's Welcome

Welcome to Living Digital Heritage (LDH) 2021! This inaugural conference, with its focus on the virtual aspect of heritage, has come together and exceeded all expectations. I'm excited to be offering this diverse programme, which highlights the many ways in which the application of virtual technologies continues to evolve and make positive contributions to our lives. We were deliberate in our formulation of the theme "Integrating the Past into the Present and Future" to raise the profile of virtual and digital approaches and to demonstrate their primacy in the engagement with our precious heritage. In this we have succeeded – we have been able to offer speakers and keynotes who will address issues ranging from VR/AR to Virtual Worlds and the application of Legacy Data. We trust you will take the opportunity to share ideas with colleagues from all places, to find new ideas to challenge yourself, but also be a part of the continuing promotion of the utility of Virtual and Digital methods for the myriad heritage issues we constantly need to address.

We are delighted and honoured to have received such a high number of quality submitted abstracts for this year's conference. We hope you take the opportunity to reflect on the presented research, practice and applications and find inspiration to further develop your own applications of virtual and digital methods to heritage. We encourage collaboration and there are a variety of sessions, so please make a point of attending a paper outside of your usual domain. We promise you will learn something new!

Thank you for attending this inaugural conference. We hope it keeps the passion for your academic pursuit or profession alive and will motivate you to continue the promotion of this all important domain!

Dr Frederick Hardtke
LDH 2021 Convenor

First Nations and Digital Mapping: Return Reconcile Renew and Māori Maps

Winsome Adam[1], Lyndon Ormond-Parker[1], Paul Tapsell[2]

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Mapping and Cartography is associated with the expansion of colonial and eastern empires, however, modern mapping tools and technologies have significant potential to support First Nations in reclaiming narratives and geography, and connecting information and records to people and place. This presentation will pivot around two case studies – the Return Reconcile Renew repatriation archive (an evidence base of information and records regarding the removal and return of Indigenous Ancestral Remains, brought together to support repatriation and reburial practice. See: https://returnreconcilerenew.info/) and Māori Maps (an online mapping tool to support Māori descendants -particularly youth- in reconnecting with their tribal communities of origin, or marae. See: https://maorimaps.com/). Exploring the opportunities and challenges of mapping in First Nations contexts in Australia and New Zealand, this presentation will examine issues of usability, security and sustainability, looking at how two discrete First Nations-led digital resources are utilizing maps to further the relevance and reach of their respective projects.

Longhouse 5.0: A Simulation of Indigenous Construction and Life in the 14th Century

Namir Ahmed[1], Vincent Hui[1], Kris Howald[2], Michael Carter[1]

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As part of an ongoing process of investigation, consultation and education Canada is coming to terms with its treatment of its indigenous population. As part of this response Ontario Universities are implementing indigenous practices and education as a core component of curriculum through a variety of strategies.

In this paper we describe one such approach. In partnership with the faculty of Architecture, and the Huron-Wendat nation, a VR simulation of prehistoric (pre 1550) Southern Ontario is in development to allow students and faculty the ability to explore an indigenous Huron-Wendat city through the lens of cultural practices and building construction methodology.

The core development team is experienced in both cultural resource management and media production. We employ these competencies throughout each stage of the project. Here we describe the development process, decisions made while engaging stakeholders and industry professionals. We describe our use of Unreal's Metahuman and cultural sensitivities that must be considered. We describe game design decisions and narrative while incorporating the needs of our Indigenous collaborators.

The process of development for effective and engaging digital media is challenging. We summarise with 'lessons learned', recommendations for other such projects and our own understanding of best practices gained.

Lanchester petrol-electric car: Gamification and storytelling

Saif Alatrash[1], Kaja Antlej[2], Sylvester Arnab[1]

[1] *Coventry University, UK*
[2] *Deakin University, Australia*

During the era of COVID-19, restrictions around the world has limited our access to museums and exhibits. The impact of this catastrophic event left many institutions behind, and many may not be able to recover due to the lack of financial support. However, many museum institutions start to implement VR technology as way to communicate their contents with their visitors around the globe. My research investigates the integration of VR technology as an instrument to communicate our engineering heritage through storytelling and gamification approaches to facilitate interaction within the museum environments. We chose the petrol-electric car developed in 1927 as the main museum object for the investigation. The VR experiments includes three different scenarios to measure the user interaction, immersion, and learning outcome during the visits. To enhance the experience for the visitors a framework model based on previous theory of communications has been developed towards providing a meaningful interactive experience within the museum environments. Around 70 participants have been recruited during the beta testing phases at the Transport Museum in Coventry as a part of the UK city of culture celebration.

Museum futures: extended reality heritage experiences in the age of human expansion in space

Kaja Antlej[1]

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Up until recently, museums were mostly involved in space exploration through collecting and exhibiting space-related objects including technical heritage and memorabilia. In relation to audience engagement, the main purpose of space museums is still often seen as a vehicle for STEM (science, technology, engineering, mathematics) outreach. With digital transformation, entrepreneurial innovation-driven movement of NewSpace and consequent democratisation of the previously closed space industry, long-duration human expansion beyond the low Earth orbit towards the Moon and Mars may become a reality in near-future. What is the role of museums and GLAM (galleries, libraries, archives, museums) sector in creating a holistic transdisciplinary approach towards a spacefaring society? How can extended reality (XR) and similar three-dimensional (3D) technologies support these memory institutions? Various geologists, archaeologists, lawyers, architects and heritage professionals are exploring ways to preserve geological and human heritage in outer space and on celestial bodies to ensure a sustainable environment and inspiration for future generations. This presentation discusses another potential role of heritage. How meaningful and engaging museum content in a form of gamified immersive XR experiences could ensure and maintain EPIC (emotional, physical, intellectual, creative) Resilience (Dominguez) of astronauts and people living and working in an isolated confined environment off-Earth.

The Nea Paphos Theatre in 3D: the use of VR modelling in research, education and promotion in Cyprus

Craig Barker[1]

[1] *Chau Chak Wing Museum, The University of Sydney; Paphos Theatre Archaeological Project*

The University of Sydney's Paphos Theatre Archaeological Project has been excavating the World Heritage listed archaeological site of the ancient theatre of Nea Paphos since 1995. The work is conducted on behalf of the Department of Antiquities of Cyprus. The theatre underwent numerous architectural phases during its six centuries of use in antiquity. This was a concept often difficult to convey to a wider audience who could only see ruins; especially once the concept of restoring the theatre structure for modern performances was raised.

Since 2017 the project has been working with Melbourne-based Lithodomos who produced a VR model of the Antonine phase of the theatre's history (c. 150-180 AD). This work was created as part of the project's contribution to Paphos' hosting of the European Capital of Culture program, where the immersive experience was first displayed. As well as the reconstruction forcing the project's architects and archaeologists to reconsider aspects of the stage building, it gave us a remarkable educational and promotional tool that has been used in both Australia and Cyprus. This presentation will review how we have used the VR model for those purposes and examine our plans for further visualisation model in the future of the excavation.

Ready to view like never before: the historical maps of the Lepsius-Expedition to Egypt 1842-1845

Susanne Binder[1]

[1] *Macquarie University, Australia*

The results of the 3-year expedition to Egypt and Nubia was published in 12 monumental folio volumes with a total of 894 plates (1849-1859) and 5 volumes of text. The enterprise, instigated by Alexander von Humboldt, was pioneering for the high standard of recording achieved by the team of architects and draughtsmen with Richard Lepsius. Their goal was to document the ancient monuments also in their architectural and topographical context. Today, the Berlin-Brandenburg Academy of Sciences and Humanities curates the expedition archive. One of the expedition diaries was discovered in Australia, and the Weidenbach-Diary Project has allowed for high-resolution scanning of the eight folio-size lithograph maps from the *Denkmäler aus Aegypten und Aethiopien,* volume 1. These historical maps are testimony to 19th century cartography but also international and inter-disciplinary collaboration. With 21st century technology, the maps are brought out to view like never before. These maps can now become the "eye-opener" they have always been: providing access to a wealth of topographical, historical and socio-cultural information with a high level of detail and in a density so far hidden from view.

Virtual Angkor: Reconstruction, Animation & Virtual Reality

Tom Chandler[1], Mike Yeates[1]

[1] *Monash University, Australia*

This presentation explores the construction of evidence based virtual worlds and how they are perceived in three modes; interactively, in virtual reality, and through rendered animations. The test case for this discussion is a large scale virtual model of the medieval city of Angkor in Cambodia, which we have gradually and iteratively developed at Monash University since 2009. In particular, we will overview how an extensive library of static and animated 3D models can be reorganized for these different formats in the Unity Game Engine. While there are advantages and pitfalls in each of these modes, we argue that the most recent technologies are not always the best. In some cases, such as the concise visualization of historical excerpts from eyewitness accounts, the 'old' format of rendered, non-interactive animations retain condensed, time limited perspectives that are uniquely suited to the exploration of the sources.

Additionally, instead of dealing with historical monuments and artefacts as isolated digital reconstructions, we will venture how the visualization of a past society can benefit from a more holistic approach; one that incorporates the ecological context of the reconstructions, their environmental soundscapes and the animation of the populace and its ambient fauna.

Museums: new technologies and museological approaches in post-covid times

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Cultural heritage has an essential role in people's communication, social inclusion, as well as in economic regeneration.

The U.N. Conference on Sustainable Development, *The Future We Want*, at Rio de Janeiro, in June 2012, highlighted the importance of cultural diversity and the need for a more holistic and integrated approach to sustainable development.

Unfortunately, Covid-19 pandemic crisis had a huge impact in economy and society, leading to the apparent need for reinventing the common values that connect people worldwide, thus becoming a catalyst for positive changes. The "new normal" as shaped out in our times has made clear that digital technologies show the way out. Accordingly, museums, in order to successfully cope with the new, unprecedented, conditions, have adopted, to a large extent, *new technologies*, mainly the ones of digital social networks and virtual reality, ending thus up in redefining the basic principles of museology and museography. In the current context, cultural infrastructure, museums and other cultural facilities are proved to function as virtual spaces for political dialogue and social inclusion, thus enhancing social cohesion and maintaining the link of society's communication with culture even in unforeseen extreme situations, like a lockdown.

This paper explores different aspects of emerging digital museological approaches, as well as their impact in museums' future strategic planning.

Digital cultural heritage theory: ghosts of objects past or bogged by binaries? A Macquarie University perspective

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Macquarie University heritage includes the campus landscape and history, objects that make up the university's museums and collections and how they are used in teaching, research and engagement; a combination of the tangible and the intangible. Material culture theorists articulate objects as decontextualized when collected, then re-contextualised in a museum collection. This establishes the principal binary of object and context underpinning museum epistemologies. By extension, the process of exhibition work involves the confluence of selected objects as cultural production, where the outcome is a newly accreted, multifaceted 'object'. The increasing use of digital avatars establishes a material / immaterial binary. However, the university has some early examples of born digital 'objects' in its collections including the pioneering holographic work of Paula Dawson and more recent media works by collectives such as TeamLab. Today, any physical object can be converted into binary data. This presentation uses Macquarie University examples of objects and exhibitions to explore the question of whether the museological concept of the object is still theoretically viable in an age of evolving technologies, massive datasets and co-creation. Is digital data subject to analogue interpretation? Is digital 'object-hood' a conceptual contradiction?

Rākau momori: Modelling Chatham Island tree markings

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Rākau momori are trees with ancestral Moriori karapuna images and other motifs that were marked in the living bark. Few remain in the kopi trees stands on Rēkohu (Chatham Islands), 800 east of the Aotearoa New Zealand mainland. Those rākau in situ are subject to natural degradation; others have historically been 'recovered' and removed to museum collections. A significant collection of the treasures are held by the Otago Museum who working with Moriori and university partners have produced 3D models to aid conservation assessment and interpretative opportunities with the distant Chatham Islands community. The collected rākau are sections of trunk about 1- 2.5 m high with the shallow '2 dimensional' designs marked around the curved bark surface. Modelling twenty rākau has been the first project of its kind in Otago Museum applying 3D recording to this size of cultural treasure. The project is evaluating the effectiveness of photogrammetry compared to laser scanning for this particular scale and character of artefact, and is exploring the utility of models for heritage projects and community when shared.

Bringing the field to the screen: A virtual field trip in the age of lockdowns

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Earth Sciences is tactile, reliant on physical interaction with rocks in the field and laboratory. COVID-19 limited face-to-face learning (including fieldwork) and challenged us to create a virtual field trip where students work through nine sites, using interactive, fully rendered, high-resolution, 3D rock models. The aim is to enhance skills in rock identification and gain insights into geological processes. Students reflected on the virtual fieldwork in a blog. While most students were disappointed about missing live fieldwork, they were appreciative of our effort to develop an engaging, detailed, and clear website. They enjoyed working in small (<9 students), tutor-guided, virtual groups and consolidated and made connections with prior learning. They reflected that the trip was challenging, enjoyable, and highly engaging and one suggested the site will be a valuable resource to revisit during their studies. The most difficult aspects of the field trip were determining scale of geological features compared to experiencing them in real life and constructive suggestions included to split the field trip over multiple days.
Though the COVID-19 pandemic was the driving force for us to create the virtual trip, on-going benefits include increased accessibility. The website serves as a template to bring similar field trips on-line.

How Real Is Too Real? Immersion, Empathy, and Digital History

Tamika Glouftsis[1]

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Historical educators and heritage professionals often attempt to use digital media, VR, and augmented reality experiences to vividly immerse the public in the events of the past. The hyper-immersive qualities of digital media have profound implications for the epistemology of ludic history. If historical experiences are absorbed by players as unmediated experiences, how does that affect their understanding of the relationship between themselves and the past? How does it influence their ability to think critically about what it is that they (virtually) experienced? Many have assumed the pedagogical value of digital immersive history without fully interrogating its consequences, particularly in the realm of fostering historical empathy.

This paper will investigate the immersive qualities of digital media through the lenses of empathy and critical thinking. Drawing on Alison Landsberg's theory of 'oscillation' between closeness and distance in historical media, I will argue for a model of historical engagement that goes beyond immersion.[1] Through examples from VR and video games, this presentation will examine how interactive digital media can use immersion in tandem with cognitive distanciation to provoke a complex, sophisticated mode of historical engagement.

[1]Alison Landsberg, *Engaging the Past: Mass Culture and the Production of Historical Knowledge*, Columbia University Press, 2015.

A new turn in heritage diplomacy: "Intimate" and "mobile" museum diplomacy

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This article identifies and describes a new turn in museum diplomacy in the processes of increasing digitalization that started several decades ago with museum creating their online presence and collections going digital. In the past two decades, the global media environment enabled a more sporadic and non-commissioned cross-cultural interaction among communities, museums, artists, and heritage objects. Online spaces created by museums have become important media channels for projecting cultural and political discourse beyond national borders creating new avenues for cultural/heritage diplomacy.

In the past two years these development trajectories inescapably reinforced. Drawing on several case studies of virtual museum engagements implemented during the Covid-19 global outbreak, my presentation will explore and illustrate two important trends that were strengthened in the condition of the pandemic. First, it will argue that recent digital museum innovations accelerated and further legitimized digital diplomacy. Second, it will demonstrate that the pandemic prompted a new cultural experience of heritage collections that is more "intimate" and customized to audiences' expectations and needs than it has been ever before. Focusing on DYI movements on museum social media as well as several VR and AR applications that went viral, the presentation will explore museums diplomacy that reaches people through their mobile phones and allows a creative play with cultural heritage beyond the museum physical or even virtual walls.

Deploying Legacy Data at an Egyptian Rock Art Site

Frederick Hardtke[1], Susanne Binder[1]

[1] *Macquarie University, Australia*

Many archives exist around the world, of archaeological data collected over and decades and even centuries, captured at times where landscapes were markedly different and archaeological remains less disturbed. Current archaeologists are keen to redeploy this "legacy data", given the selective and destructive nature of their methods of data capture. Legacy data comprises material and records that been assembled over decades, sometimes centuries, often by means and for purposes long since outdated. The field of rock art research, similarly, looks to archives of rock art recorded before disturbance of the art itself through the impact of natural or deliberately destructive forces. Egypt is noteworthy for its long history of archaeological research, which has left behind a vast corpus of legacy data. Egyptian rock art is no different and was noted by Egyptologists from the 19th century, with the first dedicated research missions led by Leo Frobenius in the 1920s and H.A Winkler in the 1930s. While subsequent missions in recent times continue to amass data, it is those from the early last century which have particular interest since the legacy data accumulated is from an Egypt far different to the one today, with regard to landscape modification and increased population. Here we explore for a particular Egyptian rock art site, how legacy data can be reused, improved upon, integrated and re-interpreted.

Bridging the gap: preserving Pacific language and music heritage for present and future access

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[2] *University of Melbourne, Australia*

Most recordings in languages of the Pacific made in the past came from the work of academic researchers, because recording equipment and consumable analog tapes were not commonly available. The task of locating those recordings now and of making them available to the people represented in them is becoming more urgent as the apparent deadline for the playability of analog tapes approaches in 2025. The Pacific and Regional Archive for Digital Sources in Endangered Cultures (PARADISEC) is a research repository that explicitly aims to act as a conduit for research outputs to a range of audiences, both within and outside of academia. PARADISEC has been operating for 19 years, and has grown to hold over 344,000 files currently totaling 140 terabytes and representing 1,291 languages, many of them from Papua New Guinea and the Pacific. In this paper we will discuss the living heritage contained in PARADISEC's current collection, and how digitising legacy recordings and making them accessible to Australian Pacific diaspora communities and cultural agencies in the Pacific keeps recordings made in the past connected to the present.

"It's Not Accurate, But It Usually Feels Authentic": Player Perceptions of Accuracy in the *Assassin's* series

Abbie Hartman[1]

[1] *Macquarie University, Australia*

As undoubtedly one of the most well-known and widely played historical video game series, *Assassin's Creed* (Ubisoft, 2007- 2020) has an immense cultural influence on the public's perception of history. While Ubisoft's rhetoric is of historical accuracy, a closer examination of this series reveals that the medium of video games mediates this claim. Video game developers must compromise accuracy due to the presence of player agency, which inherently changes and shapes the history presented, and the need for games to conform to pre-existing ideas of historical events to appeal to non-academic global audiences.

However, this doesn't mean that the *Assassin's Creed* series has forgone historical research, nor does this mean that there are no attempts at being 'approximately accurate.' Ubisoft encourages players to understand these games as authentic reconstructions of history and to embrace the opportunity to experience a lived version of the past. This paper examines how Ubisoft utilized concepts of historical accuracy during the development of their three latest games (*Assassin's Creed Origins, Assassin's Creed Odyssey* and *Assassin's Creed Valhalla*), and why it is necessary to discuss these games and their influence on perceptions of the Ancient world.

The Emergent Archive

Geoff Hinchcliffe[1]

[1]*Australian National University, Australia*

This presentation focuses on the Corley Collection Explorer, a web interface to the State Library of Queensland's Frank and Eunice Corley Collection, comprising a set of over 60,000 photographs documenting 1960s and 70s suburban Queensland houses: a husband-and-wife Google Street View team, shooting on 35mm film and developing prints in a Bedford van.

The Explorer website has been highly successful, garnering media attention and extensive audience involvement resulting in the geocoding of over 49,000 images. One of the most surprising and pleasing aspects of the project has been the thousands of audience-contributed stories which reveal the rich lived histories of homes featured in the collection. Where the interfaces for geocoding and tagging were tightly constrained, the stories interface was far more open-ended and allowed audience members to contribute unstructured text and photos. Unlike typical forms of crowd sourcing (geolocation, tagging), the stories did not seek to fulfil any particular task and instead sought to facilitate a community conversation around the collection items. More than mere annotations, the scale and richness of the audience stories demand attention as a kind of emergent archive, and also ask us to consider the challenges and potentials of facilitating and hosting community contributions and storytelling.

Evaluating Empathy in Realistic and Non-Photorealistic Virtual Reality Museum Experiences using Eye Tracking

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In recent decades, the focus of museums shifted from displaying objects to communicate ideas. Virtual Reality (VR) present the opportunity to engage museum visitors with the heritage content to develop empathy. An empathic connection in VR is able to spread awareness and illustrate the different perceptions regarding a phenomenon. The studies indicate that immersive virtual experiences result in variable levels of empathy depending on the communication media and levels of realism. However, most of these studies were evaluated using self-reporting and physiological tracking measures which may be prone to bias. Therefore, this research investigates how empathy can be measured using eye tracking integrated into VR headset as a physiological data collection complementing psychological surveys. The study also aims to explore how different levels of realism affects user empathic concern and perspective-taking in a museum context. As a case study, the manufacturing heritage of a post-industrial city of Geelong in Australia is used to explore how empathy can be developed towards the engineering sector. The preliminary results of the community and stakeholder surveys show that due to limited exposure to advanced manufacturing initiatives many locals still perceive engineering in a traditional way as "dirty" and "noisy".

Digital Preservation at an Egyptian Rock Art Site – an Overview of Techniques

David Johnson[1], Frederick Hardtke[2]

[1] *Independent researcher*
[2] *Macquarie University, Australia*

We live in constant fear that our rock art and other heritage sites will one day be subject to destructive interference or outright destruction. This risk of potential disturbance highlights the need to exploit modern technologies to the maximum extent for their recording and preservation. Rock art is particularly vulnerable in this respect as it has an enduring presence in the landscape with usually minimal safeguards. It is also a particularly challenging medium to capture and requires special techniques to facilitate its research as compared to other archaeological pursuits. This paper will present some of the techniques deployed at a vulnerable Upper Egyptian rock art site, specifically, the rapidly deployable method of high fidelity 360 degree panorama capture and the use of D-Stretch in combination with 3D modelling currently being deployed at the site to capture the relative placement of rock art panels and provide possibilities for deeper analysis.

The Archaeology of Dark Souls

Thomas J. Keep[1], Mia Nie[1]

[1] *University of Melbourne, Australia*

The Dark Souls series of videogames is renowned for its complexity and difficulty, but utilizes a unique mode of storytelling which may be of interest to archaeological digital content producers. By providing lore through item descriptions, rather than explicitly stated in cutscenes or dialogue, the game effectively creates archaeologists of the players, requiring those invested in understanding the world to hunt for clues, make inferences based on the context of item placement, and read the remains of architecture within the game world to make sense of a fragmented history. As digital and virtual representations of heritage proliferate in the post-digital and COVID era, content producers will need to take cues from video games developers if they wish to create truly engaging experiences which not only present information, but provide users with a sense of building comprehension and developing understanding of the relationship between material culture and knowledge. I contend that the mode of storytelling employed in the Dark Souls series provides a template which could be of use for such experiences.

The Hellenic Museum Digitization Project

Thomas J. Keep[1]

[1] University of Melbourne, Australia

The Hellenic Museum Digitization Project was an internship project undertaken by Thomas J. Keep in collaboration with the Hellenic Museum of Melbourne, facilitated by the University of Melbourne through APR Intern and the Research and Development Internship scheme of the Federal Government. Through the internship, a catalogue of 3D digital surrogates were composed from the material collection of the Museum using photogrammetric modelling, and made publicly available via the online platform SketchFab. The age of COVID, has exacerbated long standing problems of the accessibility of cultural heritage collections to the public, and brought to light the need to make heritage easily available, engaging, and interpretable to a variety of audiences. This project represents an application of photogrammetry in the interests of engagement and public outreach, rather than field recording for academic and professional communities. This presentation will discuss the methodology, challenges, motivations, and outcomes of the project.

Waumananyi: the song on the wind - VR project - mental health from an aboriginal perspective

Volker Kuchelmeister[1], Jill Bennett[1], Lisa Stefanoff[1]. Co-designed with Uti Kulinjaku (NPY Women's Council)

[1] *UNSW Art, Design and Architecture, Australia*

fEEL – felt Experience and Empathy Lab

The project explores mental health and healing from an Aboriginal perspective. Created by the acclaimed collective project Uti Kulintjaku (UK), formed from the Ngangkari traditional healers and artists of the NPY Women's Council, the UK addresses community issues of mental health from both Aboriginal and Western perspectives. Working with UNSW felt Experience and Empathy Lab feel, the team have created a virtual reality work, sharing their healing practices through creative visualisation. Waumananyi: The Song on the Wind is an Anangu-led response to the experiences of constraint, entrapment and depression through the traditional story of The Man in the Log.

The virtual reality experience asks 'what is it really like to be physically and mentally trapped in a space that you can't escape from?' In this case you can see through holes in the log and you can see people you love and people in your community, but you can no longer connect with them. It became a profound metaphor for incarceration, separation, addiction and that sense of powerlessness that many people experience.

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3D in the Time of Covid: Reconstructing a Real-World Location Based on Limited Digital Resources

Angel Leelasorn[1], Katrina Grant[1]

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This paper will report on a project to apply methods from the video game industry to the reconstruction of a historic garden. This project has two main aims.
The first is to create a 3D model of the amphitheatre in the Boboli Gardens in Florence, which was a site of spectacle for many centuries. A high-quality 3D model, optimised for a game engine [Unreal Engine 5], will allow users to experience the site from anywhere and can then be used for reconstructing the layout of past performances.

The second aim is to develop and document a workflow for the 3D modeling of historic spaces based on documentary sources such as photographs, maps, plans and drawings. Although this site still exists and, pandemics aside, it could be modelled using a technique like photogrammetry, many similar sites from this period (and earlier) have vanished. The advantage of using an extant site is that the accuracy of the model can be compared to the real thing, and the workflow adjusted to develop a best practice approach. This will involve a careful balancing of accurate recreation with informed best guesses based on fragmentary sources, a technique that can then be used for vanished historic places.

Panel: Digital 3D object-based learning and research at the University of Melbourne

Ben Loveridge[1], Ben Kruenen[2], Naomi Mullumby[3], Rita Hardiman[4], Monique Webber[5], Mitch Buzza[6]

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[2] *Digitisation Technical Support Officer, Student and Scholarly Services, University of Melbourne, Australia*
[3] *Faculty Librarian, Architecture Building and Planning, Student and Scholarly Services, University of Melbourne, Australia*
[4] *Senior Lecturer, Oro-Facial Anatomy, Melbourne Dental School, Australia*
[5] *Teaching Specialist, Ancient World Studies, Historical and Philosophical Studies, Faculty of Arts, University of Melbourne, Australia*
[6] *eTeaching Training and Support, Faculty of Arts, University of Melbourne, Australia*

Continuing advancements in technology has created an increasing need to retain, manage and deliver 3D digital assets, either scanned or 'born' digital. This applies equally across the areas of teaching and learning, research and cultural collections at the University of Melbourne. This session will provide an overview of how the University of Melbourne is facilitating digital object-based learning as well as discussing the challenges of creating 3D models and coordinating scanning services. It will also provide an insight into how gaming technology is currently being used in teaching and learning activities. Topics include:

- Digitising the Miles Lewis Collection project
- Preservation and conservation of biological collections
- Challenges creating and acquiring a 3D scanning service
- Digital object-based learning, equity, and workplace skills in Ancient World Studies
- Incorporating game technology in Ancient World Egyptian studies

Narratives of Affect: Living Virtual Heritage as Embodied Interactive Storytelling

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What is that turns Virtual Heritage into a *living virtual heritage experience?* The word *virtual* is often associated with technology used to fashion immersive engagements. However, we propose that postmodern philosophical perspectives can scaffold a more rigorous conceptual framework for discussing immersion, interaction and affective narrative formations as lived virtual heritage events. By focusing on embodied and immersive interactive storytelling this paper proposes that Narratives of Affect are the key to creating the embodied experience of living cultural heritage. By adopting this perspective, virtual objects become portals of Affect with which to engage and interact within immersive worlds. Through this lens, the immersive narrative event emerges as an enlivened experience of affective virtual heritage.

Key to our analysis of embodied living virtual heritage is the prototype *Wangurri Virtual Museum (WVM)*, a virtual heritage work from NE Arnhem Land designed for VR. WVM focuses on an Indigenous cultural object's affective heritage qualities. We will discuss it along with other works, through a framework of affective spatial computing and review key philosophical concepts already familiar to researchers of interactive virtual environments such Phenomenology, the philosophy of individual experience, as the posthuman aesthetic of new materialism that affords Living Heritage Narratives of Affect.

Digital mapping in student assignments. An ANZAC practicum for American students

Jonathan Markley[1]

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The paper discusses practical issues of incorporating traditional student research to be presented in a digital format. The paper discusses the issues of teaching students to use digital mapping, to access archival primary resources, and to present the results. I will focus on one particular assignment, where my students are given a single ship from the NZ Main Body and the AIF that took the first contingent of troops to Egypt in 1914 (prior to the Gallipoli campaign). My Californian students must reconstruct the journey of the ship on a daily basis from when it left port in Australia or New Zealand until the troops disembarked in Egypt, using digitally available archival evidence. The paper discusses the comparative superiority of many Australasian institutions in terms of digital access, and ways in which access could be further improved. The final product of the student work is an interactive map of the ANZAC journey, and suggests a possible approach for museums to allow visitor interaction with exhibits and archival material.

A Digital future for Australia's Convict Past

Hamish Maxwell Stewart[1]

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It is difficult not to be attracted to the nation's convict story. While the lives of most individuals are poorly represented in 19th century archives, convicts are something of an exception. The systems put in place to keep track of the unfree can be retrospectively used to illuminate the lives of the more than 160,000 felons 'who left their country for their country's good'. As one might expect, those records shed particular light on convict interactions with the court system, yet they also reveal so much more. They list the names of the parishes in which tens of thousands of convicts were born. We also know how tall transported prisoners were and how much was in their bank accounts. We even know the colour of eyes and hair. In fact, the records of the convict era are so detailed that in 2007 they were listed on the UNESCO Memory of the World Register. Digital technologies are now helping to unlock this national and international archival treasure. It is possible to map convict lives, trace the routes their vessels took to Australia, the locations from which they bolted in attempts to secure their freedom, and the many ways in which unfreedom on the shores of Botany Bay shaped later life course outcomes. This paper will highlight some of these developments while exploring the ways in which digital technologies can be used to create innovative interactive experiences designed to reengage a contemporary audience with the nation's colonial past.

Virtual Reality and Digital Reconstructions for Maritime Archaeology

John McCarthy[1]

[1] *Flinders University, Australia*

Virtual Reality and Digital Reconstructions for Maritime Archaeology
This presentation will review the challenges and opportunities that digital reconstruction and Virtual Reality presents for the sub-discipline of maritime archaeology, explored through three recent VR projects by the author for shipwrecks, maritime museum collections, and submerged ancient landscapes. Each was created using different software and designs, but all illustrate the specific nature and challenges of cultural heritage in the marine environment. Archaeological remains underwater tend to be highly inaccessible to many segments of the community, due to the cost of travel and dive training, equipment and other factors. The emergence of Virtual Reality as a more popular and accessible technology has therefore been a boon for maritime archaeologists seeking to engage the public with a largely hidden and threatened heritage resource. This has been greatly reinforced by the special value that automated photogrammetry has for underwater survey, increasing survey speed by a factor of perhaps a hundredfold, and also providing much richer datasets to build accurate reconstructions from. The great variety of Underwater Cultural Heritage means that careful consideration must be given to how best to convey the desired message at the heart of each experience, whether that is simply a sense of place or more specific information about the origin of the site.

3D Printed Puzzles for STEM Outreach and Cultural Preservation

Christian Meyers[1], Dr Kaja Antlej[1]

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Tactile learning activities are widely leveraged in educational classrooms, museums, and institutions as evocative and engaging learning resources, particularly with younger students. With the ever-increasing inclusion and availability of modern and innovative technology within these learning environments, students and educators are more encouraged than ever to focus on the new and exciting learning opportunities this technology provides.

For STEM (Science, Technology, Engineering, Mathematics) outreach, 3D digitised assets derived from significant historical and cultural objects can utilise this object based learning platform to provide a valuable foundation for creating improved tactile learning experiences whilst simultaneously facilitating historical preservation, conservation, and user awareness by providing a direct link to the past through modern research and development techniques.

The aim of this project is to develop a 3D printed puzzle of a 1934 Ford Coupe Utility to provide STEM outreach opportunities for early primary school students in the Greater Geelong region. With the history and manufacturing identity of the region overshadowed by a push for innovation, this opportunity presents as one of great value to the community by highlighting the significance of its past innovations and driving the next generation to invest in the skills required to grow that legacy.

Standing Stones and Swarm Robotics: Replication, Re/construction, Preservation

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Sacrifice is a mixed-reality artwork examining ancient and emerging technologies being produced through the interdisciplinary collision of archaeology, mechatronics, performance art and fabrication. The team has designed and built a group or 'swarm' of autonomous vehicles upon which replicated standing stones will be mounted. Envisioned as an interactive installation, *Sacrifice* requires audience engagement with the mobile stone swarm through attention and movement. At the heart of our efforts is a collaboration with a global network of archaeologists and custodians of standing stones from significant cultural sites around the world. Together we are utilising photogrammetric modelling to create 'digital twins' that inform the fabrication of high-fidelity replica megaliths at a distance using theatrical rendering techniques. This multi-directional partnership uses cooperative exchanges and novel technologies to engage and provoke audiences. By recontextualising the stones within an exhibition environment crafted to encourage performative acquisition of embodied knowledge, we explore cultural ownership, identity and appropriation, and draw attention to human trust, cultural practices, and more-than-human collaboration through cultural heritage. The work will culminate in an exhibition at Melbourne Science Gallery in 2022. This talk presents an overview of research and design methodologies, collaborative practice, data collection, preliminary results and ongoing challenges.

Rapid response collecting: The National Museum of Australia and its digital engagement throughout the 2019/2020 bushfire season and the Covid-19 pandemic

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Covid 19 has highlighted the need for museums to have policies and practices in place that allow them to be more responsive to the audiences needs during a crisis, in many cases forcing them to explore new technologies and approaches. Based on an analysis of the National Museum of Australia and its digital engagement throughout the 2019/2020 bushfire season and the Covid-19 pandemic this paper will discuss some of the contemporary logics and mechanisms at play when collecting during a crisis. Referencing "Momentous", a purpose-built web site and two Facebook groups "Fridge Door Fire Stories" and "Bridging the Distance" we explore the content shared on these platforms by users and place this in conversation with the reflections of the cultural workers who created and maintained these online platforms. We suggest that historically museums have long responded to their communities by seeking out new ways to provide collection access but suggest that we are witnessing the emergence of new approaches enabled by technologies that allow communities to take a more active role in negotiating how the museum represents their experiences.

The Greek Villa Project: Using Virtual Reality to bring historical experiences to life and arouse empathy

Bronwen Neil[1], Susan Lupack[1], Deborah Richards[1], Ayse Bilgin[1], Meredith Porte[1]

[1] *Macquarie University, Australia*

Virtual reality (VR) technology can increase prosocial behaviour toward a target person or group by enhancing their empathic response for the subject, but such technology has not always had a positive effect on learning outcomes. This interdisciplinary study compared the potential advantages of delivering the same learning material about daily life, in an ancient Greek household via two modes of delivery: VR technology and classroom lecture. The VR group explored a Greek villa containing historical artefacts and virtual characters with whom they were able to interact through set dialogues. The dialogues illustrated social hierarchies, gender relations, the situation of slaves, cult practice, and religious beliefs. The other cohort received the same information in a classroom environment.

The knowledge gained by both student cohorts was evaluated through a multiple-choice quiz. They also responded to open-text questions designed to test the degree of empathy that was aroused. We found that classroom lecture delivery was significantly superior in terms of the acquisition of factual knowledge, consistent with cognitive learning theory. We identified this as learning with the mind. The immersive VR environment, however, imparted a level of empathic response to the lived experiences of people in ancient Greece; in that sense it allowed learning with the heart. We will share the VR experience with conference participants and discuss some of the issues that arose in designing it for use in a Greek archaeology unit at Macquarie University.

Big Data Bugs: from drawer to collection site through augmented reality

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'Big Data Bugs' is a multidisciplinary project to design and build an augmented reality (AR) app for smartphones to visualise large insect collection datasets to a highly diverse audience including expert researchers, tertiary students and casual visitors. By connecting historic collections to geographical origins we hope to draw attention to the living realities of species in the modern world.

The AR app allows visitors to spatially visualise insect specimens from the geographical collection site and view more detailed information about classification in three-dimensions. In this paper we discuss our flexible design strategy for spatially visualizing and connecting specimens to geographical collection sites. The wide audience base meant the design needed to be flexible to research language and structures of biological taxonomy whilst creating opportunities for the novice to gain familiarity in insect taxonomy and physical geography The Big Data Bugs AR app enables both expert and novice users to engage with complex entomology datasets within a museum environment and via the web through connecting specimens with their habitat and allows for easier investigation of collection items in storage drawers than traditional on-line databases.

Balinese Cultural Heritage: Digital Classification Framework

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Bali and many other countries experience endangerment of large portions of objects and cultural practices and depletion due to poor documentation, largerly tacit, remains fragmented, and cultural heritage knowledge localised within a small group of people in the community.

The focus of our study is to document and preserve both aspects (artefact and practices) of cultural heritage knowledge by developing a digital classification framework. The development of the digital knowledge classification framework is to capture, classify, and organise the richness of Balinese cultural hertage knowledge based on the analysis of the information we gathered through in-depth interviews with selected Balinese culture experts. The analyses enabled us to elaborate on the key Balinese cultural principles (*Tri Hita Karana* and *Desa Kala Patra*) as they relate to Balinese cultural heritage (cultural objects and practices). The first set of concepts, named *Tri Hita Karana*, is a Balinese fundamental belief which includes three factors: universal (*parahyangan*), which refers to harmony with gods; environment (*palemahan*), which refers to harmony with nature; and people (*pawongan*), which implies harmony among people and community. The second set of concepts is called the space (*desa*), time (*kala*), and circumstances or context (*patra*). The *Desa Kala Patra* can be used to explain the variation and diversity of cultural heritage artefacts and practices in Bali.

3D digitisation at scale – Normalising the practice through collaboration, partnership and internship

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At an ever increasing pace, cultural heritage institutions are pushing forward with digitisation of collections for a research, outreach and educational purposes. This usually includes lower order processes such as scanning labels and photographing items and rarely, full 3D imaging. 3D digitization has been traditionally confined to one off or limited selection projects and has had trouble being integrated into large scale digitisation pipelines.

In this talk, the presenter will describe a new approach to this problem that has been developed and road tested at Macquarie University to allow for an industrial scale of digitisation to be planned and executed. Rather than a new push-button technology or new scanning device, this approach has leveraged human capital and the scale opportunities inherent when external and internal collaborations and partnerships are placed center stage.

MQ3DScancorp is a conceptual simulated 3D scanning company developed at Macquarie University. This vehicle takes on clients with a scanning need. It utilises the know-how, facilities and equipment investments of the University. The vehicle staffs the enterprise with student interns interested in upskilling in this area under expert tutelage. The result has been a quantity of 3D digitisation rarely reached before and ready to scale.

Towards an open set of fieldwork photogrammetry protocols

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Photogrammetry is a technology which involves taking many overlapping photos of a subject to produce 3D representations and orthographic projections of that subject using computation. Using Photogrammetry for digitisation of field sites in heritage and Archaeology practice has been steadily advancing over the past 20 years. Photogrammetric approaches have fostered stronger research outputs, quicker and more accurate measurements and drawings as well as high fidelity temporal records of sites. At the same time, the software to produce photogrammetry models has advanced; combined with ever more powerful hardware, the scale and quality of the outputs has improved dramatically.

The authors have had significant experience on digitising a wide range of sites using photogrammetry and hybrid approaches and have also worked closely with researchers and practitioners themselves to develop collaborative and distributed methods for field-based photogrammetry.

Drawing on this background, the authors are developing an open set of protocols to increase the accessibility of this often daunting technology. These protocols enable wider uptake and standardisation of photogrammetric approaches into site capture and documentation in archaeology and heritage. This paper will summarise examples of digital fieldwork, and make the case for a standardised approach to photogrammetry.

Creating the 'Living Museum' for Sustainable Development of the Past in Jordan

Gehan Selim[1], Andrew Holland[1]

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The rapid growth in digital technologies such as 3D photogrammetry, laser scanning and virtual reality are bringing new modes of interaction to the public presentation of Cultural Heritage. In this research, we will present the 'Living Museum of Umm Qais' project, which aims to re-present the complex heritage of the ancient city of Gadara in Jordan through interactive and integrated multi-layered virtual environments. We implemented a proactive engagement approach with the local community to co-produce a sustainable living museum concept that can adapt to multiple narrative perspectives. We consider the projects use of 3D tools such as photogrammetry to capture individual objects imbued with memory and narratives of the site that represent a layer of intangible heritage often overlooked. Our employed methodology also builds on the community creation of heritage material and building capacity using digital approaches. This also informed and initiated conversations with the local community, collectively enriching our understanding of its lost history's untold stories and narratives. The outcome is a variety of immersive content comprising unique exemplars of Jordanian cultural heritage, storytelling and craft traditions.

Archaeological Research at the Plain of Jars, Lao PDR

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The Plain of Jars is an enigmatic megalithic landscape, comprising more than 2,500 hollowed, stone jars, discs, and boulder burial-markers, spread over more than 120 documented sites, 11 of which were inscribed as UNESCO World Heritage (2019). Research of the sites however has been hindered mostly due to the extensive unexploded ordnance (UXO) contamination of Laos. A joint Australian-Lao initiative commenced research in 2016 in an effort to fill the lacuna in archaeological investigation. Throughout the project a vast archive of digital data has been collated from excavation, landscape survey and documentation of material cultural heritage, and stored in an open-access website repository. In an effort to aid conservation endeavours at five sites, every megalithic jar (more than 1100), disc and boulder was photographed, geolocated, with morphological attributes recorded. At the most visited and accessible site, Site 1, a high-resolution 3D map was created through extensive UAV mapping, with the precise position of each of the 316 individually numbered jars and discs recorded. This map will be used by heritage personnel to monitor 'megalith health' and site integrity. Additionally, a virtual 'fieldwork' hub of Site 1 was created at Monash's CAVE2 facility to further research and engagement.

Using legacy data to reconstruct human-landscape co-evolution in mountainous Inner Asia

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One of the most common methods of studying Holocene climate and environmental change involves examining variation in environmental proxies archived in sedimentary accumulations in lakes, swamps and mires. A number of these proxies, including preserved pollen and spore types, charcoal influxes, and mineral sediment and geochemical changes also have the potential to tell us about human impacts on the landscape in the past. While these impacts are often discussed tangentially to palaeoenvironmental reconstructions, they are rarely the singular focus of these studies. This presentation describes examines the ways in which we can examine and synthesise data from these studies that have been stored in online repositories to understand broader patterns of anthropogenic landscape transformation. In particular, this study focuses on the mountainous areas of Inner Asia, where a diversity of ecotopes have allowed for the development of various patterns of agro-pastoralism, from around 5000 BP onwards. Detecting human-landscape co-evolution among legacy environmental data situates present-day agro-pastoral populations in the region as the inheritors of social-ecological systems dating back thousands of years, which has implications for the ongoing management of these environments today and into the future.

Participation and collaboration between research institutions and civil society organizations in digital heritage projects in Tunisia: Three Case Studies

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Our study documents three study cases resulting from collaboration between of academic institution (BATir - ULB) and civil society (Edifices & Mémoires) in cultural heritage participation in Tunisia. The first project is "Collaborative Heritage Observatory", aimed to the training of a group of citizens / observers spread all over the Tunisian territory to initiate an inventory of architectural and urban heritage. The second project is "Ahkili Aliha", aimed to involve young people in the revalorization of their neighborhood by creating an immersive journey through stories told retracing the memory of a place and focusing on its main heritage buildings. The third project is "Patrimonia", aiming to carry out a massive census to broadcast and enhance cultural heritage information through participation. Based on the challenges of these three study cases, we extend our work to studying (1) types of participation involved: through the questions: what, how and why? (2) the influence of the different participatory approaches applied in the to serve the collaborative cultural heritage projects.

The Paths of Immersion (POI) Framework: An integrated approach to immersive design

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Despite the appeal of immersive technologies by the museum industry and numerous recommendations implemented, the diffusion of immersive digital engagement for visitors remains partial. Museums are reluctant to onboard these technologies due to their unknowledge of immersive design solution concepts. The Paths of Immersion (POI) Framework, my PhD research outcome, is proposed to support diverse teams in making informed, aligned decisions between what creators can engineer and what visitors can benefit from. Its structure consists of technological rules of sensory immersion providing discussion playgrounds towards design solution concepts. The three-step framework validation process: (1) Surveys – users functional requirements, (2) Make the prototype – surfing heritage of the Rip Curl Pro 1981 at Bells for Virtual Reality headset, (3) Action Research – benefits for its users, i.e., museum and technical professionals, the surf industry representatives and visitors at the Australian National Surfing Museum. Based on their prototype experience and being prompted to take the creator and visitor role, the framework performance for heritage interpretation has been validated using investigation tools: A-Affirmations (Sensory-evoked heritage), B-Being Engaged (Rules of engagement), C-Connections (Pathfinding facilitation), DAA CheckWheel (Digital Assets Assessment). Thus, the framework contributes to heritage values by complementing historical, social, educational, and research with digital value.

Linking song collections and communities: A song database and linking tool

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There has been an exponential rise in Indigenous community use of archival song data to support reclamation of song practice and knowledges. Yet, archival song collections remain relatively inaccessible owing to limitations of format and incomplete metadata, presenting technical and cultural barriers. The Discovery Database Tool (DDT) was developed to address barriers-to-access faced by song custodians by enabling linking and aggregation of metadata pertaining to songs across collections. This paper focuses on the next iteration of the DDT database, including import and export, metadata collection, and linking, functionalities. In practice, the DDT also allows for newly-collected data to be linked to previously-generated song-based materials and knowledges. Building on an export tool, future development would address the interoperability of the DDT with community-based CMSs and with the management systems of source archives. Developed alongside song custodians and with collections originating from the Kimberley, West Pilbara, and West Arnhem Land, the DDT seeks to contribute to community-led reclamation of Indigenous song and the broader challenges of in/tangible cultural heritage sustainability.

Beyond the rock surface: exploring Egyptian rock art in all its dimensions using VR

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The era of digital imaging is both opening research to new tools and methods of recording and processing archaeological data and offering new ways of putting people in touch with cultural heritage and related matters. We have certainly had the opportunity to notice, over the past 15 years of technological developments, an important and massive change in typology, quantity, and production of data, somehow always accompanied by both advantages and disadvantages.

This presentation focuses on a way to present and interact data that is positively impacting the field of ancient epigraphy, as well as the documentation of rock art and rock inscriptions in our study areas in Upper Egypt. Through Virtual Reality the user can discover and interact with epigraphic and archaeological sites both off-line and on-line, all within their broader landscape environments.

The site of Nag el-Hamdulab in the West bank of Aswan and the site of el-Khawy, located North-East of the ancient city of Elkab – Edfu will show two of the most common technologies used to build Virtual Reality experiences. In the first one, the real environment is reproduced using 360 panoramas relationally interconnected on which contents are linked and navigated via browser interface. In the second example instead, the space is built combining different type of 3D models on which the epigraphic contents are embedded and recalled throughout headsets and remote controller.

Analysing Smartphone-Based Digital Museum and Cultural Tours

Nikolche Vasilevski[1], James Birt[1]

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In the last decade, we have seen a proliferation of smartphone devices including within cultural heritage. The accessibility of smartphones has allowed personalised storytelling using a variety of media methods and techniques. However, the method to extract the relevant data and the current design elements used in the market is not readily available outside proprietary bespoke data analytic environments. Therefore, we have combined multiple measures into a framework to analyse the competitors in the production of a digitised art tour. Specially we investigate interface usability, audio, augmented reality, gamification, text, video and 3d models. To evaluate the framework, we have applied the measures across 88 case studies. Case studies were sourced from the Apple AppStore and Google Play Store. The inclusion criteria were cost, novelty, relevancy, and artwork presentation. The apps were tested in simulated environments by using printouts of the artworks and location spoofing. The results showcase the capability of the framework to filter out relevant apps and design elements. These can then be implemented to inform future developments in the cultural heritage domain. Finally, we present how this framework was used to inform the design and development of an augmented reality indigenous artwork tour.

Museology for the Curious

Natalie Vinton[1]

[1] *CEO, Curio Projects Pty Ltd, Australia*

People are drawn to places, both cultural and natural, that we feel emotionally connected to, and as a result those places with special meaning or values are the places that are preserved for future generations.

How then, in this digital age, where everything is 'virtually' at the tip of our fingers, do we use the advantages of technology to shine a spotlight on the incredible places or collections that are special enough to visit, conserve and protect for future generations? Or do we even need to?

South Eveleigh, once the gritty, dirty heart of the Industrial Age in NSW, is that experimental place where a whole team of historians, digital designers, curators, museum specialists, archaeologists, architects and artisans have been working collaboratively together for more than 6 years to bring digital and physical museology together.

Due to complete in the next few months, South Eveleigh is the museum that's not just a museum, it's a bar that's not just a bar and it's a Blacksmith, who's definitely not just a Blacksmith and so much more, all made possible because of the beautiful mix of digital and physical museology in the most curious and fun ways possible.

Through the camera lens: Investigating Italy's ancient Roman roads through Thomas Ashby and the BSR's photographic collections

Janet Wade[1]

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This paper investigates late 19th and early 20th–century photographs of Italy's ancient Roman roads and their surrounds from the British School at Rome's collections, taken by Thomas Ashby (former director of the BSR) and his colleagues. Through these photographs and other archive materials, and using the Via Flaminia as a case study, I reconstruct the research itineraries of these early photographers and historians, and bring to light the wonderful records they have left of the ancient Roman roads and surrounds in their time. Their photographs document aspects of Italy's cultural and landscape heritage prior to the rapid urban development and immense change that occurred in the 20th century. These photographs are a simple means by which we can recover and conserve lost cultural and landscape heritage. By juxtaposing the early photographs with modern images, I create a contrasting view of the state of the roads and their surrounding environment over time, and document the place of the roads in the modern landscape. The contrasting photographic views aim to provide modern communities with tangible links to their ancient and more recent past and to provide future impetus for communities to value and conserve their cultural heritage in its present state.

Virtual archaeological research - the future of remote collaborations?

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Archaeological research in caves presents a number of issues; photographing and documenting evidence in small spaces; discussing excavation strategies using 2D images or video only focused on small sections of the cave; and the challenge of preserving records of in-situ sediments before and after excavations. 3D models of sites using photogrammetry offer an excellent opportunity to solve all of these issues and offers even more opportunities for new research directions. A 3D model viewed in Virtual Reality (VR) provides an accurate, detailed and authentic representation of the in-situ cave sediments and evidence as found before and after excavation. This can be used to stimulate recall for the participants involved or to provide context for those that couldn't access the site (e.g., Rising Star Cave). It allows graphic representation from angles that are physically impossible in real life, and more recently it has become the cornerstone of remote collaborations to virtually discuss excavations, sampling strategies and stratigraphic relationships. In this talk, I will explore the potential of the VR cave model in virtual archaeological research using examples from southern China and discuss its impact on the potential for collaborations in Asian archaeology.

When doing nothing is not an option: Contemplating the ethics and value of using legacy data from the Elamite site of Susa

Yasmina Wicks[1]

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In the history of Middle Eastern archaeology, no archaeologist has been more maligned than the early 20th century director of the French delegation at Susa: Roland de Mecquenem. A mining engineer by training, Mecquenem systematically dismantled a large portion of this ancient Elamite city in southwest Iran—now a UNESCO world heritage-listed site—over the course of three decades from 1912 to 1939, showing little regard for recording progress of the work or contexts of the finds. Even by the standards of the time his methods were rudimentary, and the precious little documentation he left behind is riddled with errors and inconsistencies. On these grounds, most experts on ancient Iranian archaeology willfully ignore his published and archived reports, sketches and photographs, and are training their students to do the same. Is this an ethical approach? Do we face the danger of creating false histories if we overoptimistically draw from these legacy records? Or is disregarding an entire body of documentation of one of the world's first cultural centers an even greater injustice to history? This paper pleads the value of the legacy records of excavations at Susa and contemplates how a critical framework for approaching the material might be achieved.

The cross-platform palimpsest: archaeological visualisation and gamification for public engagement and site analysis in the excavation of a late Roman palace in Serbia

Andrew Yip[1]

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Since breaking ground in 2017, Project Glac, a joint Australian-Serbian archaeological excavation of a late antique Roman palace near the ancient Roman capital of Sirmium (present day Sremska Mitrovica, Serbia), has integrated gaming technologies into core research, teaching and community engagement activities. These technologies go beyond the use of photogrammetric, drone and lidar scanning of site and objects for documentation to encompass the experimental use of real-time engines to compile data and construct an augmented reality simulation table on site for public engagement activities, and the teaching of these digital capture and game design methodologies to local secondary and tertiary students in an extensive public education program. The ultimate goal of the digital program is to construct a 1:1 scale virtual reality replica of the site within UNSW's Advanced Visualisation and Interaction Environment, a 10m2 diameter 360-degree stereoscopic platform, that allows up to 25 simultaneous users to explore the site at various phases and to interact with high resolution object facsimiles in real time. The design of this platform uses gamification paradigms to facilitate understanding, allowing both expert users and novices to make meaning from the site through emergent behaviours.

Lithodomos: Digital Storytelling that Enriches Archaeological Sites

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"Digital reconstruction" at archaeological sites when presented as augmented/virtual/mixed reality (AR/VR/MR) is a powerful visual and aural medium that synthesises and (re)presents the results of excavation, survey and interpretation as a coherent whole that is immediately appreciated by both specialist and visitor alike. Immersion within a digital environment allows for an appreciation of social context and scale, engendering a sense of embeddedness and place: a sense that has arguably only been achievable from a guided on-site visit up to now. Lithodomos has created a library of archaeological digital models spanning 8 countries, 68 sites at 314 locations. These digital "research" models can be employed to create an on-site and off-site AR/VR experience for visitor interpretation. As mobile, VR and AR hardware development continues to accelerate and diversify; so do potential methods for the deployment and creation of digital content. Highly engaging and accurate storytelling presented with 3D models and reconstructions at archaeological sites, this paper will argue, will likewise become increasingly essential, and perhaps expected, as visitors increasingly turn to their mobile devices as their primary source of truth.