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Participatory Digital Heritage as an Integrated Sustainable Tool for Informative Interpretation of the Past: Umm Qais, Jordan

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Abstract

This chapter discusses the role of the digital heritage in documenting and preserving the local community's daily living memories associated with the architectural and sociocultural heritage of Umm Qais. Its significance stems from the need to re-establish the link between their cultural heritage and the multiple complex layers of urban and architectural traditions that influence their local identities. While considerable debates in the context of digital heritage have examined how the general public can engage with digital practices of remembering, cultural heritage institutions are progressively employing digital platforms to connect individuals with their history.

Keywords: Digital heritage; Sustainable tool; Informative interpretation; Umm Qais.

1. Introduction

Umm Qais is 120 km north of Amman. The site is characterised by a distinctive archaeological and architectural heritage developed over 2400 years of settlement. Its vicinity to the Yarmouk River and Sea of Galilee granted the site unique significance among other Roman Decapolis cities in the Eastern Mediterranean region. The tangible heritage of Umm Qais continues to suffer serious threats that impact its physical features, archaeology and urban transformations, which risk its enduring presence in the long term. Registered on the Tentative List of UNESCO World Heritage Sites in 2001, Umm Qais is in urgent need of records, documentation and comprehensive research on its origins and evolution to determine its hidden unexplored histories and develop an action plan to limit the damage caused by natural and human forces over the past two centuries.

This research was designed to use state-of-the-art point-cloud laser scanning, drone-mounted cameras and powerful processing to share virtual modelling to record and map the conditions and assets of historical sites and their evolution over time. The research team used an evidence-based strategy and action plan to inform the sustainable preservation of the archaeological site using digital and virtual laser detection and ranging (LiDAR) technologies to accurately record its fragmented remains and map sociocultural history and spatial and architectural transformation datasets to a virtually constructed and publicly-accessible platform. In this process, we focus on achieving two key objectives: a) To develop and implement a customised methodology for accurate 3D laser scans and digital surveys and to record, analyse and virtually model the archaeological site, its current conditions and historical evolution over time. Digital records form a critical database of the site's assets for restoration, preservation, protection and public engagement in an interactive virtual environment. b) Training and engaging local community members and young people in collecting, documenting and recording the sociocultural history of the Umm Qais town, including the living stories of displaced residents (Selim et al. 2022).

This research was undertaken as part of the Project 'The Living Museum of Umm Qais', funded by the Arts and Humanities Research Council (AHRC) and Led by the University of Leeds in the UK (2019/23). The project aimed to digitally document the physical heritage of Umm Qais through incorporating smart heritage and innovative 3D Scanning technologies (Song and Selim 2022), as well as to capture individual objects that carry stories and narratives of the site using the latest approaches to photogrammetry. The project involved community engagement workshops that informed and initiated a conversation with locals to enrich their knowledge of the significance of their heritage sites and train them about the latest technologies for documenting heritage sites. This research also investigated the physical layer using innovative methods of heritage documentation, while integrating the immaterial cultural layer of stories and narratives lived and experienced by the locals. These layers overlap and work simultaneously to produce the identity of Umm Qais, which feeds into the broader scope of the research project.

The overarching aim was to produce a sustainable ecosystem of cultural heritage preservation and development for Umm Qais that involved four principal objectives:

a) Capturing the physical heritage of the site through utilizing innovative digital methodologies to document, register and digitize the site's Roman and Ottoman remains. The registration process allows for accurate and detailed site documentation and initiates an investigation of potentially overlooked archaeological evidence. This is achieved using laser 3D Scanning and VR technologies and aims to produce an immersive virtual environment to engage broader audiences about the city's history.

b) Capturing objects that contain historical narratives and connect them to their places and contexts, using the latest technologies of Photogrammetry. This objective focuses on ensuring the sustainability of narratives and stories within the digital registration process and the continued connectedness of the physical objects to the immaterial heritage and local histories and stories.

c) Enquire, register, and record narratives as told by locals, as well as arts and crafts, traditions, and cultural heritage, through qualitative methods of interviews and focus groups. This aims to register the immaterial layer of history to overlap it with the physical layer. Collectively, the layers produce a comprehensive view of the overarching heritage of Umm Qais, and the layers intersect to exchange the recorded information; the narratives told will be portrayed within the virtual environment, which is developed through the registration of the physical heritage using innovative technologies -mentioned in the first objective-. This objective is covered by WP1 and not in this report.

This chapter reports on research with a primary mission to forge novel systems and the relationships between archaeological research, LiDAR scanning and virtual technologies, to build a meaningful mapping of the complex and overlaid histories of the site. It provides an evidence-based synthesis of the spatial layout, evolution and conditions of Umm Qais' ancient Gadara structures and Ottoman Houses through an interactive, integrated, multi-layered and virtual environment through the proactive engagement of users through a living museum concept. It provides an overview of the critical importance of using digital and virtual technologies to document the current assets of the site–historical and contemporary, ancient and medieval, archaeological and craft–which enhances our understanding of the historical evolution of the site over time.

2. Why virtual heritage matters

The digitisation of heritage through customs, photo archives, film footage, oral history documentaries and buildings has become central to preserving national identity and an effective tool in national strategies for undermining radical ideologies in marginalised communities. Virtual environments that encompass cultural heritage and are represented through digital media are often categorised as 'virtual heritage' (Abdelmonem 2017). Modern media and technologies offer visitors, travellers or even residents the possibility of experiencing virtually reconstructed historical sites. Although virtual heritage possesses excellent potential for rebuilding heritage and memory, critics often blame high costs, sophisticated hardware and software requirements, inaccessibility of technology and training and high maintenance for preventing widespread dissemination and use of virtual heritage platforms.

Much of the effort in virtual heritage is directed towards accurately representing historical objects and the physical precision of ancient architectural styles. However, it lacks the human aspect of city life that people can relate to (Yang et al. 2006). Perfectly modelled virtual buildings and spaces provide a sense of precision, but only rituals, human attitudes and cultural traditions enable them to engage in heritage visualisation (Mosaker 2001). Virtual heritage environments also lack 'thematic interactivity' because of the limited cultural content and engaging modules primarily used in photorealistic video game systems. In this scope, the cultural content of virtual heritage focuses on the potential of reducing technical limitations and adding sub-grid cultural terrains to attain a degree of 'reality' and photorealism of culture as a measure for virtual environments, leading to the amorphous nature of history (Selim et al. 2022).

For effective engagement with learning experiences and studies of ancient cultures or to grasp the implications of their evidence, it has become essential to introduce an interactive approach to 3D platforms. As Sanders (2008) noted, 'We understand that the past did not happen in 2D and that it cannot be effectively studied or taught as a series of disconnected static images.' In 1994, as part of a museum's visitor interpretation, a 3D reproduction of Dudley Castle in England around 1550 was initially used as a museum exhibit, giving rise to the term 'virtual tour' and its first use. This consisted of a computer-controlled laser-disc-based system designed by British-based engineer Colin Johnson (Sanders 2008). It is a little-known fact that one of the first users of virtual heritage was Queen Elizabeth II, who officially opened the visitor centre in June 1994.

Several theories address the technology and virtual heritage studies, which are associated with the disciplines of science and technology studies (STS) and communication studies. Moreover, descriptive theories attempt to address the definition and substance of technology and how it has emerged, changed and is related to the human–social sphere. More substantively, it addresses the extent to which technology is autonomous and how much force it has in determining human practices and social structures. Critical theories of technology often use descriptive theory as their basis and articulate concerns, examining how relationships can be changed.

Augmented reality is a technology commonly used in virtual heritage applications. A live direct or indirect view of a physical, real-world environment in which some elements have computer-generated sensory input, such as sound, video, graphics, or GPS data, is known as augmented reality (AR). It is associated with the broader idea of mediated reality. Processors, displays, sensors, and input devices are among the hardware elements for augmented reality. These components, which frequently include a camera and MEMS sensors like an accelerometer, GPS, and solid-state compass, are present in mobile computing devices like smartphones and tablet PCs, making them excellent AR platforms.

2.1 The Interface between Cultural and Virtual Heritage

The use of digital applications to preserve heritage has a long history in computer sciences. Since the 1990s, the evolution of digital modelling, graphics, visualisation platforms and virtual environments have driven the development of new theoretical and empirical methods for addressing the problems of archaeology and heritage preservation. However, vastly developed over almost half a century ago, virtual archaeology has remained a specialised platform for researchers and archaeologists for research-led activities. The public is neither involved in its applications nor in the output intended for public consumption and use. The proliferation of 3D modelling techniques, non-intrusive imaging, geophysics and augmented reality cameras has offered multiple platforms for storing, archiving and communicating vast amounts of information on cultural heritage sites, traditions and content (Abdelmonem 2017). There was a simultaneous necessity to experience new and sustainable ways to record, store, archive and analyse the ever-expansive records of datasets and create the best medium to communicate digital preservation systems.

Many digital projects have become an increasingly core element of museums' strategies, as cultural institutions face the challenge of bridging the gap between their capacity for technology and aspirations to enhance audience engagement with collections (Ridge and Birchall 2015). To achieve this, they often form alliances with areas of digital expertise in large creative tech industries. Several projects have explored cultural heritage sites and objects digitally. For instance, museums are investigating the possibilities offered by 3D printers to examine their collections in a form where detail can be magnified and destruction is far less consequential. For example, the Neues Museum in Berlin collaborated with CultLab to scan and develop a virtual Model of the Nefertiti Bust to enable a larger audience to visualise the details of the masterpiece without damaging the invaluable artefact.

Drones, 3D printing and augmented reality apps are just some tools used to construct 'virtual museum' experiences for real and digital visitors (Selim et al. 2022). Digital and virtual technologies open new and exciting possibilities for exhibitors, archaeologists, architects and curators; they provoke much debate in museums and user groups over real versus virtual users and the priority for investment (Song and Selim 2022). This instigates resistance around issues of authenticity, ownership and value among conventions and advocates of archaeologists (Kidd 2015). Several projects are currently underway to explore how historically or culturally significant sites and objects can be represented digitally. For instance, museums worldwide are investigating the possibilities offered by 3D printers to extend and further examine their collections in a form where detail can be magnified, and destruction is far less consequential.

The EU's DigiArt project uses drones, 3D laser scanners and 60 cameras to capture inaccessible cultural artefacts before creating advanced 3D representations. DigiArt claims to provide innovative 3D capture systems, including aerial drone capture, automatic registration and modelling techniques for post-capture processing, semantic image analysis and digital 3D representations via a 'storytelling engine' (Mohareb et al. 2022). Augmented and virtual reality technologies are used to view or interact with 3D models as a pathway for deeper understanding of artefacts. The 3D data captured by scanners and drones, using techniques such as LiDAR, are processed through robust features that cope with imperfect data. The major output of the project is the multifaceted system used by museums to create a revolutionary way of viewing and experiencing artefacts.

These developments have progressed over the past few decades. What is remarkable is how far we have come to offer real interactivity with historic environments and how the boundaries between virtual and physical experiences have begun to blur. Testing new forms of reality that no longer exist raises intriguing aspects of rereading and reinterpreting history in the eyes of the audience rather than the curator (Abdelmonem 2017.) Living experiences in past venues differed from simply watching still objects and images. Objects and images never existed outside their context. For example, a mummy never existed in daylight nor in a setting where pharaonic artefacts were often discovered. Looking at them in the tombs of the Luxor or Giza Pyramids has made them entirely more fearful than in museums (Abdelmonem 2017) Hence, virtual models of Pharaonic tombs have been created to translate this experience to the virtual visitor in a way that the standard museum could never offer.

2.2 Understanding Virtual Heritage and Immersive Technologies

Virtual and digital heritage are bodies of work dealing with information and communication technologies and their applications to cultural heritage, such as virtual archaeology. According to Erik Champion (2002), the application of virtual reality models and simulation technologies to historical knowledge and cultural heritage content is generally called virtual heritage. However, it has eluded clear and valuable definitions and has been even more challenging to evaluate. Virtual heritage aims to recreate cultural heritage environments and furnish them authentically to their history. Its fundamental mission is to complement and enable, rather than compete with historical research. It is designed to present historical information, context and practices as accurately, authentically and engagingly as possible (Abdelmonem 2017).

Addison (2000) stated that virtual heritage is the fusion of virtual reality technology with cultural heritage content. Champion (2002), citing Stone and Ojika (2000, p. 73), defined virtual heritage as: 'The use of computer-based interactive technologies to record, preserve, or create artefacts, sites and factors of historical, artistic, religious, and cultural significance and to deliver the results openly to a global audience in such a way as to provide formative educational experiences through electronic manipulations of time and space.' However, the idea of cultural content is rather limited and increasingly under-representative of several intangible aspects of cultural heritage, which were summarised the UNESCO (2003) as 'practices, representations, expressions, knowledge, skills – as the instruments, objects, artefacts and cultural spaces associated therewith – that communities, groups and in some cases, individuals recognise as part of their cultural heritage'.

While virtual heritage is primarily used as a tool for teaching and visually learning about history, it has more recently been used to navigate, test and experiment with different theories to validate historical and/or archaeological evidence. The aspects of authenticity, accuracy and realistic natures of simulations, narratives and reproductions depict intrinsic value that determines which version of history is at play. As history is increasingly contested because of different interpretations of evidence–being tangible or intangible–virtual heritage has become accustomed to interpretation, contestation and analytical debate.

However, virtual heritage is becoming a leading sector in the diverse use of virtual reality systems and applications to engage communities, industries and technology developers. This is no longer a short-term objective of visually representing historic buildings. Ababneh (2016, p. 17) argues that while visualisation of archaeological sites, objects and artefacts offer a detailed record of physical environments, those intangible aspects of heritage experiences, namely cultural feed, would enable effective human interaction and understanding of historical narratives in line with modelled objects (Abdelmonem 2017). In contrast to archaeological preservation, we must refer to human sensory experiences with history when we focus on cultural heritage. Cultural geographers tend to associate culture with what is not seen. Perceiving intangibility is the foundation of all human culture. Thus, as cultural heritage refers to historical periods and societies that no longer exist, we face the troubled task of virtualising aspects that are not visible and whose evidence of existence is depicted through scattered items, objects, spaces and a series of unconnected narratives.

3. Uncovering the archaeology, history and culture of Umm Qais: *How Virtual Heritage Environments benefit Umm Qais*

The design and planning of the Living Museum of the Umm Qais Project envisaged a series of processes to engage public users, tourists and local communities in the recording, protection and reproduction of the Umm Qais heritage site as a living environment. These virtual platforms provide access to information, learning activities, crowdsourcing data and other opportunities for actors to provide input into more democratic and user-interactive platforms that move beyond the traditional means of physical tours. They help educate, interrogate, analyse and interact with historic and ancient cultures in new ways. Under the outline of the project's aims and objectives, the following aspects would be covered when developing digital records of the Umm Qais site (Central Gadara and Ottoman Village):

3.1. Digitisation and the use of technology in the interpretation, presentation and restoration of cultural heritage

To counteract the detrimental effects of the lack of funding, excavation and tourism due to conflicts in neighbouring Syria, digital recording and modelling of the site responds to the urgent need to document existing site conditions and trace its historical layers and structures before conservation and protection of the site can commence. Archaeological structures, objects in the Roman site of Gadara and the Ottoman houses were scanned through the use of novel techniques and state-of-the-art point-cloud laser scanning, digital archaeology and virtual modelling technologies developed by the University of Leeds, using terrestrial laser scanner Trimble X8 from the ground and using an aerial imaging survey drone system from the air, to detect and record accurate architecture, archaeological and spatial data, structural deformation, deterioration and risk of structural irregularity. The scanning produced credible scenario models of the spatial and structural databases of the archaeological site and its components were archived, digitised and processed into a 3D virtual model of the area under study.

3.2. Re-writing the History of The Site through local interrogation of script analysis, historical documents and archaeological discoveries

The project focused on building a comprehensive understanding of settlement patterns, architectural and digital recording and modelling to enable the detailed and accurate interrogation of structures and archaeological remains of the Roman City of Gadara and its subsequent medieval Ottoman settlements, not only through scientific endeavours, but also through the incorporation of narratives and the oral history of local communities and their cultural heritage into its virtual platform. Incorporating archaeological records and comparative analyses through virtual platforms and models will enable the development of a credible and evidence-based layout for the entire landscape of Gadara by analysing its spatial layout, infrastructure and aspects of daily life.

This project confronts the current misinterpretation of a site's history. It reconstructed the ancient city's spatial patterns, structural layout and buildings into virtual environments that will not only reshape public perceptions but also confront the current modes of engagement with history in Jordan as a truthful record of the past. This enables ordinary users to have interpretive living experiences of the past. This activates the social role of the archaeological site as an agency for community engagement and forum for learning, reflection and expression.

Fig. 3.1. *Processing Various stages of point-cloud models.*

4. Building Multi-layered virtual heritage environments

Our methodology worked towards a 4-phased process of investigation, building a unique capacity in terms of an integrated ecosystem of sustainable preservation for archaeological sites in Jordan and using innovative virtual technologies for documenting, recording and analysing archaeological remains and their transformation over time. The methodology is as follows: a) to use archival research and accurate 3D point-cloud laser scanning to digitally survey, record and model existing conditions and features of the site; b) to undertake spatial and architectural analysis of structural and environmental elements of existing structures, archaeological and medieval houses; c) to develop a semi-automated virtual heritage interface that integrates remote sensing indicators and geophysical datasets on a custom-developed ArcGIS model of the site, including environmental and thermal modelling; and d) to develop an interactive virtual reality experience for museum display and exhibition, as well as an active public engagement platform that includes the global tourism sector, local community participation and educational material.

The research program coordinates and generates datasets on the historical, archaeological, environmental and geological surveys of the Gadara Roman Site and the Ottoman Village of Umm Qais, which are integrated into a custom-designed virtual heritage platform that serves several disciplines' investigations and projections of their datasets for public display and engagement. These activities involved developing a point-cloud multidisciplinary survey and a model of the Gadara Centre and the Ottoman Village. It coordinated fieldwork data gathering, 3D point-cloud laser scanning and multi-layered spatial and digital modelling processing. This involved developing a comprehensive strategy to investigate the site and planning and designing a surveying system that incorporated the complexity of the site's topography, different historic and archaeological elements and artefacts. A customised methodology and layout for accurate 3D laser scanning and digital surveys was developed and implemented to record and analyse archaeological sites and their components. This work involved the following series of fieldwork and capacity-building activities:

4.1. Generating Point-Cloud Models

This includes a point-cloud LiDAR survey and scanning of Central Gadara and Adjacent Ottoman Houses. This was achieved through surface point-cloud laser scanning of Basilica, on-street shops and adjacent Ottoman Houses to build an accurate digital model of the area and connect it with universal Geographic Information Systems (GIS) Geolocation data. The site was divided into eight investigative sections, with each section's coordinates and survey maps being coordinated to process and overlay detailed findings. Terrestrial LiDAR is an accurate device for recording physical objects and the ground. Multiple point clouds were recorded at several locations and a complete point-cloud model was generated for analysis and recording. We used Al-Mutaz Surveying Instruments as the local supplier and technical team to execute the planned surveys through close coordination and planning in advance. The team used Trimble X8 Laser Scanning and scanned 64 stations over two fieldwork missions. X* is the latest and most accurate scan station available; its accuracy is less than 20 mm and it can obtain data up to 120 m away.

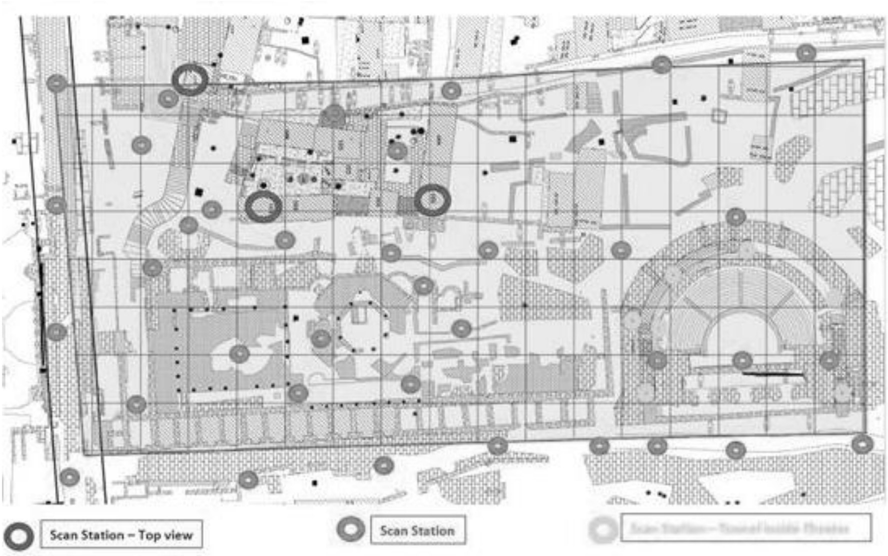

Fig. 4.1. Phase one of Laser Scanning: 45 station points, during June 15-17, 2019. This was followed by a further 19 Scanstations to complete missing data.

Fig. 4.2. Developmental phases of processing the Point-cloud model of the Western Theatre

4.2. Aerial Survey, Photography and Modelling

This task involved the use of a drone-mounted survey and digital imaging of the site at multiple altitudes to ensure accurate mapping, recording and aerial surveys. Three Victor datasets and image-based models were generated. The platform obtained low-level photographic data of the site and its topographical surroundings. This imagery will be imported into photogrammetry software to build three-dimensional spatial models for analysis and will be exported to virtual reality software. It will then be adjusted using Global Positioning System (GPS) data.

Aerial photography and drone surveys are not easily accessible, considering the site geographies and unsettled international borders. Hence, we arranged for local specialist firms to undertake this work and obtained the necessary permissions. Amman-based Intelligent surveying systems have undertaken aerial surveys in several phases. Films and spatial maps of the site were recorded and integrated into a series of virtual applications and outputs.

Fig. 4.3. *Drone-mounted aerial photography and filming.*

4.3. Capacity building workshop: Working with the community

A workshop in 2020 was designed to build the capacity for suitable strategies and practical methods to use smart and digital technologies to research, record, document and analyse heritage sites, as well as their multi-layered histories and public engagement with Umm Qais and Gadara's heritage site. It focused on training early career researchers and heritage professionals on the purpose, use and strategies of analytical archaeological methods, public engagement and digital technologies to document and preserve heritage sites in Jordan. Notably, it focuses on using point-cloud laser scanning, software and the semi-automated processing of archaeological and spatial datasets to generate digital models of heritage sites. It brought together several specialists from the UK and Jordan to work closely with local community members, residents and young people to develop an inclusive preservation strategy in Umm Qais. The workshop was designed to provide practical training onsite with hands-on tasks for the participants.

4.4. Co-production of Photogrammatery Database for Archaeological features

Photogrammetry has emerged as a leading application for creating virtual archives of ancient artefacts and Objects in modern and national museums and heritage sites. The science of obtaining measurements from photographs involves translating images into 3D navigable objects. It also allows users and the public to closely examine objects and artefacts on virtual screens. Its outputs mostly include 3D models, maps, drawings or measurements. To record archaeological sites or objects using photogrammetry, both aerial and close-range photogrammetry are required. In the former, the camera is mounted on an aircraft or drone. Multiple overlapping photos of the ground, building and site were taken along the flight path at specific but regular distances. These photographs were processed in a stereo plotter and then automated for the Digital Elevation Model creation. In closed-range photogrammetry, a camera is placed close to the subject and produces drawings, 3D models, measurements and point clouds. This type of photogrammetry (known as CRP) is also called image-based modelling.

As part of the data gathering to build a database for the archaeological artefacts and historical elements in Umm Qais, we trained local and young professionals from the community to use and produce photogrammetry models of various components of the site. These were produced by economical and accessible cameras or Hi-Res Mobile phones through 10s of pictures of each object from all angles and inclinations. Different digital imaging software packages process these images to generate digital 3D models. Such simple skills and training enable local members to continue their production and help establish crowdsourcing of this digital archive by both tourists and community members.

Using a high-quality DSLR camera, we captured images of individual objects from all angles and processed them as photogrammetry models. Nine objects were captured with an average of 90 images per object. Objects were chosen because of their known historical significance or the potential of their utilisation within the Pointcloud model produced from the laser scanning mentioned above; for instance, our team spotted a piece of marble decoration that was part of a repeated element throughout the side of the Decumanus Maximus (the east-west-oriented road). This piece was then photographed at high quality, duplicated and replicated, to recreate the Decumanus Maximus at high quality. Photogrammetry is a key transferable asset; thus, we decided to incorporate photogrammetry into the community engagement workshop.

Artefacts include ancient statues and archaeological objects, craft objects produced historically by community members and models of spaces that include details of materials such as mosaics. In the first phase, 14 objects were created, photographed by local participants and processed at a later stage. These objects will be accompanied by infographics and a soundtrack that explains their history, prominence and, more importantly, the local cultural stories attached to them.

Fig. 4.4. *illustrating the level of photos used for a single photogrammetry model, including the level of details.*

5. Analysis and Processing

It typically takes several months to generate initial models and maps through digital scans and satellite imaging of the archaeological site, as well as fragmented structures and objects in the inclusive database of Umm Qais. These were imported into the AgiSoft Photoscan software to form the initial 3D model with an expected accuracy of not less than 0.30mtr and for export to GIS. Global Positioning Systems provide millimetre accuracy for all axes. These are available for conversion using modelling software to locate points relative to the world map. Multiple points can be distanced three-dimensionally to provide connecting data for distinct objects or locations. The obtained images were 640 × 512 pixels with high overlap and were imported into the PIX4D photogrammetry software for modelling using the RGB dataset, plus a textured mesh. They were scaled using GPS information before being exported to the ArcGIS repository.

5.1. 3D Scanning

The 3D scanning documentation process was performed for three days. Each day, a predetermined area of the site was scanned to organise outputs. Using Trimble TX8, the documentation process commenced by producing a map of the implementation and pinpointing the positions of the individual scanning stations and areas they should cover. Scans were place between 7:00 and 14:00 to avoid heavy shadows in the final 3D model. After each workday, the scans were processed daily and communicated. Forty-five stations were captured from Al-Mutaz. As Al-Mutaz was involved in capturing the Roman City of Umm Qais, the Department of Antiquities (DoA) captured the attached Ottoman Village using Leica P10. Thirteen stations were received from the DoA.

Fig. 5.1. *Processed point-cloud model*

Fig. 5.2. *Processed point-cloud model for the whole site from different perspectives*

Fig 5.3. Rendered point-cloud model for parts of the site.

5.2. Community Engagement

By realising the power of communities and the significance of incorporating and engaging them in the process, the research team held a community engagement workshop in Umm Qais. The workshop emphasised the significance of utilising technologies to document heritage. It also highlighted the importance of narratives and stories in documenting the site's immaterial history and called for interest from local groups to engage in the documentation process. The community responded positively and a team of five young local females was formed. They engaged in learning the principles of photogrammetry and volunteered to aid the process of recording the narratives and stories within the site by helping to conduct interviews with their older relatives, as well as appearing in videos explaining the significance of some of the objects that they had produced photogrammetry models for.

6. Conclusion: Impact on the Local Community

Research-Led Training in state-of-the-art laser scanning and virtual digitisation modelling has supported young researchers and entrepreneurs in Jordan. The project investigation and processes were educational, providing training materials and practices by participating academics in advancing local knowledge and practice in heritage preservation, modern technology and the application of virtual reality in cultural heritage. Practical skills training through workshops were successfully designed to train local interdisciplinary research teams about the skills needed to prepare future researchers to work together on the developed methods and techniques of digital archaeology and virtual heritage. While these are central to the project, they also serve as impact pathways. They aim to help participants develop the necessary and transferable skills to sustain the long-term project impact, post-completion and elsewhere.

The interaction among humans, technology and tangible and intangible elements creates a space for intriguing and original knowledge generation and enquiry, reflecting a new stage in the site's cultural history through novel output. Developing a living museum involves more than just digitalisation and duplication; it also involves a genuine process of reconstruction to produce new, original heritage content that enhances accessibility and is a catalyst for cross-generational and cross-time agency.

The techniques utilised served as the foundation for long-term training courses that benefited local communities and related local companies as part of our efforts to create a long-term and sustainable model of living heritage. While these were essential to the project's execution, they also significantly impacted participants' ability to acquire transferable skills that sustain the use of virtual heritage techniques in Jordanian cultural heritage presentations. We generated considerable interest from a wider audience through our initially chosen participation, which led to a larger representative group of community members.

During the past two years, the living museum as a typology has changed, moving from being a site- and history-based project to becoming a more integrated project of cultural programs that engage numerous local and national stakeholders, creating a connection between researchers and local communities, as well as between people and places, as a revival of a long-forgotten relationship. Every opinion matters and every tale has value. Living museum typologies offer an open-ended, technologically-enabled strategy for preserving cultural heritage that is more dynamic, interactive and produced jointly. In addition to promoting and distributing the site’s tales and narratives to wider local and international audiences, it has established a crucial arena for the exchange of ideas and communication among stakeholders.

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