

The backstage of Byblos' Roman theatre: New Digital Devices using Information and Communications Technology (ICT)

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Abstract

This paper presents the results of a multidisciplinary research project that combines the fields of architecture and the conservation of the built heritage, history, communications and computer science. The study of new methods of experimentation will enable us to define and validate new orientations in the way we understand, structure and transfer acquired knowledge about a given architecturally significant complex.

The aim of the project is to present the various experiences obtained during the interpretation of heritage spaces, and in particular intangible heritage, using information and communication technologies. More specifically, it involves acquiring, through ICT, computer modelling and archaeologists' accurate documentation, an understanding of the consequences of successive occupations of an archaeological site on its current condition. It also seeks to gain a better understanding of the construction techniques and know-how of the Ancients.

The objective of this project is to introduce computer modelling, which is capable of showing the site's evolution over the centuries, in order to help us understand the superposition of historic layers.

This work will reflect on how to respond to certain challenges using the example of the experiences acquired at the site of the ancient city of Byblos in Lebanon, a city included in UNESCO's World Heritage List. The Byblos project also helps to re-create and re-mould a monumental complex without having all the information and to test hypotheses that we would otherwise be unable to validate without compromising the heritage values of a site by physically reconstructing it. Such a compromise was experienced in the case of the Roman theatre of Byblos (A.D. 218) which, in the 1930s, was moved and rebuilt by the sea by archaeologist M. Dunand.

1. Introduction

This research project deals with the use of information and communication technologies (ICT) in the enhancement of archaeological heritage, particularly in the case of the Byblos site in Lebanon.

Located north of Beirut, the city of Byblos, which has been included on UNESCO's World Heritage List since 1984, boasts a number of lively, ancient neighbourhoods, as well as an archaeological site where excavation work has unearthed a succession of abandoned cities revealing long-vanished civilizations [Jid04]. "The chief attraction of Byblos for visitors is the superposition, in the same site, of ruins spanning 7,000 years of history." [Dun73]. Over the course of history, the site served as a quarry for successive civilizations. Such was the case with the Roman theatre, which was used as a source of stone by the Crusaders and whose origins date back to 218 A.D. Today, only the first five tiers and the stage remain. When it was first excavated,

the theatre faced the setting sun. It was moved and rebuilt near the sea by archaeologists in able to reach the Early Bronze Age period levels.

The idea for this research [DpBEBK05] arose from the study of certain ancient sites, of which sometimes only ruins remain, but that are important enough to merit further exploration: these ruins represent an archaeological heritage. There are multiple definitions of heritage, and this a subject of ongoing debate among the various disciplines involved in its conservation. In our case, we define it as the know-how arising from the construction methods and ways of life that characterize a place through history. The goal is to reconstruct the "memory" of a place through the use of new information and communication technologies (ICT).

The underpinnings of the criteria employed in 1984 in selecting Byblos for inclusion in the World Heritage List have evolved, and consequently the criteria for selecting a

site have changed. ICOMOS selected Byblos based on criteria III, IV and VI:

- Criterion III: Byblos offers an exceptional testimony to early Phoenician civilization.
- Criterion IV: Byblos provides one of the first examples of Bronze Age urban organization in the Mediterranean world.
- Criterion VI: Byblos is directly and materially associated with the diffusion of the Phoenician alphabet (on which humanity is still largely dependent), by way of the Ahiram, Yehimilk, Elibaal and Shaphatbaal inscriptions. [IU84]

Heritage is a constantly evolving concept, particularly since 1989 when UNESCO introduced the notion of intangible heritage, the importance of which was confirmed by the “Convention for the Safeguarding of the Intangible Cultural Heritage” of 2003.

The concept of intangible heritage is increasingly gaining currency. According to M. Petzet (2003), “The preoccupation with what we try to define as intangible heritage may also contribute to a broader emotional basis of conservation practice, which can help us in the daily fight against the progressive world-wide destruction and decay of our cultural heritage.” [Pet03] Intangible heritage is not a static value, but an evolutionary concept: “The notion of intangible heritage must not be fixed at a particular point in time – it is dynamic and evolves and it is the evolving intangible heritage which is important.” [Bum03]

It is also important to note that the concept of heritage was brought to Lebanon in the 19th century by European missionaries, explorers, archaeologists and other scientists interested in identifying and describing monuments from Antiquity and the Middle Ages in the Mediterranean. Since then, the notion of heritage in Lebanon has evolved and now refers to a specifically Lebanese heritage, with ideological undertones directly linked to national identity. Lebanon is composed of several social and denominational identities, which means that heritage is perceived differently according to one’s background. Without belabouring these nuances, suffice it to say that heritage and its preservation is a major issue in the world today, and is beginning to gain importance in Lebanon.

These new approaches to tangible and intangible heritage have guided our experimentation in developing new digital devices to protect and promote the archaeological heritage through ICT.

2. Enhancing Heritage Through ICT

One of the main objectives of our research has been to gain an understanding of heritage in order to demonstrate how, using new methods of representation, we can attempt to virtually represent the tangible and the intangible: what is and what used to be. ICTs allow for an exploration involving the simultaneous use of simulation and experimenta-

tion, while respecting the guidelines set forth in UNESCO’s charters on the safeguarding of heritage.

With regard to techniques of representation, it should be noted that in the twentieth century archaeological heritage was illustrated by means of drawings, plans, cross-sections and elevations produced by architects and archaeologists. Three-dimensional reconstructions of spaces were often created as well. This is precisely what the archaeologist Maurice Dunand undertook during the excavation of Byblos in the 1930s. His sketch of the Roman theatre of Byblos is one example of this approach. It is prominently featured on a sign providing information about the archaeological heritage to visitors (Figure 1). Graphic reconstitution in the form of drawings is still widely used today for the enhancement of archaeological heritage. [DpEk05]



Figure 1: Sign providing information about the archaeological heritage to visitors (Byblos site).

The restoration of ancient monuments is another way in which architectural heritage can be enhanced. Restoration, according to Pérouse de Montclos, involves a number of different areas. These include “consolidation”, which is done to ensure a building’s durability, without modifying it; “reassembly”, the reconstruction of a building whose parts are still available on-site; “reconstitution”, the collection and reassembly of authentic elements that have been dispersed; and “repair”, the replacement of deteriorated parts with new, identical elements. [Gil06]

The physical reconstitution of monuments is now regulated. The Venice Charter, which preceded the one adopted in Victoria Falls in 2003, states “that architectural heritage must be considered within the cultural context to which it belongs, that conservation and restoration of architectural heritage requires a multidisciplinary approach, and that the latter is not an end in itself but a means to an end, which is the building as a whole.”

Finally, it should be recalled that, as with life-size reconstructions, scale models also are potential tools for enhancing architectural heritage. They can be used to depict a building, but often provide no information on the factors related to its construction history. Such models are limited to three-dimensional reconstitution of forms that are, in certain cases, hypothetical. They are often used as teaching aids, and also as tools to inform and entertain cultural tourists. [Gil06]

In this chronology of heritage expression, the use of computer models that allow for realistic simulations and real-time movement through virtual spaces, becomes relevant. Little by little, a physical environment is expressed through digital 3D spaces and a kind of architecture that is virtual and dematerialized sees the light and helps us better understand the construction of a building.

3. Methodological Experimentation

In addition to the potential of simulation, virtual space opens new possibilities of expression and experience [And98, [Eng01]. It also helps to re-create and remould a monumental complex without having all the information and to test hypotheses that we would otherwise be unable to validate without compromising the heritage values of a site by physically reconstructing it [UII94]

This was the case of the Roman theatre of Byblos (A.D. 218), which we used as a case study and which, as previously mentioned, was moved and rebuilt near the sea by archaeologist M. Dunand in the 1930s [Jid04].

In order to better understand the heritage of Byblos' Roman theatre, a preliminary experiment was undertaken based on a multidisciplinary research strategy.

This strategy allows the development of augmented reality experiences in order to make us feel present within old constructions as well as on the actual archaeological site. Based on the 3D models and photos taken from known positions on the site, we built 360° cylindrical panoramic photos related to specific coordinates. Then, through the different configurations of the building, several layers of the theatre were composed on the present site view. The activity of comprehension and communication inside this dynamic virtual historical space is more intuitive and effective than using only abstract technical data for plans and orthogonal views. Furthermore, with ICT, we are able to remotely access these augmented realities. It will also be possible to experience them in an immersive way using projection systems, placing the participant directly in the past while respecting the user scale. In addition, sound effects may be added to enhance the sense of presence. This prototype can also be shared online within the researcher community. [EkDpD06] (Figures 2, 3)



Figure 2: 3D models; corrected perspectives using QTVR.

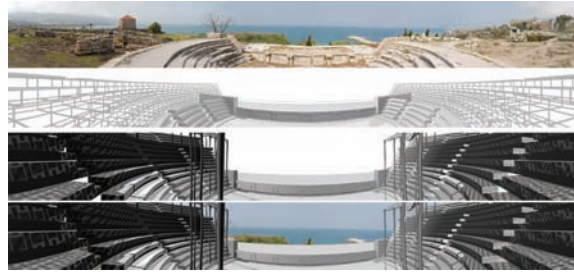


Figure 3: Augmented realities composed with cylindrical panoramic views of the real site; corrected perspectives using QTVR.

Although many current studies have focused on reading the past using ICT [Ver03, Dav05, GF05, Sal05], the avenues for research identified in the context of this work arose from the activities of the GRCAO, such as the creation of procedural models enabling the modelling of what we have termed “semantic operators”. [DpB99]

Such a model allows us to produce figurations with all the characteristics belonging to a single family of objects in order to illustrate the result of a procedure or process, and to find relationships among buildings based on their method of construction; in addition, it makes it possible to verify the validity of a rule characterizing a set of objects, thereby ensuring a dialogue between the various actors and the model. Figuration consists of a series of three-dimensional scenes that act as a metaphor for constructive and temporal reality. [DpB99]

The method of construction can be expressed by means of a functional language that enables the modelling of actions. In the same way, this language can encapsulate and transmit the conceptual properties of an architectural object, and therein lies the strength of the approach that we are presenting. Our reasoning is founded on the generic formalization of a body of knowledge. This descriptive mechanism makes it possible to establish relations between the functions. It helps us to understand the aim of the building's properties through the heritage (memory) of the characteristics that give rise to figurations (Figure 4).

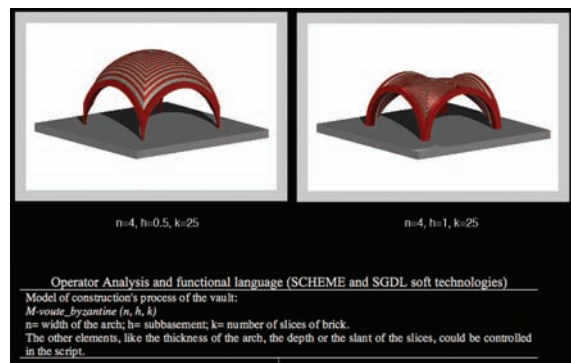


Figure 4: Example of procedural model.

Based on these research results, which draw their validity from the know-how of the architectural past, we are able to

generate figurations of similar theatres: the researcher operates within a paradigm that brings together various types of solutions by means of “figurations”. The use of parametric functions enables us to break down the construction process.

The result is an approach that integrates various design process “operators” to enable the use of appropriately structured figurations that can be manipulated, transformed and organized into a figuration of the object. This process is somewhat similar to the reuse of architectural knowledge in the creation of an architectural work. In designing a new project, architects use fragments of knowledge derived from ancient structures, whether these fragments are reutilized, or simply projected. The design is then based on the memory of a previous interpretation, since the extraction of reusable knowledge can be achieved through an interpretive process. [Leg00]

It is with a view to reusing such knowledge that we take up and further explore this way of representing know-how in the case of the theatre of Byblos.

It is important to note that our intention to transfer ancient know-how does not affect the situation of those researchers who are neither archaeologists nor tourism promoters, but who are attempting to enhance the archaeological heritage. This research project involves several disciplines: architecture, urban planning, history, archaeology, communications and, undoubtedly, other areas as well. The challenge is to bring together all of these competencies around a common objective: the enhancement of heritage. Our goal is to propose methodological experiments to define and validate new orientations in the way we understand, structure and transfer the knowledge associated with a given site.

As a first step, we organized and described approaches for the transfer of knowledge that allow us to exploit representations of spaces with the help of digital modelling software (Figure 5).

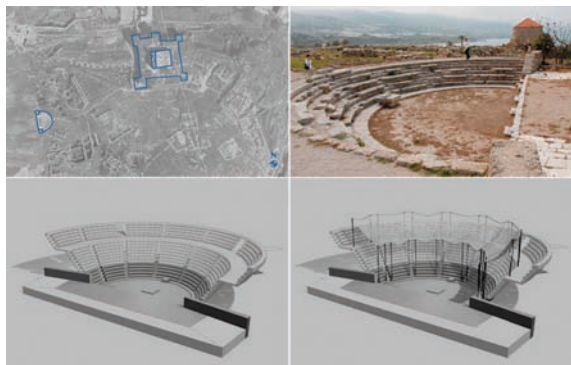


Figure 5: representations of spaces.

We then developed the information structure necessary to validate strategies for defining an informative representation model, using software applications that enabled us to create web-based interactive digital devices. (Figure 6)

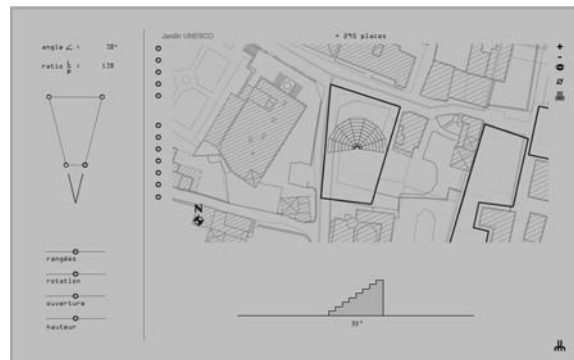


Figure 6: Web-based interactive digital devices.

As shown in Figure 7, these experiments enable us to deepen our knowledge of the construction techniques and know-how of the Ancients, and to create computer models that illustrate the site's evolution over the centuries, to help us better understand the superposition of historic layers and suggest periods to which the research proposal might be applied. [DpEk05]



Figure 7: Site's evolution over the centuries.

In order to develop modelling methods that take advantage of new information technologies, and to achieve our project's stated objective of designing computer-based approaches for representing the spaces that evoke the memory of a site, we generated an initial computer model of the theatre, in which the steps that have survived to the present (in darker colour) can be distinguished from the rest of the theatre as it might have appeared at the time (Figure 8).

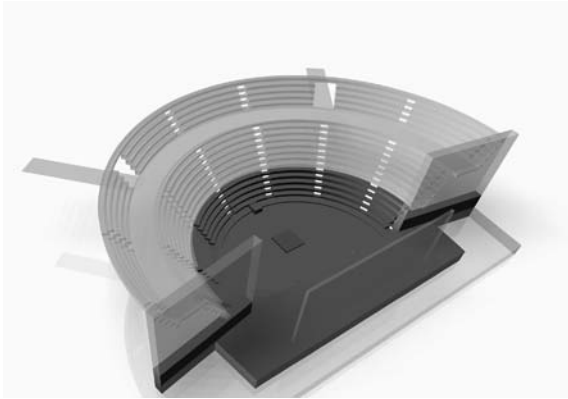


Figure 8: *Computer model of the theatre.*

Models were subsequently created using a 3D digital printer (Figure 9).

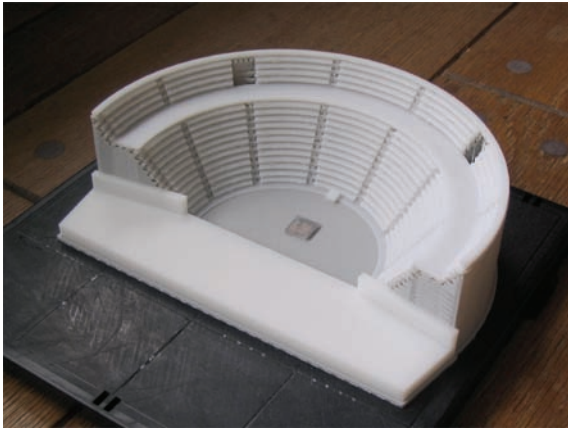


Figure 9: *Model created using 3D digital printer*

Based on this work, the reconstituted theatre was replaced in its original context, as it might have existed before it was taken apart and moved (Figure 10).



Figure 10: *Graphic three-dimensional reconstitution of ancient site of the theatre.*

The way in which these objectives were achieved will likely have an impact on the current work methods of the designers involved in the development of the Byblos site, as they can now benefit from the integration of information relating to the know-how of archaeologists, architects and historians to colligate a memory and propose new methodological orientations in the restoration of the man-made environment.

4. Conclusion

Through this work we explored different avenues to achieving the goals set forth in the research project. Our initial desire to enhance heritage sites led us to delve further into the concept of heritage and review previous work that had been done on the topic. This reflection process enabled us to define the themes for the Byblos research project by orienting its focus on the case of the Roman theatre. We realized that, although they are two different entities, the archaeological site and the medieval city of Byblos share a common heritage.

We reflected on the types of solutions that could be brought to bear. Our conclusion is that research must not lead to the automatic generation of solutions. Rather, its aim is to provide a means of understanding spaces for the enhancement of local architectural heritage, using information and communication technologies. The reconstitution of a building facilitates not only the understanding of its ruins, but also the dialogue between professionals and non-experts. The creation of 3D models provides a new opportunity for researchers and the public alike to better understand the intangible aspects of heritage spaces.

This work opens up perspectives for research that we will touch on briefly. These can be organized around two distinct poles:

The first relates to the future of heritage education, which is an essential function of a site such as Byblos if it is considered as a museum. From this standpoint, the question of how knowledge will be transmitted in the future is at the forefront, and researchers are asking themselves what type of museum should evolve in the years ahead. Will we see an “info-highway museum” in which data can be manipulated but not modified? Or a “museum without walls” that will be able to reach people wherever they are? [AB97]

Heritage education is a key element in the creation of an open museum space, as in the case of Byblos, which opens onto the city. Knowledge is thus transferred in a kind of museum entertainment.

The second pole is the adoption of an “interdisciplinary vision in the development of conservation and outreach initiatives to better reflect the richness and subtlety of the content.” [AB97] The various disciplines involved in the enhancement of heritage —history, archaeology, architecture, urban planning and others—come together and generate debate and discussion to propose solutions that integrate their combined expertise.

Research perspectives are not limited to these two poles but extend to other areas as well. For instance, the results of this research project could be used for pedagogical purposes. Teaching the history of vanished heritage sites could be made more accessible by means of models to aid in our understanding of these sites.

It is in this direction that we continue our methodological experimentation; our aim is to contribute to the advancement of knowledge by integrating the expertise of the

various disciplines involved in the enhancement of heritage sites, which can only be enriched as a result. ICTs become a unifying element between these different fields and thereby help to facilitate the process of shared decision-making.

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