GIS contribution to urban history and to the reconstruction of ancient landscape

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Abstract: This project is part of a PhD research (in History and Computing) carried out with the department of Historical Disciplines of the University of Bologna. The aim of the research is to investigate the structure of the Roman city of Bononia through the reconstruction of its surface and access to excavation data. Recognising the importance of the immersive experience, in the case of Bologna, the project attempts to answer two questions: "How did the city change from Roman period to the present?" and "What was the nature of its ancient landscape?".

Far from pretending to exactly reconstruct the ancient landscape, the reconstructed three-dimensional model tends to offer some suggestions related to distribution of urban space, in relation to its morphological structure.

Key words: GIS, Virtual reality, Ancient Landscape Navigation, Urban history, Bononia

Introduction

This work is part of a PhD research (in History and Computing) carried out with the department of Historical Disciplines of the University of Bologna.

An important research project, involving many themes related to the history of Bologna city, was started in the 1990s, involving mainly the department of Historical Disciplines (Prof. Francesca Bocchi) and an interdisciplinary group (CINECA Supercomputing Centre and Carpi Research Centre). The aim was to sort out the historical events that characterised the city, in term of urban structure and evolution, which led it to have its current form, through the construction of a four-dimension digital model.

The success of this project, is due mainly to the large number and accessibility of historical documents preserved in archives, as well as to the hard work of numerous historians, in meticulously analysing the information, keeping and digitising the most reliable and useful in order to reconstruct the different historical urban phases.

The city centre has been modelled in this way: modified and built following the evidence from those historical sources (documentary and iconographic) allowing the reconstruction of crucial urban phases, starting from the present, back to the 13th century.

A possible approach has been studied to more ancient times, but obviously obstacles were found in treating and recovering information prior to the XI Century. Historical sources are in fact quite scarce for this period and often unreliable, not allowing a proper identification and understanding of the evolution of Bologna city, between the fall of the Roman Empire and the XI-XI centuries. Archaeological excavations cannot help much either in recovering the historical and urban memory.

The research project

The present research started precisely at this point - from the end of the Roman Empire, backwards - using a different approach to the mainly archaeological sources, but with a similar aim: the reconstruction of the ancient Roman landscape.

The first step was the development of as reliable a cartographic base scientific knowledge as possible, in relation to the current form of the territory under study.

After a few attempts with Regional Technical Maps (CTR - 1:5000), detailed maps were chosen (1:2000 scale) for the city centre and less detailed for the surrounding areas (Fig. 1), used together to maintain the relationship between city and suburban zones, for both morphological aspects and human interactions.

After some verification and corrections to the digitised data, due to discrepancies between the maps at different scale and adjustment by comparison with terrain observations, a three-dimensional digital model of the territory was obtained. This model was good enough to be used as a continuous reference where necessary, particularly where documents failed to record elevation data in units above sea level.

Vectorial information, such as rivers, streets, railways and built-up areas, was overlaid on this model using ArcView GIS (Fig. 2). Aerial photographs were rectified and georeferenced in order to complete the present day 3d model.
The aim was to reconstruct a good model of the actual landscape so as to highlight the changes which occur between Roman times and the present day.

In order to obtain as accurate as possible a model of Roman landscape, it was necessary to study bibliographical and archive sources in detail.

Data have been systematically arranged in a relational ODBC database, consisting primarily of three tables for SITES, REMAINS and BIBLIOGRAPHY information. We now have almost 500 remains and 400 sites.

To start with, the database was interrogated for referenced points belonging to particular categories of contemporary sites. Some data couldn't be used, such as records referred to spread remains and underground remains (such as sewers, water courses and canals).

Using these points a three-dimensional model of the Roman surface has been calculated using the krig interpolation method.

On this new model have been placed a few themes took out from the database, through crossed-queries based mainly on the typology of the remains, their chronology and building materials. Main Roman streets (cardines and decumanos) were added, as well as observations related to the presence of domus, suburban villae, industrial structures, dumping places, amphorae storages and building's pavements.
experience, in the case of Bologna, the project attempts to answer two questions: "How did the city change from the Roman period to the present?” and "What was the nature of its ancient landscape?"

Far from pretending to exactly reconstruct the ancient landscape, the reconstructed three-dimensional model tends to offer some suggestions related to the distribution of urban space, in relation to its morphological structure.

In this first approach the particoular software was used: Terravista. It works with input data such as vector shapefiles, DEM, 3D objects and raster images (such as geo tiff) and it produces 3D real time navigation as output in *.flt format. Even if it cannot be considered as 'geographic' modeling software, Terravista has good characteristics of compatibility with commonly used GIS tools (ArcView, ErMapper, ...) and has the great advantage of producing perfectly georeferenced 3D scenes.

Thanks to this kind of software, a project to navigate on the actual territory (with aerial photographs) is in progress, together with the construction of a virtual model of Roman landscape displaying (and possibly interacting with) the data acquired (Fig. 5).

End notes

1 Nu.M.E. project (New Electronic Museum for the city of Bologna)


4 Part of the documentation was taken from Soprintendenza archives (ASAER), kindly granted by Soprintendente Dr.sa Calvani and Dr. Ortalli.

1 Every object was always connected with its bibliographical references


7 A clear example can be the case of excavation and documents without the definition of a precise dating: this led us to calculate a surface model with a generic assignment to the Roman Period (between II-I BC and III AD), considering in any case the absence of significant increase of the ground for the considered period.


9 With the co-operation of CNR ITABC and Dr. Maurizio Forte.

127
Figures

Figure 1. Bologna and its surroundings with elevation information

Figure 2. Digital Elevation Model of Bologna's area.

Figure 3. The digital model of Roman ground

Figure 4. Themes of Roman Bononia: mosaics (red), public buildings (blue), storages (violet), streets (brown), river (hypothetical: light blue; assumed: dark blue)

Figure 5. A snapshot of the real time navigation in the roman virtual environment.

Figure 6. Snapshot of the real time navigation in the actual landscape