

3D Temporal Landscape: A New Medium to Access and Communicate Archaeological and Historical Contents

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Abstract. The use of the landscape as a portal open on the history of an area can be considered a new medium for managing complex data and delivering them to a wide range of users, avoiding the great problem of decontextualisation. The territory acts as a powerful link to interconnect realities and events occurred in time, even along centuries, and highlight the relations among every noteworthy area of the landscape. A significant effort in this direction is currently carried on (or carried out) by Bologna City Council with a set of interrelated projects, aiming to valorise some areas rich in history and art. The development of this huge application has started with the Electronic Museum of the Certosa, the monumental Cemetery of the city, and the reconstruction of its history that goes back in time till the Etruscan necropolis. The 3D reconstruction of the Partisans' Sacramium was a good case study to test the capabilities of the system in building links between the objects in the virtual world and external multimedia databases. Thanks to this connection it is possible to have further information on the partisans, their formations and the actions of the resistance in the city. Other sections are currently being developed, such as the reconstruction of the Cloister III, with several artistic graves of the XIX century and its own database, and the archaeological levels, belonging to Etruscan period. The archaeological GIS is going to be added to the general application: the layers show the structure of the necropolis, the entrances and the tombs, all oriented in the same direction. A database is added even to these layers, presenting photos of the findings (kept at the Archaeological Museum of Bologna) and some clouds of points obtained from 3D laser scanning technique (a situla and the skull of an Etruscan woman that will become the base for a complete reconstruction of the soft tissues and, hence, of the physical appearance of that person). In the meantime the reconstruction of the church of S. Girolamo, pertaining to the Certosino Convent that occupied the area before the creation of the Certosa, and the modelling of the Great War Memorial will complete the first part of this "vertical" application, capable of giving back to us an organic view about the evolution of a site dedicated to the dead for more than two thousand years.

Keywords: Virtual Heritage, Landscape

1. Introduction

The development of a huge application has started with the Electronic Museum of the Certosa Cemetery carried on by Bologna City Council, CINECA, CNR ITABC and several Bolognese cultural institutions.

The Certosa Cemetery in Bologna, built in an area dedicated to the dead since the Bronze age, as demonstrated by the discovery of an intact necropolis, hosted a Carthusian convent until 1797 before finally becoming a public cemetery in 1801. It is historically and artistically an important monument but, in the world of today, where we prefer not to reflect too much on the subject of death, this site has lost relevance in public awareness. With the passing of time, the hundreds of names engraved over the tombs inside the main memorial monuments, as well as over individual tombs, have become silent (Fig. 1).

Names and faces of people, once well known to their fellow citizens, are completely unknown to new generations. The risk is to forget our past as well as our cultural identity.



Fig. 1. The Memorial Wall, a monument raised in the central Nettuno Square, shows the Bolognese people killed in the fight for liberation during the Second World War.

Instead, memorials, funeral monuments and cemeteries, become places for discoveries and meditation, emphasizing the link with the land, preserving and communicating its History, promoting continuity among generations and, at the same time, highlighting pivotal events of change in the history of the community. If we consider them in this perspective, they can be seen as Historical Open-air Museums.

Starting from this kind of consideration, a significant experience of cultural communication has been conceived in order to rediscover the Certosa in Bologna. The most engaging and captivating new technologies have been recognized as solutions for gathering and delivering information and knowledge, thereby avoiding that these monuments become just cold, distant and silent sites without anything more to communicate (Fig. 2).

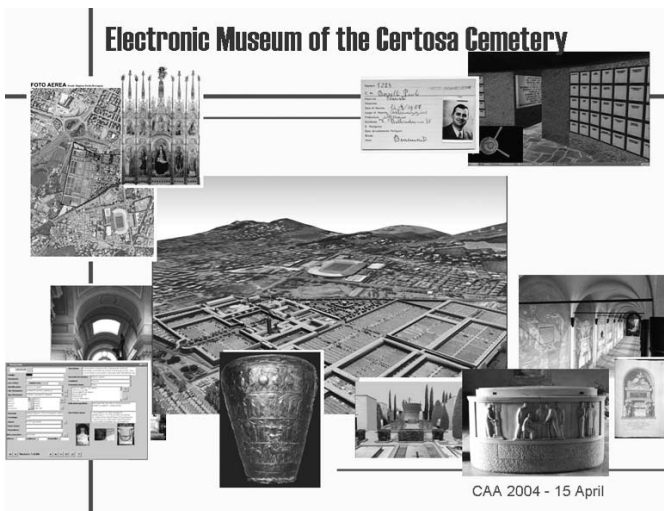


Fig. 2. The Certosa cemetery (center) and the different monuments, sites connected with it: the Partisans' Sacrarium, the Great War Memorial, the Cloister III of the XIX century, with a great number of artistic graves, the medieval S. Girolamo's church and the Etruscan necropolis.

2. The Electronic Museum of the Certosa Cemetery

The virtual museum of the Certosa in Bologna was thought as a prototype to increment the relevance of communication in the life of cultural systems inside the cities. The politics for Cultural Heritage should add, to the usual functions of collection and protection, even a didactical choice and the communication of the most relevant cultural contents. New technologies are particularly communication-oriented and suitable as cultural tools. They enable the creation of appealing products, with simple interfaces for navigating and querying the digital environment and capable of retrieving as much information as desired to widen the knowledge of specific subjects.

Thanks to the visual interface, the use of the reconstructed landscape and an easy way of interaction, similar to that of a computer game, the access to complex data is made more simple. Such a product can be considered as a "communicative machine", suitable for presenting to the public

every complex cultural site (a museum, an historic street, and so on) and, at the same time, to help researchers making the retrieval of information quicker, through the direct access to the database.

The Electronic Museum of the Certosa Cemetery is an accessing interface to historic and artistic information related to at least five different historic periods with local and national relevance (the Etruscan period, the Medieval one, 19th Century, First World War and Liberation War). In addition, it is also an opportunity for gathering contents that, until now, were "sleeping" scattered in several cultural institutions of the city. Hence, the project has promoted the creation of a completely new resource, combining data in a visual geographical portal that not only unifies a set of applications, but also constitutes a more complex conceptual access (Fig. 3).

2.1 The Virtual Reality System

As we have seen, the project "Certosa Virtual Museum" was, since the beginning, very complex in term of: types of information to be treated in input and communicated as output (sources: photos, digital texts, non digital texts, drawings, historical video etc), final aims, typologies of users, characteristic of the contents (history, archaeology, geography, administrative organization of the cemetery, etc). Moreover many institutions were involved in the projects, giving their contribution and offering different materials. For all these reasons we were forced to find a scalable solution to approach all these problems. We had to find a way to connect all this variety of data and to communicate them in a visual, immersive and interactive way.

The territory itself was the answer, since one of the shared characteristic of the data was indeed their 'geo-location' (Fig. 3). The second characteristic of our data was their belonging to a certain time. Therefore Space and Time were used to organize the virtual reality application through different behaviours or interaction activities.

In our particular case we didn't want just to collect data or to describe a 'space'. We needed to go further and to create new



Fig. 3. A snapshot of the interactive visual portal. Every content is accessed through the landscape itself.

'maps' to describe this space that was, first of all, a 'living-place'. Maps helped us even to explain how the territory was perceived (and how differently) during the centuries (Forte 2003).

In order to organize and manage all the information with a spatial component, we created, first of all, a GIS. This operation was really important because it allows us to overlay and compare different information. We used the GIS (ESRI Arcview), moreover, even to analyze data and to create new thematic layers useful for our VR application.

Thanks to a collaboration with the municipal cartographic office, we could use high-resolution air photos and all the vectorial data already available. What we have done was just to convert everything to a more commonly used projection, such as ED50 UTM32 and to generate a Digital Elevation Model of the territory.

With the mosaic of all the GeoImages and the DTM, we generated a three-dimensional model of the territory. The model was generated with a particular kind of software, a terrain generator, that allowed to maintain the geographical component of the data. The software used for this purpose (Terrex Terravista 3.1¹) uses, as input, data processed directly in the GIS (geotiff, shp files and DEM). We import all the source data directly in Terravista and after some processing of the vectorial data we built the terrain model. The use of a terrain generator is very important not only because it retains geographical projections, but also because it is assigned to it tasks such as the tiling, the texturing and the creation of different level of details (LOD) both for the geometry and for the textures (less or more detailed according to the user distance).

What we obtained is an OpenFlight model (FLT) composed by a master file (master.flt) that open all the tiles (flight1_1.flt, flight1_2.flt, etc.) of the terrain. Each tile has a certain number of Level of Details (Fig.4). The textures are saved as RGB files and as power of 2.

The model represents the actual landscape, with altimetry, vegetational and hydrographic aspect.

3D models were modeled with an external software, such as Multigen Creator and saved as well as OpenFlight files (flt). They are added to the landscape as external reference and considered as separated, but always referred to a geographical location. In this way it's possible to edit and modify the scenegraph, giving to the groups a definite name (Fig.5a). This is particular useful because it's possible to use another

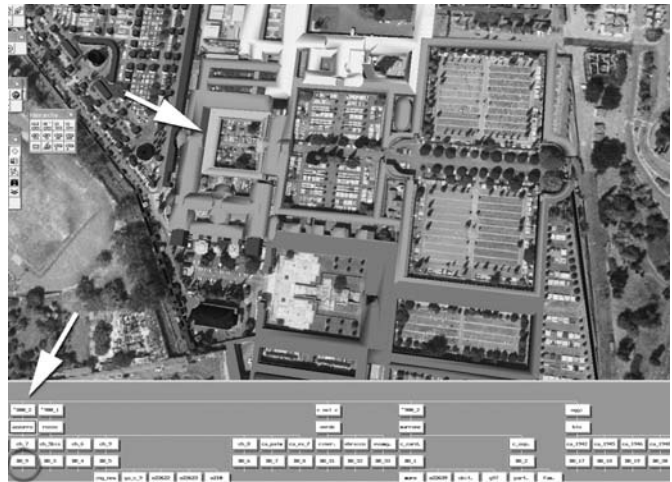


Fig. 5a. Aerial view.

software to navigate and interact with the landscape, appositely programmed. We have create for this purpose VISMAN, a software for the visualization and interaction of Virtual worlds, programmed in C++ and based on SGI OpenGL².

VISMAN is designed to interpret the names of the group and to convert it to interactions. For instance _PVIEW group allow the users to click on a monument and to "enter" in a new virtual world, opening a new file. Clicking on the Medieval Cloister (arrow of Fig5a) you can really walk inside the site, feeling to be immersed in the environment even thanks to sounds and music (Fig.5b).

Each VR world (PVIEW) is a monographic view of a particular site; it open new interactive possibilities to the user, querying all the objects and retrieving information. It's possible indeed to open HTML files or WAV audio or even AVI movies just with a click on a 3d model grouped with the name _DB. All the media and texts are organized in an external database (MS Access, at the moment) that is possible even to query separately and to "orient" the entire VR world according to the information retrieved.

As we mentioned at the beginning, this site was very important since the Etruscan time onwards (5th cent BC). The VR system was used even to connect the archaeological data to a different time-sector but with the same geographical

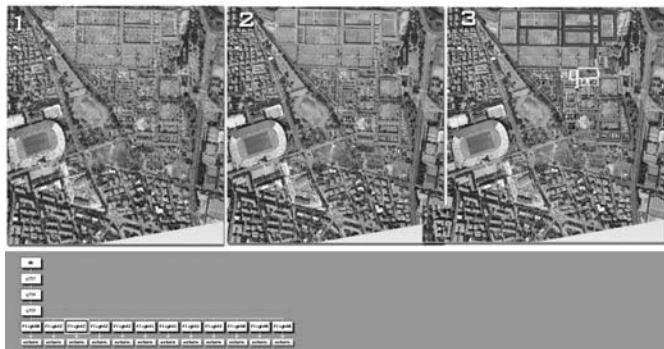


Fig. 4. The territory of the Certosa at different Levels of Detail. Below the Scenegraph as shown in Multigen Creator.



Fig. 5b. A virtual promenade inside the Medieval Cloister.

reference. This operation was really useful to access complex and heterogeneous data and objects conserved in the city museum and in different archives, managing in real time archaeological information.

This part of the system is in progress at the moment. We expect, even thanks to the cooperation of all the institutions of the city and most of all with the archaeological museum, to create a digital access for the users that cannot visit the necropolis, since it was re-covered after the excavations of the in the 19th century. Visitors should in this way better understand the history of the monument in its Etruscan phase, and re-contextualise structures, tombs and remains visible at the museum, that stands far away from the site.

Getting inside the virtual world, it's possible to see in their original locations the tombs; to query all the tombs (see Fig6), seeing what they contained and sometimes even to whom they belonged to; to connect remains with archaeological or with more didactical information; and even to connect the tombs or the remains to their high-resoluted representation, acquired with a laser scanner³.

What we would like to do in the last phase of the project is to re-create, in a didactical interactive way, a suggestive hypothetical reconstruction of the monumental streets of the stele. Recreating a mindscape (Forte, 2003) could be a interesting way to give an idea of the ancient man perspective inside the landscape, reference points, sacred and civil streets, inhabited areas and necropolis areas (outside the city), ancient hydrography, vegetation and so on.

Notes

¹ www.terrex.com

² www.sgi.com

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Fig. 6a–b. The Etruscan necropolis discovered at the end of last century in the same place were there is still a cemetery. Below a snapshot of the virtual navigation on the necropolis as discovered.

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