

THE VIRTUAL MUSEALIZATION OF ARCHAEOLOGICAL SITES: BETWEEN DOCUMENTATION AND COMMUNICATION

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ABSTRACT:

The paper concern the experience that was gained in the context of the “Virtual Museum of Iraq” Project, promoted by the Italian Ministry of Foreign Affairs and under the scientific supervision by Italian National Research Council. The project is finalized to create a rich website, free to the general public, based on the archaeological collection of the National Museum of Baghdad. The creation of an innovative virtual museum shows the need to explore new digital communication. The principal contribution of Institute for Archaeological and Monumental Heritage (CNR-IBAM) in the Project derive from the need to contextualize objects and monuments on show in the Virtual Museum. For this contextualization two main problems are highlighted and faced: the documentation and the communication of the archaeological sites. The research activity in the project provided an integration between humanistic approaches (archaeological data and historical sources) and recent scientific methodologies. More specifically, the ancient sources and the data from the old excavations are integrated with satellite remote sensing documentation; 3D image-based modelling techniques (photo-modelling and digital photogrammetry) were used for the communication of archaeological data.

1. THE “VIRTUAL MUSEUM OF IRAQ” PROJECT: PROBLEMS OF DOCUMENTATION AND COMMUNICATION

The experience that is presented here was gained in the context of the “Virtual Museum of Iraq” Project, promoted in 2006 by the Italian Ministry of Foreign Affairs and carried out by the Italian National Research Council (CNR). The project, under the scientific direction by the writer, is designed to create a content, rich website, free to the general public, based on the archaeological collection of the one of the most important museums in the world.

In 2003 during the 2nd Gulf War the National Museum of Baghdad has been looted, stripping it of a priceless collection of cultural artefacts which are important historical treasures not only for Iraqi people but also for all humanity (Fales, 2004). The creation of an innovative virtual museum shows the need to explore new digital communication systems to access into an impressive archaeological collection, currently not available yet.

The “Virtual Museum of Iraq” Project explores different new integrated digital technologies for virtual heritage, focusing on the use of photo-modelling restitution, interactive streaming video, laser scanning and 3D digital advanced technologies.

For the first time the remarkable and articulated civilizations of the ancient Mesopotamia, from the emergence of the Neolithic villages (7000 BC) until the Islamic Period (IX-X century AD), are perceived in a long-time historical sequence. The virtual tour is carried out across eight virtual exhibitions organized according a chronological sequence. The virtual journey into 8000 years of history includes a traditional informative system (catalogue of the most important artefacts) associated with a dynamic representation of the website, thanks of the use of 3D models and short videos. The virtual architecture encompasses 70 artefacts, 40 three-dimensional models, as well as 22

videoclips. In the virtual space the user has the opportunity to investigate and to understand the specific components of each artefact. For example, the ordinary visitor is able to stress the archaeological context where the artefact was found, or to appreciate material, original colours and the volumetric reconstruction.



Figure 1. The home page of “The Virtual Museum of Iraq”.

This innovative project, which displays three main languages (Italian, English and Arabic), stimulates a wider cross-cultural appreciation and dialogue between archaeologists and public. The “Virtual Museum of Iraq” Project is not the real museum of Baghdad transposed to the web or to any electronic form. Moreover, the ordinary visitor not perceives the virtual collection of artefacts as an archive of database. According to the structure of the virtual museum recently proposed (Antinucci, 2007), the virtual platform could be claimed as *the communicative projection of the real museum*. The home page successfully shows the contents above formulated: the female

marble head from Uruk, a masterpiece of the Sumerian artwork (3200-3000 BC), displays a hybrid image, in which the visual perception proceeds from the simple photogram to the photo-modelling restitution.

The principal contribution of Institute for Archaeological and Monumental Heritage (IBAM) in the project derives from the urgent need to contextualize objects and monuments on show in the Virtual Museum, linking them not only to their site of provenance, but also to the cultural sphere to which they belong (Gabellone, Scardozi, 2006 and 2007). For the contextualization two main problems are highlighted and faced: the documentation and the communication of the archaeological sites. The research activity in the project provided an integration between humanistic approaches (archaeological data and historical sources) and recent scientific methodologies. More specifically, the ancient sources and the data from the old excavations are integrated with satellite remote sensing documentation; 3D image-based modelling techniques (photo-modelling and digital photogrammetry) were used for communication of the archaeological data (Cultraro, Gabellone, Scardozi, 2007 and 2008).

The strong point of this synergic cooperation is to create the possibility of exploiting powerful and effective real means in order to propose a new perception and re-organization of the task of communication. [M.C.]

2. DOCUMENTATION OF ARCHAEOLOGICAL SITES: THE CONTRIBUTION OF SATELLITE REMOTE SENSING

The process of contextualization of the objects in the “Virtual Museum of Iraq” Project, enables the museum “visitors” to view the original territorial contexts of the finds, i.e. the archaeological sites from which the materials came from. This process can be implemented on three temporal levels: the ancient period, the moment of the discovery and the modern times. For the first two, the virtual reconstructions based on literary sources, scientific bibliography and particularly on the documentation of the archaeological excavations, yield excellent results and were a fundamental tool of communication. Concerning the third temporal level, allowing a virtual visit to the place of provenance in its current situation, considerable problems arise for contexts that are not easily accessible, and abundant, adequate and recent photographic or graphic documentation is not available, like in the case of many ancient Iraqi cities and settlements: generally, only few terrestrial images and some oblique aerial photographs of limited parts of the archaeological areas are available for these, together with some documents (graphic and photographic) of the excavations. An important contribution to the resolution of this problem was provided by high resolution multitemporal satellite images, taken by commercial satellites (Ikonos-2, QuickBird-2, WorldView-1) between 2002 and 2008; these images are taken in a very high resolution, between 0.50 and 1 m in panchromatic mode and 2.40 and 4 m in multispectral mode (Scardozi, 2008a). Therefore these images provided first of all a large, up-to-date and detailed documentation of the modern situation of some of the most important ancient cities and settlements of Mesopotamia (from Prehistoric times to the Islamic period), such as Ur, Uruk, Tell Es-Sawwan, Tell Asmar, Ashur, Nimrud, Khorsabad, Nineveh, Babylon, Sippar, Kish, Seleucia on the Tigris, Ctesiphon, Hatra, Baghdad, Samarra and Ukhaydir.

These satellite images constitute a large documentation very useful for the presentation of archaeological sites and

monitoring their transformations in recent years, particularly important in times of war. Resorting to satellite images makes it possible to observe and document archaeological areas as they are today, both as a substitute for a real visit that is currently impossible, and in preparation for a potential visit *in situ* in the future.



Figure 2. Panchromatic QuickBird image of the Ukhaydir Palace (VIII century AD), taken in 2nd of January 2008.

Satellite images also provide a crucial and invaluable tool for monitoring archaeological sites as well as their state of preservation or possible damage; in fact, when it was possible, images taken before and after the second Gulf War were used for each archaeological site. For a documentation of the situation before the first Gulf War and chronologically nearer the times of the archaeological excavations, for all the sites studied some space photos of 1960s and 1970s taken from United States reconnaissance satellites (Corona KH-4A and KH-4B, Gambit KH-7 and Hexagon KH-9, with a geometric resolution between 0.60 and 9 m) were acquired and, in some cases, aerial photos taken in 1920s, 1930s and 1940s by Royal Air Force pilots. These images are very important, because they allowed to discover abundant data on territories that usually appear developed and have been partially modified and altered. These multitemporal remote sensing data are a fundamental documentation in order to be able to correctly “narrate” the sites under study, but also make it possible to deepen their knowledge and discover new data on ancient topography, urban layout and paleo-environmental contexts, critical for the reconstruction of the historic landscape in which the ancient settlements were located. In fact their high geometric resolution makes them similar, in terms of definition, to vertical aerial photographs on a middle scale, that are scarce for the studied areas. Consequently satellite images provide a detailed view from above of the current state of the archaeological sites and their layouts, offer the possibility of noticing even quite small details, enable us to identify elements that are not easily perceptible on the ground (like ancient roads and canals now buried, paleo-river beds, etc.) and to recognize the traces of

ancient structures that are still buried or are now interred again since their original excavation.



Figure 3. Panchromatic Ikonos image (23/11/2002) of Kish: A-B, Sumerian Palace A and Sanctuary of Khursagkalama; C-D, Sasanian Palaces and Fortress.

During the activities of the Project, the study and the analysis of panchromatic images represented an opportunity to acquire new data on the ancient topography of some of the archaeological sites examined; this documentation was very important specifically for contexts that have been studied many years ago or that are characterized by a history of the research centred mainly on individual complexes, monuments or wealth of finds and has not interested the general layout of settlement. In some cases, the processing of multispectral images of Ikonos-2 and QuickBird-2, in which the measured radiation is divided in four bands including the visible spectrum and the near infra-red, and the data fusion between panchromatic images and multispectral elaborations also make it possible to identify and highlight, in a better way, archaeological and paleo-environmental traces and anomalies.



Figure 4. The remains of the Abbasid city of Samarra in a Corona KH-4B photo of August 1968, between the Mosque and the south racecourse (the area is partially now destroyed). The space photos of 1960s and 1970s taken from United States reconnaissance satellites were also very important for the study of archaeological areas, particularly when old aerial photos were scarce; in fact, thanks to their high geometric resolution (in particular the Corona and Gambit images used have a spatial resolution between 0.60 and 2.70 m) they constituted a precious documentation of archaeological areas before recent transformations and in some cases showed ancient features nowadays not visible or destroyed (Scardozzi, 2008b). However is important to specify that in the analysis of satellite images verification on the ground of presences, traces and anomalies visible in remote sensing data is very important, in order to clarify their real pertinence to archaeological elements, their interpretation and, if possible, also their dating, avoiding misunderstandings and mistakes. But in the study cases of the Project, the ground control with a survey of the sites was impossible, so we could often formulate only hypotheses and the only comparison was with published studies.



Figure 5. Pan-sharpened QuikBird image (bands 4-3-2) of Sippar (23-5-2007) with the remains of the *E-babbar* Temple (A): the shadows show traces and remains of the city walls.

The availability of satellite images with high geometric resolution represents a tool with enormous potential for the study of ancient urban and territorial contexts. These images provide plan views and make a complete multitemporal documentation of the archaeological areas available, where different monuments are integrated and correctly localized. So it was possible to upgrade the archaeological plans of the sites and to create a vector documentation utilized for 3D reconstructions of monuments and ancient cities (such as, for example, Khorsabad and Hatra). In some cases, instead, the recent satellite images were orthorectified (without Ground Control Points and on DEMs based on SRTM data) and the vectorization of all archaeological remains and traces visible in all multitemporal remote sensing data allowed the creation of new archaeological maps (ready for input in a GIS) with new data on ancient layout of sites, monuments and roads; in these maps the contour lines were extracted from DEMs.

In the chronological sections of the “Virtual Museum of Iraq” the contextualization was obtained with different solutions for different end-users: virtual reconstructions of archaeological sites or monumental contexts, images (maps, plans, photos, air-photos, satellite images) in the section “Archaeological Sites” of the web site, that offer a synthetic image of the characteristics of the ancient cities, settlements and contexts where the artefacts were found. In each case multitemporal remote sensing data are a fundamental form of documentation.



Figure 6. Sippar: a detail of an Ikonos orthoimage (23-05-2002) with vectorization of ancient traces and remains.

For scientist and scholars an “Atlas” of the more important Iraqi archaeological sites is in progress, a hardcopy volume where all the documentation elaborated for the Project is collected: processed satellite images and photos, new archaeological plans, reports of the data derived from the analysis of the images, virtual reconstructions, schedules of the ancient sites where historical and topographical development of the most significant monuments is analyzed; another highlight in this “Atlas” is the contribution of multitemporal remote sensing images for the study and the reconstruction of the ancient sites of Mesopotamia. [G.S.]

3. PROBLEMS OF DOCUMENTATION AND COMMUNICATION IN A VIRTUAL ENVIRONMENT

About communication, the Institute for Archaeological and Monumental Heritage use an integrated approach to this problem and to that of the technological transfer of the knowledge. Main attention regarded the so called “general public”, the outsiders. The experiences of the last years showed that the roll of the technology is not the real goal of the research, but that it is the tool communicating information and knowledge. The reconstructive study of archaeological sites represent an emblematic case, in which the three-dimensional graphics provide for the inadequacy of the two-dimensional drawing and give interpretative solutions that were unimaginable until few years ago. So virtual space become an important moment for reflection and study, but constitute above all a revolutionary way of learning and representing complex archaeological sites, with a creative liberty without limits. The

experience developed during the Virtual Museum of Iraq Project allowed to highlight some fundamental questions, which it was need answer concretely: whom and what have we to communicate? Which contents can we communicate? Which kind of techniques can we use? And, above all, which are the expected results?



Figure 7. The virtual Assyrian Room.

The content and the target audience of a communication project are inextricably linked. Very often in multidisciplinary research conducted by heterogeneous teams which include figures from both the humanities and technical-scientific disciplines, there is a tendency to combine mixed content in a single end-user environment; thus, historical data are accompanied by the results of chemical tests, and artistic analyses by technical data on a monument’s stability. In contrast, in the Iraq Virtual Museum project every single methodological choice is based exclusively on historical data. Every technical solution adopted for the reconstruction of the Iraqi monuments and the individual rooms of the museum is guided by this one objective: to present, concisely but thoroughly, the history of the land between the two rivers via video clips, records and images that may be understood by all users.



Figure 8. The virtual Prehistoric Room.

As often happens when dealing with human creativity, the process of simplifying the message and the content to be transmitted can become extremely difficult to manage. Less is more, proclaimed the masters of modern architecture, with the risk however of saying too little, perhaps of being superficial, while the opposite approach tends to redundancy, potentially boring the visitors with content that is too elaborate or specialised. The result of these reflections is the identification of three fundamental elements for learning: the first is the architecture of the museum room itself. The concept of a room in a museum is associated with the broader notion of cultural and historic identity: the setting up of virtual rooms has made it possible to gather significant pieces from the period of reference, enabling the visitor to immediately recognise the tangible signs of a particular way of life and thus to delineate the features that establish the distinctive character of the period.

This approach recreates in the virtual environment the familiar procedure of visiting a real museum, helping the visitor to understand the value of the exhibit as testimony, which is the second and perhaps the most important element in the process of creating the museum. The exhibit links form and content indissolubly, and establishes a clear image of the historic period, facilitating the development of those cognitive processes that are stimulated by visual memory, highly effective in most visitors. In this sense, the use of technology for three-dimensional representation of the exhibits becomes a means of increasing their appeal even further, since a model that can be explored interactively is undoubtedly more striking than a simple image.



Figure 9. The virtual Seleucid Room.

The 3D modelling of the exhibits was performed to a large extent with roto-scoping techniques, using images that had already been published or were available on the web; only in a few cases was it possible to use high quality images. Nevertheless, many 3D exhibits on display in the virtual museum are also valuable as documentation, because thanks to image-based restitution techniques they make it possible to study details and take measurements. Emblematic in this regard is the reconstructive study and photo-modelling of the helmet of Meskalamdug, which may be explored on the project's website in RealTime3D.



Figure 10. Frames of the video on the Nimrud ivories.

The third element, extremely important from the museographical point of view, is the contextualisation of the exhibits in their context of provenance. Very often in traditional museums, groups of exhibits of the same type are displayed in accordance with purely aesthetic criteria, neglecting their function or symbolic significance in order to highlight individual stylistic aspects. However, there are sculptures such as the Assyrian Lamassu or the orthostats of Khorsabad, which would be practically incomprehensible if removed from their specific architectural contexts. This led to the idea of describing the complexity of these situations by means of animated video clips, in which the exhibit is reconstructed together with its context of provenance, regional surroundings and city environment. In this broader vision, the process of

communication and setting up the virtual museum tend to coincide, because the video clip does not describe the museum but is an integral part of it. It reveals and deciphers, rapidly and concisely, the content of the item, placing it in the historic period to which it belongs.



Figure 11. Frames about the *tumuli* of Uruk in the video on the Seleucid period.

In this context the expected result is to provide the visitor with the key to understanding historic phenomena and the tangible signs of material culture, as displayed in eight rooms corresponding to eight historic periods. The interactive vision of the exhibits includes their territories of origin, studied in detail. The basis for this is a narrative of great emotional impact, using the language of 3D Computer Graphics. [F.G.]

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