A Digital Publication Prototype: The King's Chamber

Owen Murray [1], Alexis Pantos [2], Ariel Singer [3]

[1] OMM Photography, Edmonton, Alberta T6E 2R2, Canada - omurray@ommphoto.ca
[2] Museum of Cultural History, The University of Oslo, Norway - g.a.pantos@khm.uio.no
[3] The American Research Center in Egypt (ARCE), Cairo, Egypt - a.w.k.singer@gmail.com

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Abstract

Remote sensing and 3D digitization technologies now generate rich heritage data streams that deepen our understanding of past civilizations. However, despite advances in web-based distribution platforms and efforts to establish standards — including the EU Study on quality in 3D digitisation — effectively sharing the synthesis, interpretation, and meaning derived from this data remains challenging. Existing scholarly platforms such as Omeka, Scalar, the Getty's Quire, Pure 3D's Scholarly Editions, and Harvard's Digital Giza Project each approach this challenge differently — though these represent just a few examples.
The King's Chamber is a digital publication prototype that integrates 3D datasets from photogrammetry and laser scanning with high-resolution 2D imagery, illustrations, archival photography, and detailed epigraphic analysis. This practice-led exploration examines how digital publications combining 2D and 3D data can complement traditional print publications, functioning as a case study to define community needs rather than being driven by technological capabilities alone.
The project treats information organization and aggregation as vital documentation components. As 3D documentation becomes ubiquitous, a central question persists: what unique value can 3D publications offer beyond their 2D counterparts?

1. Introduction

The King's Chamber digital publication prototype emerged from COVID-era collaborations between the Epigraphic Survey's DigitalEPIGRAPHY website and partners from KU Leuven and Harvard, developed by Egyptologist and artist Krisztián Vértes. These efforts focused on the digital re-publication of the Qar and Idu tombs on the famous Giza plateau in Egypt, drawing on Harvard's archives and IIIF-compatible image server.

Like many heritage institutions, Harvard has made a substantial repository of largely unstructured data, including IIIF format images (Digital Giza, 2021), available online. This resource, in combination with the material of the Epigraphic Survey, sparked conversations about long-term solutions for presenting and archiving epigraphic documentation that build on open access resources while meaningfully re-curating them. We recognized that digitized archives — dig notes, sketches, photographs, surveys, plans, commentary, and interpretation — do not alone constitute a publication. The synthesis, consolidation, structuring, editing, and design that produce traditional print publications remain crucial for making information not just available, but understandable and accessible.

1.1. The Egyptological Context

The Epigraphic Survey (Chicago House), operating since 1924 under the University of Chicago's Institute for the Study of Ancient Cultures (ISAC), produces photographs and precise epigraphic line drawings of inscriptions and relief scenes in major Luxor temples and tombs.

Working under the auspices of Egypt's Ministry of Tourism & Antiquities (MoTA), the culminating objective of the Survey is to produce large folio publications featuring photography, epigraphic drawings and commentary including transliterations and translations. These serve as a scholarly ground truth and preserve ancient records for future generations.

The manner in which these volumes are produced has become known as the Chicago House method; an epigraphic tradition where attention to detail and the expertise of artists, photographers and Egyptologists work in concert to form the foundation of the documentation process. Rectified photography provides accurate proportions and scale, an Egyptologist's philological knowledge and inspection reveals historic significance, and the artist's hand sets forth these observations for posterity; the fruits of their labour acts of scholarship, art and conservation combined.

100 years on, the Chicago House Method remains faithful to its origins, most importantly a series of checks and discussions carried out in situ between Egyptologists that serves as a built-in peer review process of the quality of the documentation in question. 3D data is now used to reproduce a traditional 2D workflow, but this 3D space has also enabled the 2D data, both current and archival, to become reused in a 3D publishing context.

1.2. Research Question

This long-standing publication tradition led us to our central question: what unique value can 3D publications offer beyond their 2D counterparts? Rather than seeking definitive solutions, our exploration of this question — particularly regarding Egyptologists' needs and broader digital humanities applications — revealed both mediums' capacity to augment one another.

2. Methodology & Community Engagement

2.1. Literature & Platform Review

The prototype soon became a tool for identifying requirements and challenges for meaningful digital publication. At the outset of our collaboration and throughout development, we conducted and maintained a review of digital collections, publications and relevant technologies, examining Egyptological resources such as: UCLA's Digital Karnak (2021), Stanford's Constructing the Sacred (Sullivan, 2020), the American Research Center in

Egypt (ARCE) Virtual Tours (2021), the Universitätsbibliothek Leipzig’s Papyrus Ebers viewer (Papyrus Ebers, 2021), Indiana University’s Sketchfab models with translation (Nebsen & Nebetta (w/ Translation), 2021), The New Book of the Dead in 3D at UC Berkeley (NanytheMummy 3D viewer, 2021), the Theban Mapping Project (2020-25), the Wadi el Hudi Expedition (2022), KU Leuven Puzzling Tombs (Sykora et al., 2023), DigitalEPIGRAPHY (2021), Digital Egyptology (2021), Harvard’s Giza Project archives (Digital Giza, 2021), as well as the ISAC collection (2021). More broadly this review included: the IIIF Working Group (2021), the IIIF 3D Specification Group (2022), the Ghent Center for Digital Humanities (2022), the Ariadne Portal (2021), the EU study on quality in 3D digitization of tangible cultural heritage (2022), the University of Lund’s DARKLab Dynamic Collections (2021), NTR’s Jheronimus Bosch – the Garden of Earthly Delights (2021), the RIJKs Museum collection (2022), Cultural Heritage Imaging (2023), the Smithsonian’s Cook, Packrat and Voyager (2021) as well as their OpenAccess collection (2023), Maastricht University’s Pure 3D Scholarly publications (Pure 3D, 2021), the CNRS Aoili Project (Abergel et al., 2023) & Notre Dame Reconstruction (CNRS, UMR 3495 Reperage, 2022), the University of Heidelberg’s Gigamesh (2022), the British Museum’s collection (2021) and ResearchSpace (2023), and Carleton University’s Immersive Media Studio (CIMS, 2021).

Key articles and books including: Resilient Scholarship in the Digital Age (Huggett, 2019), and Virtually Real or Really Virtual: Towards a Heritage Metaverse? (Huggett, 2020), as well as, Publishing Complexity in the Digital Humanities (Wachter, 2021), Publishing Scholarly Editions: Archives, Computing, and Experience (Ohge, 2021), Textuality in 3D: three-dimensional (re)constructions as digital scholarly editions (Schreibman and Papadopoulos, 2019) and Living Books, Experiments in the Post Humanities (Adema, 2021), sparked ideas and conversations about what digital publications might look like, contain and deliver.

Digital publication platforms such as Omeka (2021), Scalar (2021) and the Getty’s Quire (2022) were discussed while 3D model viewers such as 3DHop (2021), Smithsonian Voyager (2021), Matterport (2021), Sketchfab (2020), Google Model Viewer (2022), NIRA (2023), and the Kintsugi 3D Builder (2022), were logged and evaluated. Influenced by Quire’s way of structuring and formatting content, as well as discussions post prototype release, our conversations moved to accessible website design, as per W3C, WCAG 2.1 (2022) guidelines as well as FAIR (2022) compliance principles.

2.2. Defining the Problem

Underlying all this was a desire to do more with the 3D data that was being produced, almost as a byproduct of the epigraphic documentation process of the Chicago House method. Initial discussions centred on creating comprehensive “3D wonder-base” solutions or “digital twin” repositories that emphasized 3D models. However, not only did we lack the resources to venture down these paths, but a closer examination of traditional print publications – in our case, what the large folio print publications, epigraphic illustrations and large format photographs *actually did* – revealed simpler, more refined solutions where 3D content played a supporting rather than dominant role.

Interactions with Giza archives and ISAC collections demonstrated that disparate information – including digital photographs, archival film and glass plate negatives, object registers, diaries, finds and artifacts, wall drawings, paintings, maps, plans and sections, as well as any published or unpublished bibliographies and manuscripts, and any of their associated metadata and paradata – required structured organization beyond simple search results. We recognized that 3D models could provide this organizational framework while existing platforms fell short: Pure 3D emphasized 3D models at the expense of 2D written and visual content, while Quire couldn't handle 3D assets.

2.3. Community Input & Design Evolution

Conversations with Epigraphic Survey members confirmed traditional print publications' value while highlighting missed opportunities in simply digitizing existing publications. We identified complementary strengths: print publications offered clear organization, archivability, and accessibility; 3D models provided intuitive spatial understanding of geo-contextual relationships between inscribed scenes.

The prototype evolved to combine these strengths: 3D models serve as organizational frameworks and navigational aids, while 2D data can be examined in detail without page dimension constraints. Georeferenced data can be layered GIS-style, allowing epigraphic illustrations to align seamlessly with their photographic sources.

Our prototype marries 2D imagery and 3D models with available linked data. Rather than be the pure focus of a digital publication, the model functions as a library shelf repository for all other related data, including any written commentary, translation or transliterations, while simultaneously serving as a navigational aid to the publication itself.

2.4. Dissemination & Feedback

A model texture-swap feature of the prototype was first presented at ARCE’s Annual meeting in 2021 (1), followed by presentations of the prototype at the ARCE Annual meeting in 2022 (2) and 2023 (3), the RIJKS Museum 2+3D Photography conference in 2022 (4), the International Congress of Egyptologists conference (5), the Ancient Egypt New Technologies conference in 2023 (6), and the Cultural Heritage and New Technologies conference in 2023 (7). The beta prototype is hosted online (The King’s Chamber: a Prototype, 2022) (Figure 1) with source code available via GitHub (The King’s Chamber Inscription Viewer, 2022) and a feedback form implemented (The King’s Chamber Feedback Form, 2022). While conference presentations have received encouraging responses, online engagement remains limited.

[1] The American Research Center in Egypt (ARCE) Annual Meeting. Virtual, April 22-25, 2021.
[2] ARCE Annual Meeting. Irvine, California, April 22-24, 2022.
[3] ARCE Annual Meeting. 2022. Minneapolis, Minnesota, April 21-23, 2023.
[4] RIJKS Museum 2+3D Photography Conference. Virtual, June 07, 2022.
[5] The 13th International Congress of Egyptologists (ICE XIII). Leiden, Netherlands, August 6-11, 2023.
[6] Ancient Egypt, New Technology Conference (II). Naples, Italy, July 5-7, 2023.
[7] Cultural Heritage, New Technology Conference (CHNT 28). Vienna, Austria, November 15 17, 2023.

Figure 1. The King’s Chamber Prototype Landing Page.

3. Design, Structure & Features

3.1. Technical Implementation

The King's Chamber prototype uses standard web technologies and open-source services. 2D data leverages the IIIF format via Open SeaDragon 2.4.2 (Open SeaDragon, 2021) with modified curtain-sync functionality (Open Seadragon Curtain Sync, 2021), and code adapted from Open Seadragon Viewport Coordinates (2021), the National Institute for Standards and Technology (NIST, 2021), Kirupa (2018) and Codepen (2021). 3D content is hosted through Sketchfab (The King’s Chamber Scene Selector Navigation Model, 2022), making use of their API (8). The interface uses Bootstrap 5.0 (Bootstrap, 2021) and integrates photogrammetry and laser scanning datasets with high-resolution 2D imagery, epigraphic illustrations, and archival photography alongside detailed analysis from the Epigraphic Survey's archives and publications (The Epigraphic Survey, 2009).

3.2. Core Components

The prototype comprises three integrated components: a scene selector tab, a IIIF scene viewer with inscription and archive tabs, and a text and commentary section (Figure 2).

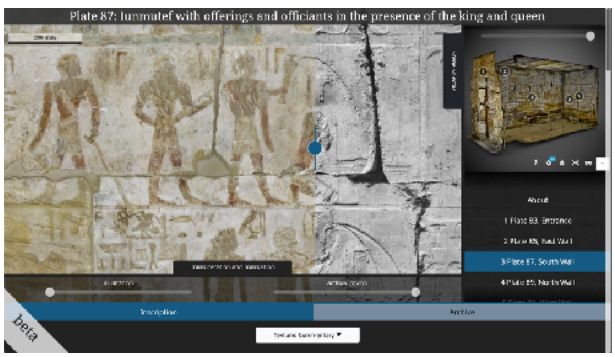

Figure 2. A screenshot of the prototype showing the relationship of the three core components; scene selector (right), IIIF scene viewer (left) and text and commentary section (bottom).

3.2.1. Scene Selector: Contains a 3D model allowing users to navigate content through free exploration or sequential annotated nodes. The model provides implicit spatial understanding of scene relationships and user location while maintaining access to the other two core components. A traditional table of contents below the model links each annotated node to corresponding 2D data in the scene viewer, including photographs, facsimile illustrations and archival imagery. It also loads applicable text and commentary, including inline footnotes, in the text and commentary section below the scene viewer. The scene selector model can be made full screen (Figure 3), or shrunk to a single tab (Figure 4).

Figure 3. The scene selector tab with 3D model in full screen mode.

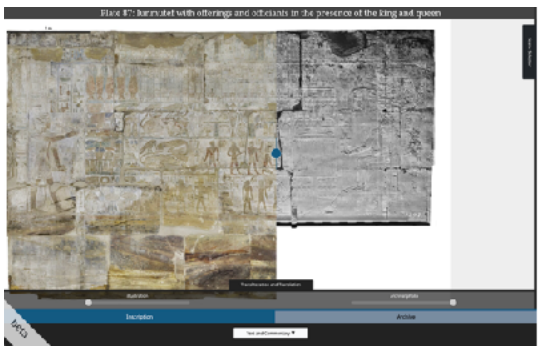

Figure 4. The scene selector model shrunk to a single tab creating more space for the IIIF scene viewer.

3.2.2. IIIF Scene Viewer: Occupies primary screen space with inscription and archive tabs. The Inscription tab enables side-by-side and overlay viewing of high-resolution 2D data — recent photogrammetric documentation alongside archival materials with overlaid epigraphic illustrations at variable opacity. Toggle overlays provide transliterations and translations highlighted for easy identification. (Figure 5) The Archive tab displays historic 2D data with associated metadata and paradata in a comment toggle overlay (Figure 6).

3.2.3. Text & Commentary: Contains transliterations, translations, and commentary as found in traditional print publications, enhanced with inline footnotes throughout the body text. (Figure 7).

[8] Sketchfab API: https://sketchfab.com/developers/viewer

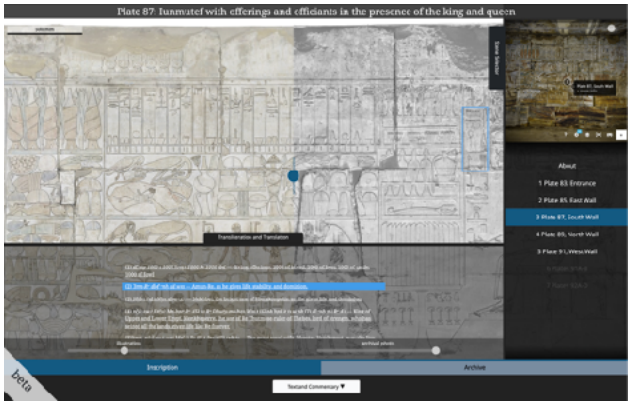

Figure 5. The inscription tab of the IIIF scene viewer showing high resolution current (left) and archival (right) orthophoto documentation with epigraphic illustration overlaid at 1/2 opacity. Transliteration and translation tab active with blue box highlighting for easy identification.

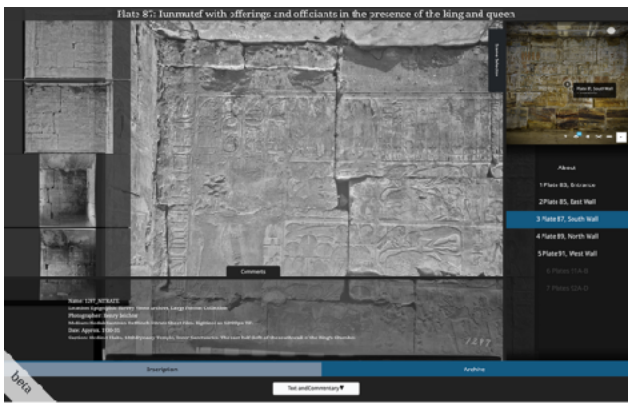

Figure 6. The archive tab of the IIIF scene viewer displaying historic 2D data with associated metadata and paradata in a comments toggle overlay.

Figure 7. The text and commentary section displaying an enhanced inline footnote.

3.3. Unique 3D Publication Value

The prototype's key innovation lies in presenting epigraphic illustrations in contextual three-dimensional relationships — providing definitive facsimile recordings seen 'in situ.' What only imagination paired with keen spatial awareness and dedicated study afforded scholars in the past, now becomes explicit for all users. While 4K texture streaming has limitations, combining IIIF 2D and 3D data delivers a unique experience: contextual geospatial relationships with multiple textures in 3D, plus detailed surface examination with multiple visualization layers in 2D (Figure 8).

This structure enables extensive data reuse and future exploration, incorporating archival materials with current documentation and future research.

Figure 8. The prototypes' key innovation; epigraphic illustration shown ‘in situ’ on the scene selector model with a detail surface examination in the IIIF scene viewer.

3.4. Technology Considerations

From the beginning of our explorations, it was clear that any 2D data should make use of the open source IIIF format as this was one of the great strengths of the Giza project archives over others such as those of ISAC. However, 3D model handling posed challenges despite ongoing standardization efforts from the IIIF 3D Technical Specification Group. Various platforms offer different approaches: the University of Lund's Dynamic Collections integrates 3DHop research tools, while Pure 3D relies on the Smithsonian's 3D Voyager. Data accessibility and physical storage location are of real concern to heritage organizations and research institutes, especially in light of AI LLM data web-scrapping training techniques, but such factors also need to be evaluated in light of the maintenance and upkeep that are often bundled into proprietary for-profit platforms. In turn, they must also be weighed against any licensing models for the data hosted on them.

We selected Sketchfab for our beta prototype primarily because the Epigraphic Survey had existing 3D data hosted there, thus reducing development time and hosting requirements while respecting MoTA data use concerns. The platform provided browser caching, maintenance, and built-in VR/AR capabilities. For long term implementation, self hosting and open source technologies such as 3DHop and Voyager are likely more sustainable, though the model in our beta prototype still functions as implemented despite Sketchfab’s platform transition to EPIC’s new FAB marketplace in 2024.

Crucially, the specific model viewer technology matters less than how the three core components of the prototype interact to deliver a truly unique 3D publication experience.

4. Improvements, Backend Structure & Future Development

4.1. Current Limitations & Mobile Optimization

The beta prototype functioned well on desktops, laptops, and tablets but failed on mobile devices (2022). While GPU advancements now enable mobile loading (2025), navigation remains problematic: the site selector component is unwieldy, title bars overlap between sections, and the texture-swap feature in the scene selector is obstructed. Significant coding adjustments are required for future iterations.

4.2. Backend Restructuring for Sustainability

Though the concept of sustainability underpins much of the beta prototype, from technology selection to embracing a "degrade gracefully" philosophy, we realized these ideas could be pushed further. Our conversations turned to archivability and accessibility, and how a larger publication might be fleshed out (Singer, Murray and Pantos, Forthcoming) (9). Inspired by Quire we explored backend frameworks with a Markdown-to-HTML approach. This static file system—rather than database-driven architecture—simplifies versioning, referencing, and reduces technology-dependent failures. For our purposes this would mean core 2D and 3D data assets belonging to the Epigraphic Survey would remain unaffected by website coding and accessible for download.

Our proposed structure centres on a parent folder containing:

- 3D model in openUSD format supporting AccessibilityAPI annotations
- A Markdown-formatted text file for the text and commentary section
- Subfolders for each inscribed scene containing high-resolution JPEG images of all data layers displayed in the inscription tab of the IIIF scene viewer for that scene
- Digitized PDF of original print publication
- Current publication pdf formatted and output as per Quire conventions

The prototype would pull web content from the parent folder, which would also be zipped and stored for download, such that all 2D and 3D assets belonging to the Epigraphic Survey could be accessible offline and/or archived as such. Though database-driven HTML/CSS and Javascript would remain necessary for interactions and API integrations, this approach addresses Epigraphic Survey concerns about data accessibility and preservation.

4.3. Institutional Integration & Standards

Aggregating images across institutions without copyright infringement requires careful consideration. IIIF format ensures FAIR compliance for 2D assets, and we hope similar specifications for the IIIF 3D format are forthcoming. While ISAC's collection currently lacks IIIF support, hosting institutional IIIF servers for inter- and intra-institutional use may prove a wise and timely investment.

4.4. Accessibility & Citation Methodology

Future iterations will aim to implement W3C WCAG 2.2 standards (W3C, 2022) including screen-reader support, assistive technologies, and multilingual capabilities.

Citation methodology presents ongoing challenges, particularly for transliterations, translations, and commentary. While the beta prototype employed Roman numerals, this approach becomes unwieldy for larger publications. Following F. Poole's work on Rivista del Museo Egizio's digital publication (Poole, Forthcoming) (10), future iterations will have the page number from printed sources noted in brackets in the same text line where the page break would have occurred in the physical copy.

4.5. Technical Realities

Despite careful planning, technological obsolescence remains inevitable as companies continue innovating. However, focusing on sustainable formats and graceful degradation principles can extend digital publication longevity while maintaining core functionality.

5. Conclusion

The prototype's development has reinforced that value stems not from technology or data alone, but from their contextualization. While content, structure, and presentation remain essential to both traditional and 3D publications, our methods of understanding and synthesizing information evolve with technological tools. Notably, this project began before AI-powered LLMs became dominant — tools that will make the substantial labor of backend redesign, interface development, data consolidation, and coding to accessibility standards increasingly manageable.

Developing this prototype has deepened our understanding of digital publication's technological, theoretical, and ethical landscape — considerations that appear often poorly understood in wider academic and heritage circles. Many specialist groups are slowly discovering shared needs while for-profit AI solutions are positioned as complete answers unto themselves rather than tools.

5.1. Publications vs. Archives

Our prototype collaborations have illuminated crucial distinctions between digital publications and open archives — increasingly blurred entities with significant implications for complexity, sustainability, and costs. While machine learning and AI will undoubtedly transform Egyptology and humanities research, and it seems increasingly likely that text, prompt-based AI interfaces with access to vast troves of cultural heritage data will form the bedrock of such research and institution archives, critical questions remain: can institutional or corporate AI LLMs produce grounded, cohesive and publication worthy commentary from database search results? What are the token costs? Might the results function as an intermediary step?

[9] Presented by A. Singer at the Ancient Egypt, New Technology Conference (II). Naples, Italy, July 5-7, 2023.
[10] Presented by F. Poole at the Ancient Egypt, New Technology Conference (II). Naples, Italy, July 5-7, 2023

5.2. Human Expertise & AI Integration

It is clear that both print and digital publications are labour-intensive, but that, in part, is where their value is derived; the contemplation and craft of specialist individuals is a key element of both traditional and digital publication workflows. Insofar as Egyptology and the Epigraphic Survey is concerned, the time and human effort involved in interpreting and making intelligible use of the inscribed data cannot be overstated. We consider digital publications combining human expertise, intention and structure an important stepping stone alongside the pursuit of meaningful machine-driven analysis of the future.

The perennial question persists: how do we embrace AI technologies to serve human narrative, education, and research rather than replace them? For those valuing traditional publication utility to those eagerly embracing 3D publication's contextual and organizational advantages, maintaining focus on user needs while embracing open-source, community-led technologies offers the best path forward.

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