

Digitizing Knossos Using the Sir Arthur Evans Archive

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1. Introduction

When Sir Arthur Evans died in 1941, his archaeological papers were donated to the Ashmolean Museum. The task of gathering together the records of a lifetime's work at Knossos and as Keeper of the Ashmolean Museum (1884–1908) fell to Sir Arthur's half-sister, Dame Joan Evans.¹ Despite the constraints of the Second World War, she ensured that the bequest was removed from his mansion at Youlbury, near Oxford, and deposited in the Ashmolean Museum. This material became the nucleus of the Sir Arthur Evans Archive (Oxford, Ash, AJE; hereafter the Archive). It consists of over 10,000 archival objects, among which are drafts of Sir Arthur Evans's lectures and publications, his correspondence with other scholars, and records of sites and objects including notebooks, photographs, and drawings. Although some of the original order of this material when at Youlbury can be deduced from surviving boxes and folders, no catalogue of the Archive was made upon its arrival. Over the years the Archive has been reordered, catalogued in part, and extensively studied. A number of archival items have been published, often as part of ongoing discussions about the excavations at Knossos. It is only now, with the arrival of a new digital collections management system, that a full catalogue is being produced. As a result, the process of cataloguing is happening alongside the process of digitization. The opportunities that this offers are the subject of this paper.

Sir Arthur Evans began excavating at Knossos in 1900 and worked there until 1931. There he uncovered a grand building known as the 'Palace of Minos' and various surrounding structures including houses and tombs. The Bronze Age Palace at Knossos was clearly a significant structure, but Sir Arthur Evans established it through his writings as the centre of the 'Minoan Civilization', a concept that he largely created and popularized. His four-volume work *The Palace of Minos at Knossos*, published between 1921 and 1935, set out this vision of Minoan Knossos and Crete, and remains influential for the archaeology of Bronze Age Crete.² By modern standards, however, this is not a final publication of the site, setting out all the data from excavations. The Sir Arthur Evans Archive contains many of the primary records for the excavation, particularly the notebooks kept by Evans and his

¹ Evans 1941, vii.

² Evans 1921; 1928; 1930; 1935.

assistant, Duncan Mackenzie. Archaeologists have continued to draw upon these records in their publications of the site, but Evans's excavations remain essentially unpublished. As a result, the process of digitization is also a form of publication, the implications of which will also be considered here.

Another legacy of Sir Arthur Evans was his work to restore the Palace and surrounding buildings, creating an archaeological site that has become one of the most popular visitor attractions in Greece. With over 950,000 visitors in 2019, it was the second most-visited archaeological site in Greece after the Acropolis in Athens.³ This also has implications for the digitization of the Sir Arthur Evans Archive: there is a large potential audience for the Archive consisting of people who have a general interest in the site, particularly visitors. This paper will consider how the Archive can be made available to a non-specialist audience. This audience has diverse needs, but a key aim of digitizing the Archive is to provide a tour of the Palace, whether for people at the site itself with their smartphones in their hand or sitting in front of their computers at home. The three-dimensional digital model of the Palace presented here provides one way to engage this audience.

2. Contents

The Sir Arthur Evans Archive contains a variety of different types of material retained by Sir Arthur Evans over the course of his career at the Ashmolean and excavations at Knossos but is far from complete. Since the bequest specified that his archaeological papers should be donated to the Ashmolean, the Archive did not originally contain any personal papers. Some of these were retained by Joan Evans, for writing her biography of Sir Arthur Evans and his ancestors, before coming into the possession of Arthur L. Evans, a relation of theirs. His gift of these papers in 1985 provided the Archive with records of Sir Arthur's childhood, up to the time he went to university, and also some other family papers. After university, Sir Arthur Evans travelled in the Balkans, but the papers from this period of his life were instead bequeathed to the School of Slavonic and East European Studies at UCL (London, UCL, EVA); relevant material later discovered among the Ashmolean bequest was later sent there on loan, although a small number of Balkan-related items remain at the Ashmolean. The papers of Margaret Evans, Sir Arthur's wife until her early death in 1893, went to a relation

³ Hellenic Statistical Authority 2022.

of hers and were later sold at auction.⁴ Other papers related to Sir Arthur's administrative work as Keeper rather than his research, are in the Oxford University Archive. A small amount of material relating to the excavations at Knossos, including some notebooks of Duncan Mackenzie, is held by the British School at Athens (Athens, BSA, Mackenzie Pottery Notebooks). One of the benefits of digitization is that a scattered archive of this kind can be reconnected online, particularly if all institutions adhere to the same basic standards. This point will be developed below.

[Insert Fig.1 here]

The focus of this contribution, however, is the material from Knossos. Sir Arthur Evans first visited Crete in March 1894 and met Minos Kalokairinos, a local scholar and businessman, who had started to excavate the Palace of Minos in 1878. Since Crete was at that time part of the Ottoman Empire, his peers had forced him to stop in case his finds were removed to Constantinople Museum. Evans's diary from this period records his visit to Knossos in the company of Kalokairinos, who generously showed him round. Another member of the party was Iosif Hatzidakis, another local scholar, who helped Evans to buy a quarter share of the land on which Kalokairinos's excavations had taken place. This subsequently enabled Evans to buy the remainder of the land, once Crete had gained its independence in 1898, and begin excavating in 1900.⁵ Given the historical interest of this diary, it was published in full by Ann Brown, with an image of each page and facing transcription, along with extensive supporting material.⁶ One particular point of interest was that the diary recorded the purchases of antiquities made by Evans in this period, many of which are now in the Ashmolean collection (Fig. 1). This provides another dimension to the diaries and notebooks, since connections can be drawn with archaeological objects in the Ashmolean collection. Whereas Ann Brown's transcription listed objects in a separate appendix, a digital publication can establish dynamic links between an object in an online collections database and the relevant page in a digitized diary. Although this will be the subject of a future project, it illustrates the different potentials of an annotated online version of a diary versus the published transcription. On the other hand, the printed publication has a permanence that online publications can lack. Similarly,

⁴ Pettigrew 2010.

⁵ Brown 2000.

⁶ Brown 2001.

the electronic files for this publication were deposited in the Archive on multiple zip disks. These now need specialist equipment (and software) to read, illustrating the greater permanence and accessibility of the printed version.

The 1894 diary, and forty-nine notebooks related to the excavations of Knossos from 1900 onwards are now in the process of being digitized.⁷ These notebooks (sometimes also called daybooks) were kept by Sir Arthur Evans and his employees at Knossos: his assistant, Duncan Mackenzie and the architects Theodore Fyfe and Christian Doll. Together they provide a uniquely important account of the excavations and reconstructions of Knossos, and are often the only record of the find-spots of particular objects. As a result they have been heavily used by archaeologists studying Knossos, and sometimes the subject of fierce debate.⁸ They are now too fragile to consult and so facsimiles made in the 1980s are provided to researchers instead (and also exist on microfilm). The current digitization project involves photographing each page or double-page spread, and these will be put on the Ashmolean collections website in due course. The form this will take is currently under discussion: an online reader would ease navigation by enabling users to virtually flip through the pages. Even then, 3000 pages of archaeological observations are of limited interest to most readers. Further work is needed to make them truly accessible: annotation, mentioned above, is one means to do this, as is text encoding to enable them to be searched. A distinction is often made between digitization (i.e. digital photography) and digitalization, which in this case would be the use of digital technologies to increase the accessibility and usefulness of the notebooks. This is a process which the Ashmolean is only just beginning.

[Insert Fig. 2 here]

Evans employed a number of architects and artists at Knossos and the Archive contains around 2000 original drawings. Of these over a half are object drawings, around 400 are technical drawings of the excavations, and another 400 relate to the colourful frescoes that decorated the walls and floors of the Palace and surrounding buildings. Among these are a number of imaginative reconstructions, including Theodore Fyfe's drawing of the Throne Room (Fig. 2). The plans, sections and fresco drawings were digitized in 2004–2005 by the

⁷ We gratefully acknowledge the support of a grant from the Gladys Kriebel Delmas Foundation and an anonymous donor to enable the photography of these notebooks.

⁸ Boardman and Palmer 1963.

University of Oxford's library (the Bodleian) rather than the Ashmolean Museum. As a result they are available online via the library's digital repository, Digital Bodleian.⁹ These drawings are not part of the Bodleian Library's collection, although the Ashmolean and Bodleian are part of the same division of the University (Gardens, Libraries, and Museums). Because these items were digitized by the Bodleian Library, however, they have been given an online presence which the rest of the Archive lacks. On Digital Bodleian they are presented as individual archival items with limited metadata rather than being contextualized in terms of the excavations at Knossos. The provision of a richer context and metadata for these drawings is one of the aims of the digital model, discussed below.

Another significant aspect of the Archive are around 3000 photographs of the excavations at Knossos including architecture, finds, and workers. There are also a significant number of photographs of related sites and objects. These include some original glass-plate negatives and prints. Many of the prints were numbered and annotated by Evans or Mackenzie and stored in box folders, but after they arrived at the Ashmolean Museum, many were removed and pasted into albums. Although this has enabled them to be viewed more easily, the ordering of the albums is not the same as the box folders. Some of the photographs of pottery were subsequently removed from the albums and ordered by archaeological sequence instead, in new folders. Only a small number of photographs have been digitized, mainly to fulfil commercial image orders. This indicates a general interest in images of the Knossos excavations, but the remainder of the photographs awaits digitization. One of the advantages of putting the photographs in a collections database is that they can be reordered digitally, according to the original numbering system, without the need to remove them from the physical albums.

The Archive also contains material relating to the publications of Sir Arthur Evans, about Knossos and elsewhere. All of the stages of the publication process are represented, from manuscript notes and drafts of text, to page proofs and even some of the original printing blocks for *The Palace of Minos*. Since Evans's ideas have remained influential in Aegean Bronze Age archaeology, the unpublished drafts of some papers are of historical interest for scholars. On the other hand, the thousands of pages of illustration proofs for *The Palace of Minos* are of less interest, although some are annotated by Evans, and are not a candidate for digitization. As a whole this part of the Archive is likely to appeal to a more specialist audience. Related to the publications are the cuttings of press reports kept by Sir

⁹ See <<https://digital.bodleian.ox.ac.uk/collections/arthur-evans-archive/>> [accessed 20 August 2022].

Arthur Evans. In some cases (e.g. *The Times*) the relevant article is now available online but some of the reports from undigitized newspapers, such as those printed on Crete, are of interest to researchers.¹⁰

One of the priorities for digitization is Sir Arthur Evans's correspondence with other scholars. Some of the letters have been published in scholarly articles or biographies of Evans. With the growing interest in the history of archaeology, digitization will allow researchers to trace these networks of interactions between scholars more effectively. Letters are usually straightforward to digitize through scanning, and this will reduce the need for researchers to handle the original, a consideration that applies to other parts of the Archive. Given the age of the letters, most – but not all – are out of copyright, and it is hoped that other institutions will digitize their correspondence relating to the same individuals, allowing links to be made between them. For instance, the Faculty of Classics at Cambridge holds the papers of Alan Wace, a frequent correspondent of Evans (Cambridge, CU, GBR/3437/AJBW).

3. Work on the Archive

The Sir Arthur Evans Archive has always been available for consultation at the Ashmolean Museum, but it was long seen primarily as a resource for archaeologists to use to understand the excavations at Knossos. This appears to have affected early decisions to sort the material, notably the photographs being removed from box files and placed in albums but also the creation of categories of 'Architectural Plans', 'Fresco Drawings', and so on, since there are indications that Evans kept folders or envelopes of mixed materials on particular subjects. Some of these folders and envelopes survive in the Archive, but often their contents have been removed. The original order of the Archive will never be known, and indeed it is likely to have arrived in a state of disorder. Considerable work in cataloguing and boxing the Archive was undertaken by Ann Brown, administrator in the Department of Antiquities, who also published a number of works based on the material. Further cataloguing work on the correspondence, press-cuttings, and drawings among others was undertaken by Nicoletta Momigliano and Susan Sherratt as part of fellowships at the Ashmolean. As well as the digitization of the drawings, mentioned above, this also resulted in two small exhibitions at the Ashmolean and provided material for a number of publications.¹¹

¹⁰ Sherratt 2009.

¹¹ Brown 1983; 1986; 1993; Momigliano 1996; 1999; 2002; Sherratt 2000; 2009.

The first overview catalogue of the Archive to ISAD(G) standards was produced by Yannis Galanakis in 2012. This brought together some of the existing item-level catalogues into a coherent structure for the first time and organized the remainder of the Archive at the level of series or file in some cases. This catalogue was placed online, allowing potential users to understand the scope and content of the Archive, but it remained necessary to visit the Ashmolean to see material.¹² The Sir Arthur Evans Archive website itself is now regarded by the University as a 'legacy website' which will no longer be maintained. Sustainability is a perennial problem with digitization, and in future we have decided not to try to maintain a stand-alone website about the Archive. Instead a guide to the Archive will be provided as part of the new collections website. Digital Bodleian has proved a useful lesson because material digitized nearly twenty years ago has remained online as a result of being included in a digital collections resource which the University has a long-term commitment to sustaining in some form.

An ongoing project to update the Ashmolean's Collections Online website has provided an opportunity to put the Archive online in a more sustainable form. Whereas the previous website and collections database supporting it were not able to include archive items, this is now possible. One of the differences between museum objects and archives is that the latter require a hierarchical ordering, which has been enabled by the new collections database. At the same time, a collections database is primarily designed to record information about individual objects or items, and so this has prompted a shift in priorities. Although we are still working on a comprehensive hierarchical catalogue, there is now the possibility of including different identifiers to archive items which could be used to generate different orderings. For instance, a photograph in an album can be recorded with both its original Evans identification number and its album reference page. Although in archival terms the album page is the file within which the photograph is included, it will be possible to reconstruct a different hierarchy based on the box file within which the photograph was previously kept. In addition the database will record other information about photographs, such as subject or date created, that can be used to create different groupings. Items can also be cross-referenced with the publications they appear in or the museum objects they depict. Hence the use of Collections Online for the Archive offers opportunities for presenting it in a non-hierarchical way based on links between items.

¹² The work of Yannis Galanakis on the catalogue and website was funded by the Gladys Kriehle Delmas Foundation. See <<https://sirarthurevans.ashmus.ox.ac.uk/archive/index.html>> [accessed 20 August 2022].

A hierarchical catalogue is still in preparation, which will be used as a finding aid and placed online.¹³ It is anticipated that it will remain easier to search a discrete catalogue for particular terms rather than a collections website. Another option which is under consideration is the use of Archives Hub, an online service which brings together different UK repositories.¹⁴ This would allow users to search the Sir Arthur Evans Archive alongside other archives in the UK, which is particularly useful for areas such as correspondence. Whereas users might expect the Sir Arthur Evans Archive to include records about Knossos, it might not be the first place to look for a letter from the Nobel Prize-winning author Anatole France for instance.

4. Why Digitize?

The digitization of an archive requires resources and a long-term commitment to maintaining the digitized files online. The Sir Arthur Evans Archive has always been accessible to scholars by appointment, so it is worth asking what the purpose of digitization is. As a publicly funded institution the Ashmolean Museum has a general commitment to making its collection accessible online, but there are also specific reasons for digitizing this Archive. These relate to the decolonization movement, the publication status of Evans's excavations and the existence of online resources relating to Knossos. There is also a digitalization aspect: using the Archive to complement visitors' experience of the archaeological site of Knossos.

The Ashmolean holds the primary records for Sir Arthur Evans's excavations at Knossos. When Evans began excavating at Knossos in 1900, Crete had recently become independent and passed legislation to allow foreign institutions to conduct excavations.¹⁵ Although there were strict rules about exporting finds, there was no requirement to deposit the excavation archive in Crete.¹⁶ At that time Crete was keen to encourage foreign excavators as a means to establish itself as an independent nation, with a view to union with Greece (which occurred in 1913). Since 1952, the Palace of Knossos has belonged to Greece, having previously been the possession of Sir Arthur Evans and then the British School at Athens. This means that the Ephorate of Antiquities of Heraklion has responsibility for

¹³ Work has continued on Yannis Galanakis's overview catalogue. Further cataloguing was undertaken by Senta German and Alison Roberts in 2016, prior to the work described in this paper which began in 2019.

¹⁴ <<https://archiveshub.jisc.ac.uk/>> [accessed 8 August 2022].

¹⁵ Carabott 2006.

¹⁶ Panagiotaki 2004.

maintaining the site and has conducted extensive conservation work on both the Bronze Age fabric of the Palace and the later concrete restorations undertaken by Evans. The Archive holds, among other things, plans and elevations relating to these restorations as well as a considerable amount of information, particularly photographs, about the way the site looked before it was restored. In this context digitization becomes a form of repatriation, a means of reuniting excavation archive and archaeological site now that they are no longer owned by the same person. In addition, the sharing of information could potentially support the ongoing bid by the Greek Ministry of Culture for Knossos and the other palaces of Crete to be listed as a UNESCO World Heritage Site.¹⁷

[insert Figs 3 and 4 here]

The archaeological site of Knossos is now a major visitor attraction. The visitor experience is largely shaped by the restorations of Sir Arthur Evans and the way in which he interpreted the building. For instance, the Throne Room now sits within a 1930s concrete structure with an unmistakably modernist air. The room itself was restored with replica paintings of griffins which, although based on the original frescoes found on the walls, are now regarded as being inaccurate.¹⁸ The Sir Arthur Evans Archive holds photographs which show the excavation of the Throne Room, as well as the reconstruction drawings which were then realized in the space itself (Figs 3–4). There is potential for visitors to be able to access these archival items via their smartphones if they are interested in the history of excavation and reconstruction at the site. Indeed, some of this archival material is already shown on display boards at the Palace. There are also commercially available digital tours of the Palace available which purport to show the Palace as it was in the Bronze Age. Rather than stripping away Evans's restorations, these simply add another layer of often dubious interpretation. As the material in the Archive shows, Evans's excavations and restorations are an important part of the history of the building. The digital model, to be described below, is one means to present this material.

Although there are numerous publications about Knossos, the Palace and surrounding buildings have never been fully published by modern standards. In his lifetime Sir Arthur Evans published reports on his excavations, particularly during the period 1900–1905 when

¹⁷ See <<https://whc.unesco.org/en/tentativelists/5860/>> [accessed 20 August 2022].

¹⁸ Galanakis, Tsitsa, and Günkel-Maschek 2017.

the Palace was excavated.¹⁹ His four-volume *The Palace of Minos at Knossos* is not a site publication so much as an encyclopaedia of Minoan Civilization: there are descriptions of areas of the Palace and surrounding buildings, but these do not list all the finds or give a detailed account of the excavation.

There have been attempts to provide a more complete publication of Knossos. In particular, Sinclair Hood and William Taylor's *The Bronze Age Palace at Knossos: Plans and Sections* included new drawings of the Palace as well as an index, organized by room, to the published sources.²⁰ Vasso Fotou has compiled an index of references to some of these rooms in the unpublished notebooks in the Archive.²¹ Other authors have restudied the excavated material and brought this together with Evans's publications and unpublished material in the Archive in order to produce full publications of particular areas.²² Given the scale of the task, a digital publication is the most obvious way forward, since this can link together the enormous amounts of data relating to the Palace and its surrounds. It can also draw upon the invaluable work that has been done by these scholars to establish a systematic means of publishing the Palace, by individual room or space.

The Ashmolean can decide whether and how to digitize the Sir Arthur Evans Archive, but there is already a considerable amount of content relating to Knossos and Evans's excavations online. From this point of view, digitization is about contributing to an existing resource rather than initiating a new process. In particular, *The Palace of Minos at Knossos* has already been digitized and made freely available online by the University of Heidelberg.²³ The annual reports published by Evans in the *Annual of the British School at Athens* are available, too, although only to subscribers of JSTOR. Copyright in the published works of Sir Arthur Evans has expired in the UK and EU meaning that there are fewer restrictions on placing his work online. The Ashmolean holds the copyright in nearly all of the unpublished material in the Archive and is committed to making it freely available online, at least for non-commercial use.

In addition to published material, there is a wealth of other data online relating to Knossos. The Pleiades website has resources which provide spatial data about Knossos,

¹⁹ Evans 1900; 1901; 1902; 1903; 1904; 1905.

²⁰ Hood and Taylor 1981.

²¹ Karetso and Fotou 2004, 586–608.

²² Examples include: Panagiotaki 1999; Mountjoy 2003; Hatzaki 2005; Oddo 2022.

²³ See <<https://digi.ub.uni-heidelberg.de/diglit/evans1921ga>> [accessed 20 August 2022].

including individual rooms of the Palace, and also information about publications.²⁴ The existence of these place resources means that it is unnecessary for the Ashmolean to create its own spatial data when digitizing the Archive since this is already available online. It is an example, too, of crowdsourcing since anyone can contribute data to this resource. There are other spatial resources, too, including OpenStreetMap or Google Maps. Similarly Wikidata and Wikipedia contain both spatial data and contextual information about Knossos, in a variety of languages. Wikimedia Commons is one example of a website which contains recent images of Knossos, provided by users.²⁵ Although free to use these images are often not without copyright problems, particularly under Greek law. Nevertheless, these sites show that user-generated content is available which can be incorporated into the digitization process.

5. Making Links

Our future plans for the digitization of the Archive involve putting it on the Semantic Web, using Linked Open Data (LOD).²⁶ LOD is a set of standards and tools which allow different datasets on the web to be brought together. These datasets are also machine readable because the data is semantic, that is, structured in a logical and meaningful way. Museum collections websites typically allow (human) users to search for objects or archive items using a bespoke search interface that cannot be extended to objects in other museum collections without including them in the same underlying database. Even so, online collections databases can be integrated into LOD by ensuring that each item in the database has a unique, unchanging web address, known as a URI (Uniform Resource Identifier). This allows the item to be described in a machine-readable way using a particular standard known as Resource Description Framework (RDF). LOD works by making statements about the item, which are composed using other URIs. For these statements to be machine readable, they need to be in a standard form, known as a triple (subject-predicate-object) and use an agreed set of terms, known as an ontology.

To give an example, the reconstruction of the Throne Room by Theodore Fyfe introduced above can be described using a set of interrelated statements. One might be: ‘Evans Fresco Drawing B/4a depicts the Throne Room at Knossos’. As LOD this statement

²⁴ See <<https://pleiades.stoa.org/places/589872>> [accessed 20 August 2022].

²⁵ See <<https://commons.wikimedia.org/wiki/Category:Knossos>> [accessed 20 August 2022].

²⁶ Berners Lee 2009.

links three URIs: the first is the Ashmolean (or Digital Bodleian) online collections record;²⁷ the second comes from an ontology used to describe cultural heritage known as CIDOC-CRM, where ‘depicts’ is property P62;²⁸ the third comes from Pleiades resource for the ‘Throne Room in Palace of Minos’.²⁹ Similar statements can be made about the date of the drawing, its creator, the collection it belongs to, and so on. If these statements are put into a database known as a triplestore and put online, they can then be queried like any other online database. The difference between a triplestore and the current Ashmolean collections database is that data from different triplestores can be brought together online and queried at the same time. Web users could effectively create their own collections databases which include this drawing because the Semantic Web is structured like a database.

There are a range of tools available which allow users to bring together data in this way. ResearchSpace is one example which provides a platform for visualizing and creating knowledge graphs (sets of linked triples).³⁰ On ResearchSpace these knowledge graphs can be built to link together different entities, such as archival items, using the CIDOC CRM ontology. There are also tools for annotating texts and images with semantic data such as Recogito.³¹ This was an experimental project but showed how texts and images could be linked with the Pleiades spatial resources by annotating them. This tool can be used in conjunction with the Fyfe drawing on Digital Bodleian because of the way it is made available online. This is because Digital Bodleian uses IIIF, a set of standards for images, which are compatible with the principles of LOD.³² Tools such as ResearchSpace and Recogito allow the creation of content but are primarily means to link together content that is already published elsewhere on the web (for instance in collections databases). As a result they are most useful as means to visualize data rather than long-term sustainable ways of storing data. They provide the next step after an institution has committed to publishing its collections as LOD.

²⁷ <<https://digital.bodleian.ox.ac.uk/objects/59f4aa40-47c3-4707-a28b-29fe30c5a462/>> [accessed 20 August 2022].

²⁸ <<https://www.cidoc-crm.org/Property/p62-depicts/version-6.2.1>> [accessed 20 August 2022].

²⁹ <<https://pleiades.stoa.org/places/739470591>> [accessed 20 August 2022].

³⁰ Oldman 2021; Oldman and Tanase 2018; <<https://researchspace.org/>> [accessed 20 August 2022].

³¹ Rainer and others 2015; 2017; <<https://recogito.pelagios.org/>> [accessed 20 August 2022].

³² See <<https://iiif.io/>> [accessed 20 August 2022].

The Archive is not yet available as LOD, but some preparatory work has been done at Oxford, and there are an increasing number of similar examples to use as benchmarks. The Ashmolean has been involved in a pilot project, OXLOD, which examined the feasibility of making collections data available as LOD. This involved mapping it to the CIDOC CRM ontology rather than publishing it. The British Museum did publish its collections as semantic data in 2012, but unfortunately this pioneering resource was not sustained by the museum. A successful example in a related field, Nomisma, allows users to query multiple coin datasets using one interface.³³ These datasets, which include the Ashmolean's coins, are linked by a shared set of LOD standards, partly based on Nomisma's own ontology for numismatics. A current research project is exploring ways of creating LOD from the Ashmolean's exhibition data using the Linked Art Data Model.³⁴ This will include some items from the Archive.

At the same time as exploring ways to publish the Archive as LOD, we are working on visualizations of it. Traditionally archives are presented in a hierarchical form, and the Archive will appear in this way on the new collections website. This is most useful for users who are already looking for something in particular, whether drawings or correspondence. Our aim is to engage the users who are simply interested in the Palace of Knossos. Rather than browsing an archive, we want to allow them to explore the site. This is the reason for working on a 3D model of the site at the same time as exploring LOD applications. A similar approach is being developed for Pompeii: *The Pompeii Bibliography and Mapping Project* provides a map of the site, with increasingly rich associated data, and the *Pompeii Artistic Landscape Project* aims to allow users to discover and explore the associated artworks by publishing them as LOD.³⁵

6. Palace of Minos 3.0

Nearly all of the material from the excavations at the Palace of Minos is split between Oxford and Crete, with the majority of the excavation archive at the Ashmolean Museum, and the objects found during the excavations held in the Heraklion Archaeological Museum and the

³³ <<http://nomisma.org/>> [accessed 20 August 2022].

³⁴ *Enriching Exhibition Scholarship: Reconciling Knowledge Graphs and Social Media from Newspaper Articles to Twitter*: <<https://gtr.ukri.org/projects?ref=AH%2FW00559X%2F1>> [accessed 20 August 2022]; see also <<https://linked.art/>> [accessed 20 August 2022].

³⁵ <<https://digitalhumanities.umass.edu/pbmp/>>; <<https://palp.p-lod.umasscreate.net/>> [accessed 26 August 2022].

Knossos Stratigraphical Museum. Perhaps paradoxically, whilst separated by geography, the disparate components of the excavation can be reunited using a Geographic Information System to create a digital twin of the Palace of Minos – a virtual representation of the Palace to which records and objects from the Archive can be linked. A digital twin of the Palace of Minos is currently being created alongside the ongoing digitization of the Sir Arthur Evans Archive as part of a collaborative project between the Ashmolean Museum and the School of Archaeology at the University of Oxford. Initial work on the digital twin has focused on the Throne Room Complex³⁶ – a complex of buildings which has been extensively documented and typifies many of the challenges inherent in creating a virtual representation of the Palace that can be used to explore the contents of the Archive. At a fundamental level, any virtual representation created in a Geographic Information System must address two deceptively simple questions – what and where? These questions are particularly challenging when trying to create a virtual representation of an archaeological site excavated over a century ago from legacy data.

6.1 What?

The Throne Room Complex was first investigated by Minos Kalokarinos in 1878 when the rounded corner of the façade of an earlier phase of the Palace and the steps at the eastern end of the Antechamber to the Throne Room were discovered during his excavations of Kephala hill.³⁷ It was later investigated further by Sir Arthur Evans in 1900 during the first season of excavations at Knossos which focused on the West Wing of the Palace when the Antechamber to the Throne Room and the staircase to the north, the Throne Room and Lustral Basin, the Room of the Stone Lamp and adjoining room, the Room of the Cupboard, and the Corridor of the Stone Basin were excavated to floor level.³⁸ Investigation of the Room of the Cupboard (by then referred to as the Room of the Lady’s Seat) and the Corridor of the Stone Basin continued in 1901 during the second season of excavations at Knossos when the Room of the Stone Bench, Room of Stone Drum, the Room of the Plaster Table, and adjoining gallery of three rooms were again excavated to floor level³⁹ – the block of

³⁶ Evans 1921, 4–5; Evans 1935, 901–44.

³⁷ Stillman 1881, 43–49.

³⁸ Evans 1900, 35–43.

³⁹ Evans 1901, 31–35.

rooms connected to the Throne Room were referred to collectively in the preliminary excavation report as the Women's Quarter.

[insert Fig. 5 here]

The progress of the excavation of the Throne Room Complex can be tracked in the notebooks, photographs, and drawings held in the Archive (Fig. 5). Individual entries in the notebooks, photographs, and drawings can typically be related to specific parts of the Throne Room Complex using the names of the rooms used in the preliminary excavation reports published in the *Annual of the British School of Athens* and the interpretative synthesis published in *The Palace of Minos at Knossos*. The names of the rooms are interpretative and, as with the Room of the Cupboard/Lady's Seat, changed over time as Evans's theories developed. Whilst interpretations of the Palace have changed since Evans's day, the names of the rooms are a convenient way of linking records in the Archive to the corresponding elements of the Palace. The index created by Hood and Taylor in 1981 to accompany the plans and sections of the Bronze Age Palace at Knossos⁴⁰ seeks to decouple the documentation and interpretation of the site, assigning numeric identifiers to rooms (Table 1) which have been used to index some, but by no means all, of the unpublished records of the excavations held in the Sir Arthur Evans Archive.⁴¹

[Insert Table 1 here]

6.2 Where?

The locations of the rooms which form part of the Throne Room Complex are shown on the plans by Theodore Fyfe and Christian Doll published in the interim reports of the excavations and *The Palace of Minos at Knossos*.⁴² These plans are schematic and typically show the layout and configuration of the rooms, with limited detail showing architectural features and finds central to Evans's interpretation of the site. Additional detail can be found in the sketches and earlier drafts of the plans held in the Archive. Detailed stone-by-stone plans of the Palace, including the Throne Room Complex, have subsequently been produced by

⁴⁰ Hood and Taylor 1981.

⁴¹ Karetsou and Fotou 2004.

⁴² Evans 1900 Plate XIII; 1901, pl. I; 1928, plans A and C; 1935, fig. 877.

Sinclair Hood and William Taylor and the Ephorate of Antiquities of Heraklion at scales of 1:100 and 1:20, respectively.⁴³ Both plans are accompanied by sections that show the profile off the Kephala hill and elevations of key buildings. The plan of the Palace produced by the Ephorate of Antiquities of Heraklion is accompanied by a series of levels which define the heights of individual architectural elements within the Palace and was produced on a 2 m grid with coordinates that can be used to locate the Throne Room Complex in its correct geographic position. While the Ephorate plan provides a robust basis for the geometry of the digital twin of the Palace of Minos, it shows the Palace as reconstructed by Evans and subsequent generations of archaeologists.

Later additions related to the reconstruction of the Palace can be identified by cross-referencing the architectural elements shown on the plan with the notebooks, drawings, and photographs held in the Sir Arthur Evans Archive. Although later entries in the notebooks refer to named rooms and can easily be cross-referenced with the plan, earlier entries in the notebooks typically do not specify room names and are harder to cross-reference with the plan. A 10 m grid was established early in the excavations and is shown on the plans of the Palace published in the interim reports. The notebooks kept by Duncan Mackenzie reference this grid, with grid squares denoted by numbers and letters – early entries in the notebooks related to the excavation of the Throne Room Complex are referenced by grid squares K5 and K6. Prior to the establishment of the site grid, the entries in the notebooks refer to regions under active investigation – the area of the Throne Room Complex fell within Region 4 and corresponding entries are typically (but not always) numbered accordingly. Drawings and photographs are either labelled by room or contain distinctive architectural features and consequently can be easily cross-referenced with the Ephorate plan.

6.3 Digitization

The Throne Room Complex is shown on four separate sheets of the unpublished plan of the Palace of Minos produced by the Ephorate of Antiquities of Heraklion (Tablets 86/47, 86/48 87/47, and 87/48), with separate drawings showing rooms on three levels of the Palace (Plans A, B, and Γ). Only Plan A shows the elements of the Throne Room Complex excavated by Evans – Plans B and Γ show the Loggia conjectured above the Throne Room and relate solely to the reconstruction of the Palace. The four separate sheets for Plan A were georeferenced in ArcGIS Pro 3.0 using control points corresponding to the intersections of

⁴³ Hood and Taylor 1981.

the gridlines and were added to a mosaic dataset to create a seamless image showing the plan of the Throne Room Complex at ground level. Architectural elements, including walls, floors, benches, and pillar bases, were digitized as 2D polygons with attributes defining the base height and extrusion of each feature based on the levels shown on the plan. The resultant polygons were then extruded to create 3D volumes (multipatch features) representing the built architecture with precise geometry equivalent to Level of Detail 4 or 300 in Building Information Modelling (Fig. 6). A virtual representation with a higher Level of Detail could in theory be created from the Ephorate plan; however, uncertainty over the scale and extent of modifications related to the reconstruction of the Palace preclude this here.

[insert Fig. 6 here]

Photographs published by Evans show the degree of preservation of the Throne Room Complex at the time of the excavation.⁴⁴ The western part of the Throne Room Complex was well preserved, with the walls of the Throne Room surviving to a height of *c.* 1.75 m above the floor level, and the bottom of the Lustral Basin *c.* 0.75 m below the floor level. In contrast, the eastern part of the Throne Room was less well preserved, with the gypsum block at the north-east corner of the Antechamber to the Throne Room discernible on the surface and only the bases of the bannisters/reveals of the door jambs from the steps at the eastern end of the antechamber surviving. The 3D volumes for individual architectural elements of the Throne Room Complex can be modified to reflect their extent at the time of excavation by georeferencing drawings or by perspective matching photographs from the Sir Arthur Evans Archive. Once the geometry of the multi-patch features has been adjusted, surfaces of the modified 3D volumes can be textured mapped using images extracted from the digitized drawings and photographs.

Additional 3D volumes were created for the rooms/spaces used to denote different components of the Throne Room Complex and index the notebooks, drawings, and photographs held in the Archive, inheriting the geometry of the multi-patch features for the architectural elements where possible and using measurements given in the published and unpublished accounts of the excavation. Individual entries in the notebooks, drawings, and photographs can then be linked to the corresponding multi-patch features using attributes to store text and images directly or to store links pointing to Uniform Resource Identifiers

⁴⁴ Evans 1900, fig. 9; 1935, fig. 879.

(URIs) or Digital Object Identifiers (DOIs). The enriched multi-patch features were published to ArcGIS online as a scene layer package and hosted feature layer, creating a digital twin of the Throne Room Complex that can be embedded in web-mapping applications that can be tailored to different audiences with Scene Viewers allowing users to explore the contents of the Sir Arthur Evans Archive on their own and Story Maps allowing the construction of narratives that guide users through specific aspects of the Archive. Ultimately, the digital twin will allow visitors to the Ashmolean Museum to view the records and object held in the museum collections in their original context and will allow visitors to the Palace of Minos to access records and objects in the museum collections directly from the site itself.

7. Conclusion

The Sir Arthur Evans Archive is of particular significance as the primary excavation archive for the Palace of Minos at Knossos, but it has always been accessible to researchers prepared to travel to Oxford. The digitization of over 10,000 items requires significant resources and a continued commitment to sustain those items online. This paper has addressed why the digitization of the Archive is important and what form its digitization and subsequent digitalization should take. A compelling reason for digitization is as a form of digital repatriation of excavation records that relate to a site in Greece. This enables them to be shared with a much wider audience, from those responsible to maintaining and promoting the site now to its hundreds of thousands of visitors. Whereas specialists will be able to find what they are looking for once the Archive is put on the new Ashmolean Collections Online website, this paper has considered how to make these digitized items more accessible, both to machines and humans.

The digitization of Archive items as machine-readable LOD means that they can be linked with other related items on the Semantic Web. Since the Palace of Minos remains unpublished by modern standards, LOD provides a means of digital publication. This will be a form of publication distributed across the web, since there is so much data already available about Knossos already, from published reports to spatial data and images. Publication in this context is a process of giving Archive items URIs and then linking them to other items, within the Archive and on the web. This provides an interesting contrast to traditional hierarchical archival catalogues and also traditional linear print publications. This form of online publication will not supersede either but is complementary since it allows information about the excavations to be ordered and queried in different ways. It is also potentially open-ended, as new Archive items are placed online, and new links are formed.

Alongside the long-term project of online publication of the site, there is also a need for visualizations to enable users and visitors to Knossos to explore the Archive in a more accessible form. The 3D model aims to do this by presenting items from the Archive spatially. This will be piloted in a forthcoming exhibition at the Ashmolean: *Labyrinth: Knossos, Myth and Reality* in the first half of 2023. The longer-term plan is to provide a resource to enable visitors to explore the Palace at Knossos. This will complement the visitor experience of a world-famous archaeological site.

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Oxford, Ashmolean Museum, Sir Arthur Evans Archive (AJE).

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List of Illustrations

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- Fig. 2: Theodore Fyfe (1875–1945), Watercolour reconstruction drawing of the Throne Room, 1901, 38 x 56 cm, Evans Fresco Drawing B/4a (© Ashmolean Museum, University of Oxford).
- Fig. 3: Photograph of the Throne Room of the Palace of Knossos, 1900, Ashmolean Museum AJE/3/1/12/34/2 (© Ashmolean Museum, University of Oxford).
- Fig. 4: Photograph of the Throne Room of the Palace of Knossos, c.1930, Ashmolean Museum AJE/3/1/12/25/1 (© Ashmolean Museum, University of Oxford).
- Fig. 5: Plan of Throne Room, including Inner Shrine and Lustral Basin (draft of Evans 1935, fig. 877), undated, pencil, 25 x 30 cm, Evans Architectural Plans WW/28 (© Ashmolean Museum, University of Oxford).
- Fig. 6: Digitized version of the plan of the Throne Room Complex at ground level produced by the Ephorate of Antiquities of Heraklion (Courtesy of Heraklion Ephorate of Antiquities and John Pouncett).

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Tables

Table 1. Summary of rooms related to the Throne Room Complex after Hood and Taylor 1981 (Index B. North-West Quarter).

Index Number	Name	Alternative Names(s)	Number on plan
123	Throne Room Complex	Throne Room System	41-48
124	Antechamber of the Throne Room	Anteroom of the Throne Room	41
125	Throne Room	Room of the Throne, Consistory Hall/Chamber	42
126	Lustral Basin	Bath, Tank	43
127	Loggia	-	Above 42
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132	Gallery	-	W of 45/N of 46
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