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N.B. Affiliations shown are those of the first author. Titles marked with * are posters.

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Abdelmoniem M. Abdelmoniem
Assistant Lecturer at Conservation Department, Faculty Of Archaeology, Fayoum University, Egypt

Documentation methods of a polychrome coffin, dating back to the Late Period at Saqqara, Egypt.

This paper aims to document a polychrome wooden coffin at Saqqara dating back to late period. The exterior part of the coffin is decorated with painted layer and on inside it is covered with a layer of the black resin decorated with a depiction of Nut, The goddess of sky. The coffin was found in a bad condition, covered with a thick layer of dust, loosing parts of the painted layer and gesso layer and others parts of theses layer are lost. Photographic documentation, 2D illustrations and 3D modules were made to document the coffin. Photographic documentation was used to document the current state of the coffin and document aspects of damage, and the images were used in two-dimensional and three-dimensional documentation. Adobe Illustrator was used to highlight the decoration of the black resin layer on the cover of the coffin. PhotoScan program was used for photogrammetric documentation to make a three-dimensional model from images. This helped translate the decoration to know the name of the deceased person on the coffin. It was found out that the coffin belonged to Psamtik Sinb the son of an army chief in the Late Period. There were 12 Gods on the right side and the same number on the left one, indicating the number of hours of the day and the night.

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Jeremy Armstrong, Timothy Mackrell, Nicholas Harrison, Joshua Emmitt
University of Auckland

Sethlans in the 21st Century: 3D applications to Etruscan bronze armour and modern reconstructions.

Museum collections provide invaluable opportunities for analysis. The objects they contain typically offer relatively complete examples which, in part because of their visibility and

prominence, often become reference points for newly excavated material or analyses. One of the biggest challenges with the analysis of objects in museum collections is precisely that museum-based context. Objects on display have often only been directly analysed immediately following their initial discovery and are increasingly inaccessible for direct analysis now, fixed in such a way that their removal from the display case is difficult, and even permanently attached to stands that hinder examination. More generally, modern repairs of objects (which have occurred at various periods, often decades prior, and are not always documented) may obscure or hinder further analysis. We discuss the issues faced when analysing and making digital models of objects, which are used to explore the nature and importance of military equipment in Italy during the first millennium BCE. Applications of digital models are also discussed, including their use to aid modern reconstructions of armour. In addition, we argue that, although famous, many of the pieces held in collections, both public and private, are currently being underutilized in studies of the ancient world. We suggest digitization, even when conducted quickly, can help to unlock more information from previously excavated and analysed items and go on to highlight the pros and cons of various techniques when working in museum-based contexts.

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Matthew Barrett
University of Auckland

Flake to Core Ratios, Computer Simulation, and Human Mobility.

This paper uses technological analysis of stone artefacts and computer simulation to investigate past human mobility in a case study from late-Holocene western New South Wales, Australia. Recent studies leverage the physical separation of the products of stone reduction in determining the nature of past human movement. The flake to core ratio method is one such approach. Once the influence of initial cobble size and differential reduction intensity are accounted for, flake to core ratios reflect the movement of material to or from a given location, and by proxy, human movement. This patterning is also explored using computer simulation. Computer simulation is increasingly used in archaeology to explore the effects on observed patterning of processes otherwise invisible or difficult to experimentally test. With the increasing push for open science, simulation code is often provided open-source, presenting a valuable opportunity to replicate or reuse existing software to address new problems. Here, a replication of a computer simulation originally developed by Davies and colleagues (2018) to explore the effects of different movement and stone reduction practices on the cortex ratio, another empirical measure of artefact movement, is used to contextualise the results of the flake to core ratio analysis.

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Jessie Birkett-Rees, Andrew Connor
Monash University

Museums at home: access to digital archaeology during the COVID-19 crisis.

In the last six months, 90% of museums around the world have been temporarily closed (UNESCO 2020), abruptly changing the ways that researchers, students and the public may interact with museum collections, archaeological sites and artifacts. A 'digital stampede' (Rees Leahy 2020) to produce online content has been a visible feature of lockdown life, enabling new means of access to institutions and collections in the form of exhibition tours, blogs, workshops, and webinars. Likewise, universities have shifted to fully online teaching, with staff scrambling to deliver engaging content in an online environment. While larger museums with established digital outreach programs could more easily pivot towards and diversify within this all-digital environment, this has been more difficult for smaller, regional, or university museums. Current circumstances constrain opportunities for engagement with artifacts across the GLAM (galleries, libraries, archives, and museums) sector, but those circumstances also provide a moment to experiment. We examine this moment through the lens of object-based teaching and learning in archaeology and ancient history. Using the Monash University Museum of Mediterranean Antiquities, we highlight the use of digital replicas to inform and engage students in an entirely online environment. We demonstrate that digitization is a scalable process just as applicable to university collections and smaller museums as it is to large, well-resourced collections at international flagship museums. As we contemplate the enduring impacts of the COVID-19 pandemic, interactions with digitised archaeological collections will undoubtedly shape expectations around access to collections and teaching in archaeology for museums and universities alike.

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Cassandra Bugir, Matt W. Hayward
The University of Newcastle

Prey preferences of extinct hominid groups.*

As hominids have evolved and coalesced into larger, complex social structures, energy requirements to power large brains have driven the need to target larger prey. Technologies used to hunt evolved into projectile-type weaponry, resulting in less direct contact with prey. Using Optimal Forage Theory and honest signaling theory as the backgrounds for investigating extant and extinct hominid prey preference will look at variables such as prey abundance, killed/cut-marked bones, site location, and tools. Obtaining extinct hominid kill and prey abundance data from published and grey literary sources on assemblage sites (often from sink holes and confirmed by paleontologists and taphonomists) provides data for use in calculating

the Jacobs' Index value for each species hunted. For extant hunter-gatherers, we obtained kill and abundance data from primary literature and researcher collaboration using the same Jacobs' Index value equation. Generalized linear models within a maximum likelihood framework determined the drivers of hominid prey preferences for each group studied. Understanding the role of humans as apex predators and their prey preferences is fundamental in reshaping anthropocentric attitudes and behavioral impacts.

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Tomás Partiti Cafagne, Alex Martire, Vagner Porto, Priscilla Ulguim, Amanda Viveiros Pina, Vinicius Marino, Caroline Oliveira, Matheus Morais, Angélica Jordani, Cleberson Moura
University of Sao Paulo

ARISE A Digital Archaeology Research Group in Brazil.

This presentation aims to showcase the research group ARISE, one of the main research groups in digital Archaeology in Brazil. Our work consists of digital archaeology methods, theory application in education and academic contexts. Also we are going to present our work in development of archaeogames with focus in education and our analysis of material culture in games.

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Agata M.C. Calabrese
The University of Sydney

Experiencing the dead: GIS and the Phenomenology of Funerary Practice in EBA North Mesopotamia.

This paper will employ GIS in exploring the experiential aspects of the burial process in Early Bronze Age North Mesopotamia. To investigate past sensorial experiences, a multi-criteria cost-surface and visibility analysis were performed on a 10m DEM and land-cover map, in order to model movement, proximity and visibility aspects. Finally, an audio and smell analysis explored the potential impact of vocal/musical sound and odour, associated with burial rituals. A 10m resolution Digital Elevation Model (DEM) was developed to locate key Early Bronze Age sites (i.e. Ebla, Mari, Gre Virike, Tell Banat and Ugarit) and as foundation for further analysis. The DEM was created using spatial datasets from French and Soviet maps, CORONA satellite images, ASTER DEM V.2, ESRI ArcGIS basemaps, and individual site maps for each archaeological site analysed. A land-cover map was also created to support the analysis drawn

from three main datasets, the Global Land Survey (1975), CORINE Land Cover (1990) and the Vector Map (VMAP). The results suggest that there was more than one significant sensory experience associated with the funerary arena in Early Bronze Age Mesopotamian society. The funerary sphere involved many different aspects and rituals (i.e. lamentations, food consumption, music and visible displays). Moreover, this study showed that GIS-based analysis, when used critically, is a valuable tool in studying past landscape perception.

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Matthew Coller, David Thomas
Temporal Earth

The end for Sahul Time... Introducing Temporal Earth!

The "Sahul Time" visualisation of ancient Australasia debuted at the 2007 AAA conference, and has remained a popular demonstration in university lectures. However, its utility for researchers has been limited by its Adobe Flash delivery platform, which will soon be deactivated on most browsers.

This talk will showcase the successor project, "Temporal Earth", which combines an expressive multi-scale timeline with a virtual globe (Cesium.js), populated with a large collection of animated data-layers depicting topics in Australian history and archaeology.

On the archaeological timescale, a detailed palaeogeographic reconstruction now depicts the drier climate of the LGM, with glaciers in Tasmania and New Guinea. A collaboration with Aboriginal Victoria and La Trobe University has produced a visualisation of a verified dataset of radiocarbon dates from Victoria, with other dates from AustArch providing a broader temporal context. To avoid less-precise dates from visually dominating this animation, the opacity of each icon is regulated by treating its probability-density like the concentration of a dye dispersed in water.

Content is delivered in the versatile KML format (an Open Geospatial Consortium standard), and a current collaboration with the University of Newcastle will facilitate researchers to author and input their own datasets. For example, animated hypotheses of human dispersal can be plotted in Google My Maps, then loaded into Temporal Earth to assess their match to the underlying archaeological data through time.

Temporal Earth aims to provide a tool for researchers, educational resources for school curriculum, and a framework for building interactive touchscreen interfaces linked with cabinet displays.

Joshua Emmitt, Rebecca Phillipps, Sina Masoud-Ansari, Simon Holdaway
University of Auckland

Assessing formation with 3D point densities.

The twentieth-century excavations of Kom W on the north shore of the Fayum region, Egypt, led to a variety of interpretations, including the argument for the presence of a Neolithic village. The main evidence for this interpretation comes from the excavation of the site by Caton-Thompon in the 1920's. Reassessment of the erosion and deposition processes at the site and its surrounding environs has shown that from the time of its initial formation, Kom W was subject to a variety of geomorphological processes, particularly wind erosion. These processes have affected the site's current form and the preservation of features and artifact within the deposits. We further examine these processes by examining the 3D artefact distribution of two excavations adjacent to Kom W. The composition of deflated deposits that surround Kom W suggests that the site is not as unique as once imagined and any remains that might have allowed interpretations of a village occupation have not survived.

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Andrea Jalandoni
Griffith University

Digital advancement in Northern Territory rock art research.

Western Arnhem Land (incorporating Kakadu National Park) in the Northern Territory of Australia is home to thousands of rock art sites and its caretakers face the challenge of developing conservation management programs to protect this heritage with limited resources. This situation offers many challenges and opportunities for digital archaeologists. For example, how can site recording processes be improved and streamlined, how can large sites be better monitored, and how can we best integrate historical data with new information being recorded? I will present recent digital advancements in rock art research that address these problems using three case studies from western Arnhem Land. First, I examine the benefits and disadvantages of creating digital inventories of an entire rock art site compared with in the field recording using the famous Blue Paintings site. Second, I discuss creating digital 'mud maps' of large rock art sites using Nanguluwur as an example. Third, I demonstrate visual change detection of a buffalo panel at a site known as Djarrng using structure-from-motion photogrammetry with historic photographs. While these case studies were developed for addressing issues with rock art research in the Northern Territory, the solutions are applicable to many rock art contexts across Australia and internationally.

Ian Johnson
The University of Sydney

40 years, 20:20 vision: why we still need domain-specific databases.

From 1980-87, at a time when DBase II was the go-to system, I developed Minark, a flexible database manager for archaeology used by several state site registers, various excavations and some non-archaeological projects. Its basic principle was to allow archaeologists to define their own structures and reports without programming, to modify them as needs changed, and to carry out some basic filtering and data exploration prior to exporting subsets to other programs for further analysis.

40 years later I am still developing (although I no longer do the programming) a flexible database manager, Heurist (HeuristNetwork.org), which follows the same basic philosophy. The scope has expanded to a broader Humanities remit, and the technology has changed - everything is web based and richly connected, with multimedia, web site generation and sophisticated searching and mapping built in - but the need for such software still exists despite the rise of the web and web services, the development of intuitive touchscreen interfaces, and the astonishing computing power and storage capacity in our pockets.

In this presentation I will look at the costs and risks of developing databases which are more than just spreadsheets, and the reason why targeted solutions (such as regionally-specific excavation data systems or museum management systems) are still very much in demand. Outside these well-defined applications more flexible, secure and user-configurable systems are needed to cope with the heterogeneity and continuous evolution of research and consulting requirements. Plus ça change, plus c'est la même chose…

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Ben Jones, Simon Bickler, Jaime Grant
University of Auckland

Re-mapping The Fortifications of the New Zealand Wars with High Resolution LiDAR.

Nigel Prickett's (2016) "The Fortifications of the New Zealand Wars" summarises the history and locations of the fortifications of Pakeha and Māori built during the New Zealand Wars. One of the major outcomes of Prickett's reports is the need for a major update of the archaeological sites of this era. Many are well known, but others have had only cursory information recorded and others are completely missing either having never been accurately located or having been lost to development and farming. Following the work by Rudd (2003), we take the opportunity of

re-evaluating these significant sites with high-resolution LiDAR. Starting from the list of sites from Pricket (2016), we focus on sites in the Auckland and South Auckland regions to map, and assess these sites. We generate maps using LiDAR of the extant features of known sites to provide data for updating site records. The maps are then used to examine how those sites fit within their broader landscape. Finally, we use the LiDAR data to search for un-recorded features associated with the known sites and see if we can located some of the missing sites that have not yet been previously located.

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Amir Kanan Kashefi, Justin Walsh, Alice Gorman, Rao Hamza Ali, Erik Linstead
Flinders University

The International Space Station Archaeological Project: Data Management Challenges.

The International Space Station Archaeological Project was established in 2015 to study how material culture is used in the creation and maintenance of a unique space society. The first module of the ISS was launched in 1998, and in November 2020 it will have been continuously occupied for 20 years. As it is not possible to conduct archaeological field work on the ISS due to prohibitive cost and crew privacy, NASA has provided data in the form of the photographic archive and the Inventory Management System (IMS) database, which catalogues all objects sent to the station. In this paper, we discuss the challenges in studying photographic collections of this kind, using the example of the presence (or absence) of astronauts in ISS modules. We also discuss how data science techniques have re-purposed IMS legacy data, using Ziplock bags, an artefact type found on the ISS since its inception, as a case study.

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Tom Keep
The University of Melbourne

The Mernda VR Project.

The Mernda VR Project, funded by a Student Engagement Grant from the University of Melbourne, plans to develop an immersive virtual reality reconstruction of an archaeological site along the banks of the Plenty River in Mernda. The site was the focus of a 2015 excavation conducted by Heritage Victoria, which was widely publicised as an engagement opportunity for the locals of the area to better learn the heritage of the region, which has seen dramatic development and population increase over the last 30 years. In the hopes of taking up the torch of engaging the people of Mernda with their local heritage, the Mernda VR Projects seeks to use 3D modelling software and photogrammetry to reconstruct the site in virtual reality for display in

local libraries, historical societies, and schools. The project would involve reconstructing a researched hypothetical model of the site in two phases of its history: the Indigenous management and occupation of the area prior to European colonization; and the small cottage used for management of the mill, both constructed in 1855. Emphasis will be on the relationship to the land, and the different agricultural strategies employed by its varied occupants.

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Kieran McGee
The University of Sydney
Quantifying Lithic Reduction: Reexamining the Scar Density Index.*

The Scar Density Index (SDI) has been proposed as a method for calculating a lithic artefact's lost mass due to continuous flaking. Such a method would be extremely valuable to the field of lithic technology. The SDI, as proposed by Clarkson and Shipton, asserts a correlation between the ratio of flake scars to surface area of a flaked artefact and the amount of material lost due to flaking. This research presents an independent test of this hypothesis. Fourteen identical, ceramic blocks were reduced using three simple flaking methods. Photogrammetric methods allowed for the fast, accurate measurement of the block's surface area at each stage of reduction. The results indicate that the SDI is not an effective measure of lost mass. This is due to the SDI's reliance on the gross scar number which indicates reduction events, as opposed to the amount of reduction, and the high variability in the number of flake scars over the life of reduction.

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Kristen Mann
The Australian Archaeological Institute at Athens

Praxis and digital field recording: How digital tools change the way we relate to the archaeological record.

Digital recording methods are a major asset to archaeologists, enhancing the quality and quantity of data we can collect, as well as our ability to analyse and process it in a timely and substantive fashion. Yet how we integrate digital recording into our field toolkits can have a profound, often unanticipated, impact on how we think about and engage with the archaeological record. While some aspects are positive, the efficiency of digital recording tools can at times result in a loss of deeper "joined up" thinking that slower modes of recording fostered. Without reflexive consideration of how digital tools can change and affect our praxis, and accounting for this, we risk losing deeper, qualitative understanding of the archaeological record.

This paper presents observations on the use of digital tools in archaeology based on personal experience in the field and in post-excavation archiving, data processing, analysis and interpretation. This reflection posits ways to ensure insights gained from more traditional recording methods are preserved in contemporary field practices that are reliant on digital recording tools. Specifically, it discusses recent experiences as part of the Zagora Archaeological Project which employs ODK and GIS field recording in conjunction with a Heurist MySQL database, and as part of the Keros-Naxos Seaways Project, which was designed to be 'paperless' and employed the ASCSA's iDig system for all field recording, write up, and the processing of finds and samples in conjunction with other tools such as photogrammetry, GIS and a Filemaker Pro database.

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Joel Mason, Anthony Barham, Tessa Bryant
Navin Officer Heritage Consultants

Where the Big Scrub met the Big Swamp. Using LIDAR to predict Holocene archaeological site stratigraphy at palaeo estuarine margins: a case study from coastal NSW.*

Holocene sea level rise is recognised globally as a key factor in the formation of Holocene archaeological records at wetland margins. Relocation of human activity into novel mid-Holocene wetland edge ecotones, between drier land and swamp, are forcing functions for changes to site types, resource acquisition strategies and cultural behaviour reflected inter alia in eg waterlogged organics preservation, rock art, and midden composition.

Wetland margin archaeology often yields evidence of past human actions, which are poorly preserved on dry land sites. Dating potential, site preservation and stratification is often excellent. Wetland margins are also places where deposit modelling is critical to predicting impacts on buried prehistoric archaeology from infrastructure design (Historic England 2020).

The Richmond River floodplain is the largest Holocene alluvial - infilled estuarine embayment on the NSW coast. This pilot study examines the task of defining Potential Archaeological Deposit (PAD), at wetland margins using standard Google Earth satellite imagery, informed by engineering geotechnical data.

LIDAR is used to i) assess wetland edge topography ii) model past (pre-European) wetland extent and iii) develop GIS layers to predict PAD and archaeo-stratigraphic potential (as deposit models).

Excavations at three sites confirm model predictions, demonstrating LIDAR micro-topography layers can provide first-order prediction of sub-surface stratigraphy in Australian palaeo-estuarine wetland margins.

References

Historic England 2020 Deposit Modelling and Archaeology: Guidance for Mapping Buried Deposits. Swindon: Historic.

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John McCarthy
Flinders University

Maritime Archaeology and 3D Digital Libraries.

This presentation describes the outcomes of a recently completed PhD study on the power of technological advances to shift the gaze of maritime archaeologists beyond individual ships towards broader trends in vessel use, design and modification over long periods. The sheer logistical burden of investigating a shipwreck and the romantic nature of the material has discouraged maritime archaeologists from attempting the kind of typological and longitudinal studies that underpin research into most other types of archaeological site. However, digital techniques have the power to capture and combining very different types of source material and allow for tracing of trends in the archaeological record which can be liked to significant social and technological changes. A suite of novel techniques has been applied to the rich evidence base for seventeenth- and eighteenth-century Dutch merchant ships, including digital scans of in situ and recovered shipwreck remains, contemporary scale models, shipwreck material, and other sources such as paintings, manuscripts and charters. A substantial digital library was built up through diving in Iceland and Australia, and scanning of contemporary ship models in museums in The Netherlands, Belgium, Norway, the UK and the USA. Detailed analysis of dimensions and scale, typology, and hull form has provided a much richer understanding of this material. Beyond its relevance to Dutch ships, the methodology developed is proposed as a model for discipline-wide collaborative development of 3D libraries which could have a transformative impact on ship studies and, in turn, maritime archaeological practice.

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Aleks Michalewicz
University of Melbourne

Digital data management: tedious compliance or exciting opportunity?

Research data management, which now includes the management of digital data, is a domain often viewed with ambivalence or disinterest; yet, as archaeologists we are creating increasing volumes of digital 'assets'. While institutions may mandate specific requirements for the safeguarding of digital materials to their academic and graduate researchers, it is often the case that these are not adhered to. This talk will outline some of the reasons for this, and introduce the Melbourne Data Analytics Platform, an innovative research unit at the University of Melbourne. Through our interdisciplinary and data-intensive collaborations, we are trialling a new approach to research data stewardship and data analytics. An integral part of this process, throughout the entire research life cycle, is the focus on long-term digital data preservation, sustainability and interoperability. Examples will be provided to demonstrate that rather than being an onerous compliance issue, robust digital data management provides unique opportunities to archaeologists, not just to secure research data, but likewise to create new opportunities for material culture and its meaning. Finally, the talk will consider how contemporary digital data become legacy data of the future and explore the idea of data as artefacts.

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Patricia Pillay, Gerard O'Regan, Joshua Emmitt
University of Auckland

Spatial Applications to Rock Art in the North Island of Aotearoa New Zealand.

Māori rock art is widely distributed across Aotearoa New Zealand. It has been extensively studied in the South Island where a strong correlation between rock art and limestone outcrops in the South Island has been identified. However, few studies have investigated the distribution and preservation of petroglyphs and pictographs in the North Island. Previous studies suggest preliminary correlations between the distribution of North Island rock art and the availability of suitable rock surfaces. As they are based on broad regional observations of the distribution of sites and geological formations, the observations of correlations of art with rock type are limited. Here we adopt a landscape approach using Geographic Information Systems (GIS) to quantitatively test previous correlations. A bias in the placement of rock art on ignimbrite rock formations is shown. This preliminary location-based analysis provides a foundation for more detailed regional studies to understand if the correlation reflects a deliberate selection of certain geological rock surfaces by North Island Māori, and how differential weathering and preservation processes may contribute to the present-day spatial distribution of rock art.

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Michael Rampe
Macquarie University

Photogrammetry of Perachora Waterworks - work in progress.

Over the European winter of early 2020, Shawn Ross and Susan Lupack led an archaeological survey of the Perachora Waterworks in Greece. The author worked with these researchers to develop a comparative photogrammetry project utilising new equipment, software and processes recently funded at Macquarie University. This paper will discuss the work in progress, initial discoveries of photogrammetric processing and the challenges of working internationally during the Covid crisis.

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Carla Raymond, Charalambos Rossides, Luis Siddall, Christopher Davey, Joseph Bevitt
Macquarie University

Investigating Hidden Texts on Encased Cuneiform Tablets using Synchrotron X-ray and Neutron Imaging.

This study investigates two cuneiform tablets: the first tablet from Nimrud c.650 BC (ND 3430) was suspected to have a tablet encased due to its pillow-like shape; The second tablet from Ur c.2000 BC (MU 4083) reveals an inner tablet through a partial fracture. Cuneiform tablets allow us a glimpse into the values, beliefs, and practices of daily life in ancient Mesopotamia. Frequently these tablets were reused by resurfacing with new clay, creating multi-layered tablets with encased correspondences and documents. Historically, many of these envelopes were forcefully opened to reveal their hidden texts, and this has caused irrevocable damage.

Herein we demonstrate the efficacy of two non-destructive imaging techniques, synchrotron X-ray and neutron CT, in extracting hidden texts, and in understanding tablet manufacture and reuse. The chosen techniques successfully revealed that each envelope carried an inner tablet with legible text (translation ongoing), providing valuable context to their respective histories. Manufacture of the envelopes is illustrated by visible voids and fold directions, as well as signs of repair seen in neutron CT reconstruction. Additionally, a new digital flattening method (C. Rossides 2020) was applied to facilitate easier translation, and to visualise the tablet surface in an alternative way to the standard "fat cross" figure format.

This is significant work that negates the need for destructive study of encased tablets; It demonstrates that valuable information about context and manufacture can be gained, and successful translation of inscriptions made non-destructively through both X-ray and neutron CT.

Claire Reeler
Catalyst IT Australia

Privacy in Digital Work and Research.

This year has shown us how dependent we are on our digital world. In the rush to move everything online, some people have found issues with retaining sufficient privacy. So what's the big deal around online privacy? Why is it important? What are the implications and what can we do in our own work and research? In this presentation we can explore the social context of being digital; the major ethical issues and some of the quick and easy ways we can manage these issues to best effect. Privacy is important for us, for our colleagues and for our community and we do not need to surrender it in a digital world. These issues affect not only how we conduct our own work and research but also what is happening in the broader world around us. We have a unique opportunity now to work to shape the future direction of our discipline and our community. We can learn from the ways that past pandemics shaped society to use this opportunity to best effect.

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Madeline Robinson, Augustine Porter, Will Figueira, Roland Fletcher
University of Sydney

Neolithic Temples of Malta: 3D analysis points to novel roof reconstruction.

The Neolithic temples of Malta are among the oldest examples of prehistoric architecture, yet the construction of their roofs remains a mystery. The absence of any roofs or roofing material at the temple sites has resulted in conjecture regarding the original appearance of these megalithic structures. The most valuable indications of prehistoric Maltese roof architecture are found in the Neolithic burial complex, the Hypogeum of Hal Saflieni. Two chambers in the Hypogeum are modelled closely after the above-ground temples, with indications of a roof structural system on the ceilings. This paper uses LiDAR and photogrammetry-derived 3D models to provide a partial temple roof reconstruction that has its design entirely based on contemporaneous archaeology. Photogrammetric reconstruction of the Mnajdra and Tarxien temple complexes allowed for detailed architectural analyses including key structural features and any indications of previous roof construction that would be evident in situ. A LiDAR model of the carved chambers of the Hypogeum of Hal Saflieni was superimposed onto corresponding positions in the temple models. Merging the LiDAR imagery onto the photogrammetry temple models confirmed structural consistency between the two megalithic complexes; supporting the theory that the carved façades were a deliberate reflection of the original architecture of the

Maltese temples. This evidence points to an entirely new temple roof reconstruction, founded upon the archaeology of Neolithic Malta.

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Shawn Ross, Brian Ballsun-Stanton, Steve Cassidy, Penny Crook, Adela Sobotkova
Macquarie University

FAIMS 3.0: Electronic Field Notebooks.

Fieldwork is time consuming and researchers are always looking at ways to increase efficiency in data recording in the field, while also improving our ability to share reusable data following international good practices like the Transparency and Openness Principles (TOP) and Findable, Accessible, Interoperable, and Reusable (FAIR) data principles. Achieving these goals is easier when data is born digital, but commercial software is not optimised for research and bespoke software is expensive to build and onerous to maintain. The Australian Research Data Commons (ARDC) recently awarded the Field Acquired Information Management Systems (FAIMS) Project, based at Macquarie University, a large, three-year grant to renew our existing platform, FAIMS Mobile, which has been customised and deployed at more than 60 workflows on 40 projects worldwide but is reaching end-of-life. FAIMS Electronic Field Notebooks will produce and manage mobile apps for a range of disciplines including not only archaeology, but earth sciences, ecology, and oral history, ensuring data is captured consistently and is well documented. The platform will use modern web technologies and integrate with existing analysis environments to provide a seamless workflow. FAIMS Electronic Field Notebooks will accommodate diverse data capture, localisation and complex workflows, and provide seamless synchronisation, backup and version control, just like FAIMS Mobile. It will also be cross-platform (Android, iOS and Desktop) and self-service allowing uses to customise and deploy modules through a graphic user interface. This presentation will introduce the next generation of FAIMS, and how it can contribute to open research in archaeology.

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Emily Simons
University of Melbourne

GIS: Griffins In Space.

The Bronze Age iconographic repertoire of the eastern Mediterranean contains diverse and ambiguous creatures. These representations exhibit considerable contextual, spatial, and temporal variation; however, determination of their meaning remains planted in the realm of

iconographic and stylistic interpretation. In Aegean archaeology, there remains substantial reliance on objects that not only lack secure provenience, but which are frequently constructs of 19th and 20th century grandiloquent reconstructive narratives. Focusing on Aegean Late Bronze Age griffins as a case study, this paper discusses the role of object find context in determining meaning. By scrutinizing find context details in a quantitative and spatial framework, it is possible to critique the field's continued reliance on objects without context, and to develop new methods of viewing the data for future interpretations. I utilize geographic information systems techniques to investigate influential narratives and explore potential correlations between context, materials, and composition.

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Sylvana Szydzik
Port Arthur Historic Sites Management Authority

Digitising ferrous objects through radiography.

In Southern Tasmania, the Port Arthur Historic Sites Management Authority (PAHSMA) is responsible for the management of three of the eleven places that comprise the Australian Convict Sites World Heritage Property. Archaeological research and management are key elements of PAHSMA's conservation work, which includes custodianship of 43 years' worth of archaeological data. Many archaeologists will be aware of the issues arising from the study and storage of that vulnerable material class, 'ferrous metal'. In a new approach in 2016, PAHSMA implemented a radiography program for all ferrous objects recovered during the research excavation of the penitentiary laundry precinct. By no means new in the field of archaeology or the study of cultural objects, radiography offers the potential to identify details of metal objects that would be impossible through visual analysis alone. This approach not only provided a record of this unstable and deteriorating material type immediately post-excavation, but enabled the identification of 95% of the ferrous objects, and also informed post-excavation conservation priorities. This presentation will examine how digital radiography has been included in the workflow of archaeological research and management at PAHSMA, by moving away from targeted investigations of problematic or 'interesting' objects to an assemblage-wide use that seeks to maximise and systematise data recovery from a previously under-studied – and unloved – material type.

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Alix Thoeming, Lesley Beaumont, Simon Wyatt-Spratt
University of Sydney

New Eyes on Old Objects: photogrammetry as a pedagogical tool for teaching archaeology.

Photogrammetry is an increasingly common component of archaeological recording and analysis. In a museum context, photogrammetric models provide both a new method to display objects and create interactivity within exhibits and also a tool for artefact digitisation which can democratise access to collections. In a professional context, photogrammetry has become a highly sought-after skill in complement with existing artefact management protocols. To date, though, there has been little formal discussion around the use of photogrammetric models as pedagogical tools. First-year archaeology students at the University of Sydney have traditionally been given supervised hands-on access to artefacts from the Nicholson Collection of the Chau Chak Wing Museum (CCWM) as part of their tutorials. This however excludes objects that are too fragile to be handled and also restricts student interaction with the objects to a very narrow temporal window due to the requirement that all object handling take place under staff supervision.

The New Eyes on Old Objects project was a trial digitisation initiative between the University of Sydney Department of Archaeology, Arts eLearning and Sydney University Museums that aimed to both increase student access to the collection and support its use in practical assessment tasks. Selected objects from the West Asian and ancient Mediterranean collections were digitised using a low-cost photogrammetric method. Students were initially given access to the physical objects in class and then were able to access their models online afterwards, before incorporation into object-based assessments. This paper will present the architecture of the NEFOO project, staff and student reception, and the lessons we learned in its implementation. Digital accessibility, in particular, remains a challenge for projects of this sort. We argue that through the use of this relatively simple tool, archaeology departments can leverage their collections in increasingly adaptive and progressive ways.

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Katherine Thomas
La Trobe University, Andrew Long and Associates

Emerging Technology - RPAs, Digital Twin, and Quantum Computing.

This talk discusses emerging technology – RPAs, Digital Twin, and Quantum Computing. Potential impacts of these three growth areas on the archaeological discipline should be our focus. Archaeology is continually changing in tandem with environmental and technological advances. Furthermore, demands for technological advances have been accelerated by the pandemic, COVID19. Collaborative technological tools are now increasingly being relied upon to enable documentation, communication, and facilitation of information across multiple stakeholders. Work within overlapping commercial fields with RPAs, Digital Twin, and Quantum Computing work are signposts for the archaeological discipline. Concomitantly, the talk will also investigate how ethics could and should be considered by archaeologists during the rapid

adoption of these technological advances. The extraordinary is rapidly becoming the new ordinary and we are not prepared.

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Liying Wang, Ben Marwick
University of Washington

The practice of open science in archaeology using R and online digital repositories in a case study research.*

A typical publication process in archaeology involves data analysis, visualization, and interpretation. These steps are normally done separately, in different software, and the outputs combined during the final writing stages. The disconnected nature of this process, and the availability of only the final product in publication, means that research transparency is limited. Open science emphasizes the free, public availability of research data, methods, and access to publications, to enable others to more fully examine the research process. This has become normal in many fields, and is important because it can enhance research credibility and reproducibility. Using a case study from an Iron Age site in northeastern Taiwan, we demonstrate an open science workflow in archaeology that is relevant and practical for archaeology. We show how to write the manuscript with R Markdown to combine our manuscript text and R code, Git for collaboration and version control, deposit a preprint, and finally archive all our research materials for long-term availability on the Open Science Framework (OSF). We used an R package as a research compendium to organize all digital materials of our project. This standard compendium structure enables other researchers to easily inspect our data and analytical processes. This workflow is practical, easily learned, and applicable to many other types of archaeological research. This practice of open science benefits not only researchers with increased impacts but also archaeology as a discipline through data sharing and reproducible research.

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Morphological and Elemental Analyses of Ancient Egyptian Shabtis.

One of the best-known funerary objects recovered in ancient Egyptian burials are shabtis. Shabtis are funerary figurines which have often been described as mass-produced objects due to the large number of such objects routinely found in Egyptian tombs. The term

mass-production, however, is incongruent with a number of known shabti sets which demonstrate significant morphological variability between each object within the set. Furthermore, limited work has been done to evaluate the standardisation of shabti composition, which represents another dimension where manufacturing variability can exist. In this project, we analyse the morphology and elemental composition of three sets of seven shabtis to assess the level of object standardisation within these three sets. Using 3D scanning and X-ray Fluorescence Spectrometry, we conclude that these three shabti sets were made with different degrees of morphological and compositional standardisation, which is indicative of different styles of manufacturing, such as batch-processing. Our results suggest that while there is evidence of aspects of mass-production manufacturing, the general use of the term to describe all shabti manufacturing is an oversimplification of what was likely a more nuanced process that also involved batch-processing.

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Rita Zhang
University of Melbourne

(Re)Constructions and Receptions: Critical Engagement with Video Games Set in Antiquity.

In the last few decades, video games have become an increasingly mainstream mode of engagement with the ancient past. This has led to a shift in the (re)construction and reception of ancient worlds in the popular imagination. Using Ubisoft's 2018 release 'Assassin's Creed: Odyssey' as a case study, this paper identifies presentism and humanism as products of the game-makers' modern-day contexts, which have been "retrojected" into representations of the past. Through player interviews and discourse analysis of online forums and "Let's Play" livestream broadcasts, this paper examines how these ideologies are legitimated through the publicised involvement of historical consultants, claims of historical accuracy, and the immersive nature of atmospheric and sensorially realistic video games. By elucidating the power relations between game designer, medium, and player, this paper demonstrates the significance of video games as popular representations of antiquity. It highlights both the value of video games as an interactive medium through which audience members may engage closely with no-longer-accessible ancient sites and lives, as well as the importance of active and critical engagement with their content.