Visual Analysis of Architectural Heritage: The Interior Décor of the Domus of Roman Tunisia

Aida Hermi-Nasr[1], Najla Allani[1] and Jean-Yves Blaise[2]
[1]*National School of Architecture and Urbanism, University of Carthage, Tunis,Tunisia*
[2]*UMR CNRS/MCC 694 MAP, Marseille, France*

Keywords: Domus of the Roman Tunisia, Inventory, Comparative Analysis, Architectural Modelling, Information Visualization.

Abstract: This paper aims to propose a new approach which can bring a renewal of the means of study of the Domus of Roman Tunisia. We had chosen thirty roman houses built from 146 (B.C) to 439. These houses are spread over 19 Tunisian cities. The paper is based on an approach called information modelling, which is situated at the interface of the architectural modelling and the Information. This study is built on a numerical implementation, which allows us to test some methods of analysis based on the group of the gathered cases. It proceeds, following a method inventory prior to these houses to a comparative analysis by focusing on the mechanisms of visual comparison between the Domus. In one hand, the study tries to structure and save large volumes of data which are generally heterogeneous, doubtful, incomplete and sometimes contradictory. In the other hand, the study attempts to preserve the history of the architectural evolutions. Applying this method of work on the suggested cases permits to focus on the regularities and the individual and collective evolutions, to emphasize the convergences and the divergences between the edifices and the periods. Finally, it permits to improve the exchange of knowledge between experts.

1 INTRODUCTION

In recent years, under the influence of development of NICT, the study of the architectural heritage is a sector in full revaluation. This study of architectural heritage has undergone profound changes, with the introduction of new information management tools and with the application of new technologies of data acquisition and volumetric representation of the building. This research aims to characterize Roman architecture through a recognition, identification and modelling procedure. It concerns the Roman domestic architecture of Tunisia from 146 (B.C) to 439 as an experimental ground (this point is discussed later). We assume that this type of architecture lends itself well to a new scientific study (Bullo et al., 2013).

This research proposes a new conception of heritage information systems based on tools in the areas of database management. Digital modelling is as an essential tool for advancing knowledge. Works are developing primarily in two directions: The design of heritage information systems leveraging tools in the areas of database management systems. The inventory makes it possible to set up a recording and data management tool (Morand, 2002). The second part deals with comparative analysis and information visualization through which we will try to answer, through practice (s), some of the issues raised by the introduction of new technologies in the study of heritage buildings.

The method we introduce identifies three key elements:

- A formal analysis of the architectural typology in order to define the parameters we need to compare, and the visual sign in charge of conveying comparisons. Result of this first step is a univocal graphic symbolization of the typology's architectural composition and a relational database containing the data set itself (Hermi et al., 2014).
- A database of Domus of Roman Tunisia, in order to investigate an architectural inventory approach, multidisciplinary, authorizing an operational chaining between tools, approaches, and disciplines dispersed (Hermi et al., 2014).
- A set of visual signs, calculated dynamically for each object in the data.

Generally, we try to explain, using a data set concerning antique houses, that visual comparative of

Hermi-Nasr, A., Allani, N. and Blaise, J.
Visual Analysis of Architectural Heritage: The Interior Décor of the Domus of Roman Tunisia.
DOI: 10.5220/0008261004050408
In *Proceedings of the 11th International Joint Conference on Knowledge Discovery, Knowledge Engineering and Knowledge Management (IC3K 2019)*, pages 405-408
ISBN: 978-989-758-382-7

the data can provide a major methodological innovation for questioning of information on architectural objects. This research sought to illustrate how infovis methods can be fruitfully applied in the architectural heritage. Throughout this article, we try to present three important steps: Morphological analysis, Elaboration of a Database and visual tools.

2 PRESENTATION OF DATA SET AND METHOD

Roman domestic architecture presents a heritage from an architectural know-how that we must try to analyse, recognize and understand its evolution. The data set we have chosen is an ensemble of 32 Domus of Roman Tunisia and in time from 146 (B.C) to 439. The first criterion for selecting the material is its state of conservation which must be adequate for this type of analysis. Roman houses, a typical element of antique towns, have common features wherever they are, and whenever they were built: their architectural composition (three major structures: Open spaces is the atrium was the open central court with enclosed rooms on all sides, A triclinium is a formal dining room in a Roman building, and residential rooms). But elements of variation in the Domus typological family are numerous. Still it is important to stress that if we are to enable visual comparisons (and thereby maybe better understand the variations), we need to clearly delineate for each structure its specific parameters. Naturally, parameters exist, such as date of construction, which qualify the Domus as a whole. The specificity of our approach appears to us rather in the fact that inside the Domus we identify significant architectural structures that we analysis formally in step 1 (Morphological analysis) of the proposed method. In step 2 (Elaboration of a Database) we focus on developing a heritage inventory of corpus spread over the Tunisian territory. Finally, we try to develop a set of visual tools, it allows us to gaining insight on each object and on the data set as a whole by fostering one-to-one or several-to-several comparison and characterising each object by providing a univocal visual signature not of the object itself but of the information behind the object (Blaise et al., 2006).

2.1 Morphological Analysis

Morphological analysis of the architectural typology can be described as an investigative process in which we first identify main structures. This step allows understanding and formalization of objects of knowledge in order to show their characteristics. This method seeks to determine the morphological identity of the studied object by constructing one or more structural models of the object under consideration. Consequently, we have performed a decomposition of the architectural object into segments according to the manifest discontinuities and then, we have tried to regroup the Domus having the same structures of segmentation. This stage will be followed by a statistical analysis (degree of absence or presence of segments). The analysis that we conducted allowed us to identify the structural models relating to the disposition of segments and the nature of the shapes of components, see Fig. 1. We have schematized this model according to a simplified representation. This led to an organized model. We obtained from the analysis three distinct families, see Fig. 2.

Figure 1: The process of structural analysis.

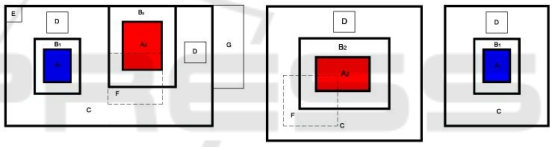

Figure 2: Structural model for each major category.

2.2 Elaboration of a Database

The functional and technical analysis, allowed to list all available data. Now they must be organized in a model data. Merise method provides a framework to enable this analysis and optimize the creation of the model. The analysis method Merise (Baptiste, 2009) was created in the late 70s, by the will of public authorities wishing to provide the government and public enterprises with a rigorous methodology. It incorporates new features: computer database. There For Domus: Denomination, Floor underground Upstairs, Total surface area of the Domus, urban type, maximum length Domus, maximum width Domus, Orientation Domus, Delimitation Position Domus and general presentation. The steps of the elaboration of the database are:

1. Designing a conceptual data model without considering the computational aspects;
2. The implementation of a logical data model depending on the structure of the computer software selected;

3. And the establishment of a physical model of data with the language used in the software.

Figure 3: General structure of the method of constructing a database.

The data in the database are managed in a designed system that imposed its performance in managing databases relationally model. This tool is the SGBDR MySQL (Server of relational databases, software widely used for the manipulation of textual data), that is part of management software database most used in the world. This tool provides a work environment because of the wide variety of elements based on language SQL that he provides. While the interface to manage data MYSQL performed on a server PHPMyAdmin constitutes an excellent tool for server administration MySQL (Meier A., 2006). This handy interface allows you to run, easily and without much knowledge in the area of databases, many requests such as creation of data table, inserts, updates, deletes, changes in the structure of the database. This system is very useful for backing up a database as SQL file and easily transfer their data.

After the analysis phase, it is possible to develop a conceptual data model that integrates the different reference tables and which taking into account the needs of users leaving a possible subsequent changes if necessary. The database is structured around entities. These entities are used to organize in a relevant and practical way the information on the Domus of Roman Tunisia. Each entity must have a code corresponds to a unique identifier for each object.

Take the case of this two entities, which have the following properties:

- For Domus: Denomination, Floor underground Upstairs, Total surface area of the Domus, urban type, maximum length Domus, maximum width Domus, Orientation Domus, Delimitation Position Domus, general presentation;
- For sites: Current name, Latin name, area of town, area of the city, Year of inscription by UNESCO, Registered by UNESCO, current urban Configuration, Punic, and Azimuth Domus.

This part is used to establish a database of Domus of Roman Tunisia from 146 BC until 439 before from heterogeneous data need rigor and planning during the analysis phase.

3 VISUAL TOOLS

Roman Domus is a construction rich in structure as in decoration. In this research, we apply our analysis protocol to the décor. Up to here what we have done is distribute in space a visual sign that connects each to a given implementation of the antique house typological family. We need to clearly define for each structure its specific parameters. For this, several criteria can be taken into account. It is a question of codifying the material expressions of soil, walls and threshold. The last step is then to use the parameters defined in order to permit comparisons. Finaly, showing through the visual signature of a Domus, the combination of values for parameters of a given Domus (Bertin J., 1998), see Fig. 4. This technique proposes to codify the chosen parameters of the Domus. For example; Visual site codification, see Fig. 5, 6.

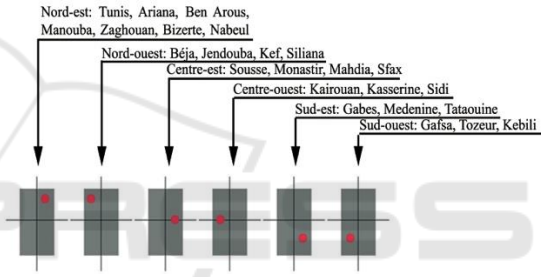

Figure 4: Visual site codification.

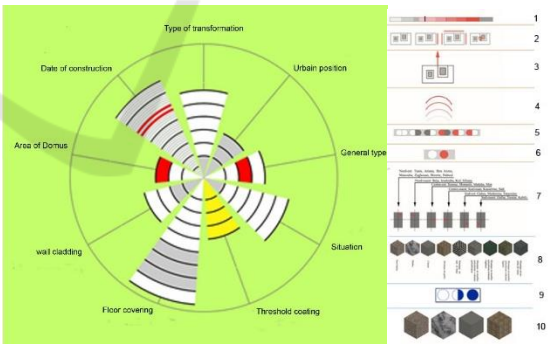

Figure 5: (a) Typical example: Visual graph of the Domus Protomes, in Thuburbo Minus; (b) Value of the same parameters across the data set, example: 1-date of construction, 2-urbain position, 3-orientation, 4-area of Domus, 5- type of transformation, 6- general type, 7-situation,8- floor covering,9- threshold coating,10- wall cladding.

The implementation of the method is based on a combination of standards or robust technology, and can be considered as quite straightforward. Graphics are SVG inside which interactions are simple

Javascript commands. The SVG files and their Javascript associated scripts are produced at query time by a set of Perl script that read the MySQL inside which the data set is maintained.

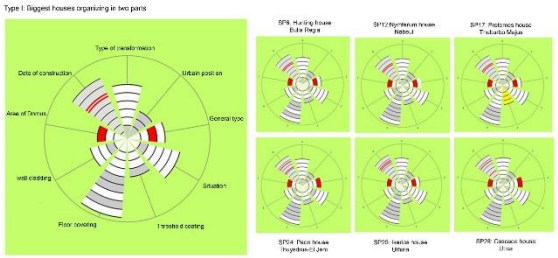

Figure 6: (a) Visual graph of the Domus Triomphe Neptune in Acholla; (b): A comparison of six Domus having the same structure (identical morphological configuration, class II).

We notice that the decoration of each Domus could fit into a particular type of structure and have a specific plastic modality. The majority of Domus, built between the end of the 2nd and the beginning of the 3rd century, use black and white mosaic and the mosaic in polychrome tesserae with geometric designs. During this period the Romans use architectural and plastic coatings simplified. Houses that settle in outlying neighborhoods, built between the 3rd century AD and the 4th century AD, use architectural coatings with style and patterns floral, vegetal and figurative. We remark that each neighborhood has specific stylistic features that could explain its location.

4 CONCLUSION AND PERSPECTIVES

In this paper we try to present, using a data set concerning antique houses, that visual comparative of the data can provide a major methodological innovation for questioning of information on architectural objects. This research sought to illustrate how infovis methods can be fruitfully applied in the architectural heritage. Our work is based on three important steps: Morphological analysis, Elaboration of a Database and visual tools.

Two benefits of the method we introduce can already be accentuated:

- Finalize the development of visual codes in development of other research. The graphics does not only enable comparison but also underlines lacks of information. Showing us unambiguously what we know and what we don't know.
- Rectify the organization of the database

More generally, this work, although a lot more needs to be done, does already underline the gain of insight researchers in the field of the architectural heritage, can expect from investing in graphics that say something. There is no doubt our contribution remains very isolated show it is worth trying to exploit architectural analysis using concepts stemming from infovis. For the future work, we aim to introduce a three-dimensional visualization, through which the 3D model plays the role of interface. Otherwise, the proposed 3D models will serve as a rich visual interface. They always to interrogate the base from the scene to quickly build a scene corresponding to the response to a query on the database.

REFERENCES

Bullo, S., and Ghedini, F., 2003. *Amplimissimae Atque ornatissimae Domus, résidences des cités de la Tunisie Romaine. Tome I - Tome II, éditions Quazar, Rome.*

Morand, B., 2002. *Cours d'analyse et conception des systèmes d'information. Université de Caen.*

Hermi, A., Allani, N., 2014. *Strucrural modeling of Domus of roman Tunisia (146_439 B.C),* IWCEA (International Workshop on Civil Engineering and Architecture), Istanbul, Turkey, 2014.

Hermi, A., Allani, N., and Blaise J.-Y. 2014. *Elaboration of a database of heritage inventory*, JETAE (International journal of Emerging Technology and Advanced Engineering) Volume 4, Issue 9.

Blaise, J.-Y, and Dudek I., 2006. *Modélisation informationnelle: un cadre méthodologique pour représenter des connaissances évolutives spatialisables* , Proc.EGC Conf. (Knowledge Extraction and Management) Lille, RNTI-E-6, pp.347-358.

Baptiste J-L., 2009. *Merise guide pratique, Modélisation de données et des traitements*, Langage SQL.

Meier A., 2006. *Introduction pratique aux bases de données relationnelles*, Collection IRIS, Deuxième édition.

Bertin J., 1998. *Sémiologie Graphique*, Editions de l'EHESS, Paris.