MODELING DECORATIVE FORMS AND DESIGN KNOWLEDGE

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Abstract. Form analysis in architecture is a method to increase knowledge of human made objects, by observation and description. Modeling attempts to identify characteristics carried by these objects and the rules of their production. Two approaches are relevant here. The first concerns the analysis and modeling of an object corpus (decors worn by windows), belonging to colonial architecture of Tunis from the late 19th to early 20th century and the second deals from a GIS, storing and mapping the forms variation, taken on the analyzed objects. The set allows developing tools for decision support, used not only in the description of a corpus, but also ultimately to lead to the architectural and stylistic classification of the city buildings.

1. Introduction

The review of architectural decor of urban buildings of Tunis from the late 19th to early 20th century shows a remarkable organizational unity and a wide form variety: cornices, friezes, frames, balconies and consoles, are all significant elements that hold meaning and value and act in harmony with the ornamentation of facades. These objects, bear similarities corresponding to conceptual designs, which are terminologically classified in scientist directory based on a conceptualization phenomenon (Pérouse de Monclos, 2004).

Many brief studies focused on decoration as the main compositional element of the architectural facade expresses design knowledge and which reflects the technical know-how of its time; but few of them have addressed the issue from a morpho-quantitative stand-point, that considers this device as an identification and measurement tool of architectural and stylistic characteristics of the observed forms.
2. Problem and Analysis Methodology

This paper aims to state the main methodological tools used to analyze and model an unpublished corpus of objects-decor and to understand the rules employed by European architects of the time in designing the buildings decor of Tunis. The question is to know how the organization of this decor appears and to determine to what extent the analysis allows to account for morphological and stylistic properties. These decorative organizations are they specific at the time, at the city or at the authors? The answers can lead to a very broad historical, spatial and stylistic knowledge (Barbouche, 2012).

2.1. METHODOLOGICAL PRINCIPLE

The fundamental postulate of the study stipulates that forms of these cultural objects are artificial human productions. They thereby constitute a clear interest to produce knowledge on their production and their producers. Their architecture would be an appropriate indicator for identification of a certain architectural culture. These objects have an organization accessible to knowledge which justifies the existence of the paradigm of their modeling.

2.2. PROTOCOL ANALYSIS

The study of a set objects-decor worn by the window openings aims to give an objective and controllable content at which appears to constitute the morphological identity of these objects. It adopts an empirical method for characterization / identification based on explicit operations of descriptive and comparative analysis. The analyzed objects are considered here both in that each of them having a form and that this form can be correlated with that of others to determine what characterizes them.

The method is to decompose systematically the objects into elementary entities and to specify the form of each of them, to account for their structural and plastic organization. It seeks to specify these elements into distinct homology classes and to register, following a proper codification (Gardin, 1978) which is translated in tables called “attributes-objects”, the morphological properties of each object for each class of similar elements. For this purpose, a homology relationship is founded between the elements by observing, with systematic comparison, regularities and variations of their disposition. The assembly provides structural modeling of analyzed objects, corresponding to a double morphological identity and distinguishing structural identity and plastic identity of elements of that structure; then these are taken in specific operations of quantification and measurement.

The results interpretation of the analysis is based on a set of data processing instruments whose forms are to be analyzed in turn, but which
are designed for it. These instruments allow one hand a scientific treatment of the studied forms identification and develop specific formal models. On the other hand, they enable to validate or refute modeling performed on logical and objective criteria. They constitute adequate tools of objectification and aid in the construction of model objects (Duprat, 1995).

3. Modeling of Decor

The arrangement of the decor is considered here as a system that governs produced forms. It controls and measures them following organizational laws that modeling allows to highlight and to explain. The modeling of the objects organization is necessary to understand the issues. Its objective is to define elements of each specimen and to study relations of the parts of a same specimen and those of homologous parts from one specimen to another. This is to build a structural model of the objects; that is to say a systematic representation of a stable and efficient modeling process, applicable to all occurrences encountered (Figure 1). Modeling offers thus the advantage of recurrence and the ability to compare all specimens with each other.

The study conducted using this analytical framework aims to describe properly all the cases present in the corpus, raising the difficulties and impossibilities due to complex entities that appear in the operations of decomposition of studied objects.

Figure 1. Structural model of the decor: (A) Lintel; (B) Coronation; (C) Central decor of coronation; (D) Lateral decor of coronation; (E) Jamb; (F) Frame; (G) Frame decor; (H) Support; (I) Central decor of support; (J) Lateral decor of support

The structural model thus defined is subject to catalogs of elementary forms; one catalog by class of homologous elements where are recorded, at various levels of decomposition, structural and plastic properties. These significant morpho-structural informations, suitably transposed into a coding...
system in the form of tables “attributes-objects”, are subject to statistical calculations, logical seriations and mapping tools (Deloche, 1985).

The matrix method or the seriation method by “scalogram of Guttman”, applied to table “attributes-objects” can handle a lot of informations as the case here. According to this method, sets x and y (structures and elements) are reordered by permutation of rows and columns depending on the information quantity they respectively carry, which modifies the initial image of the table without loss of information or alteration of basic data. The measurement of this information quantity is represented by a matrix diagram called “scalogram” (Bertin, 1977). The method revealed in the order of the diagonal, significant clusters of structures documented and described as homogeneous classes, resulting from strict partitions of the studied set, based themselves on important variations of the information quantity associated. Each structure can be stored in one and only one of these different classes, not only by the number of elements this structure involves, but also by the types of elements belonging to that structure.

![Figure 2. Scalogram of decor structures according on their elements](image)

If calculations show no significant classification of structures and/or elements, they however allow seeing opposition series (Figure 2): the column at the center of the graph represents the dominant element (support) that is commonly shared by most structures; the rarest elements which
oppose the structures of the top and the bottom of the graph are located on either side of the central column.

4. GIS and Morphological Data

In order to store in an organized and structured way the informations obtained from the morphological analysis and to manage the identified forms of the corpus, a Geographic Information System (GIS) was constructed in wide plot of city buildings. The objective is to develop a knowledge tool, based on the identification of morphological characteristics of windows decor from field investigations, to lead finally to stylistic classifications. This operation also allows testing the application of such tool in the treatment of morphological data with spatial dimension and particularly the inclusion of dynamic mutations of architectural and decorative typologies in the time. The development of the GIS results certainly of a choice dictated by explanatory hypotheses of recorded informations. Search for example to group some forms into coherent classes or study the localization of certain characteristics give an explanatory and interpretative scope, or at least cognitive; in this sense that the review and registration of attested traits or even comprehension of their combinations provide an “objective knowledge” (Popper, 1991) of observed phenomena.

4.1. DATA STRUCTURE

The corpus of the study contains 1600 buildings corresponding to about 3550 specimens of window. It is almost exhaustive and enough to define the architectural characteristics of buildings to highlight. The tables of the GIS database were built according to two levels of questions. A first level involves simple queries about buildings on which specimens have been identified, such as dating, height, facade width, designer, builder and building transformation. A second level is to use morphological analysis results by processing information relating to forms variation of the analyzed specimens. These coded informations are integrated into the GIS in tables “attributes-objects” that records modalities of morphological variables representing forms taken by the various specimens for a trait or a given descriptor.

4.2. ANALYSIS, VISUALIZATION AND CARTOGRAPHY

Once recorded, the morphological informations are easily accessible from the database of the GIS. Several operations can be performed such as:
– Select buildings with decors of same forms or find co-occurrent forms on a specific building.
– Seek and locate buildings with specimens that satisfy a given condition on structural or plastic attributes.
– Organize specimens of buildings designed by a particular designer, on a specific date or in given area.

The informations analysis from the database of the GIS is subject to graphics maps showing their spatial distribution in the city, to try explaining them. The objects of the map, which are polygons representing plots of buildings, can be discerned by the values of informations associated with the graphic map (Gauthiez, 1993). Reading the spatial distribution of decor structure elements through city areas shows that some of them are more dominant than others (Figure 3). These elements are significant as to the chronology of urban area development. Therefore, there are remarkable correlations between the number of elements that structures employ and city areas. More this number is high more the wealth of decor is accentuated.

The cartography of attested structures (Figure 4) shows that they are grouped in each area according to relations which read through their constitutive parts. That reflects the modes of organization adopted by designers of the time: homogeneous groups in wealthy areas, opposed organizations in modest areas where designers incorporate different elements of all kinds to link them to multiple generic models, often hypothetical.
On their side, motifs of decor are quite diverse, coinciding remarkably, they-also with significant cartography. This is explained by the fact that city areas were built at different times and that each time the designers take different organizations; which results in a particular spatial distribution of decorative motifs from one area to another.

The review of the motifs cartography (Figure 5) shows that some of them are elements of stylistic differentiation. But besides the fact that they are difficult to read directly on the buildings facades, these decorative units are interspersed between areas. However, the variety registered in the motifs spatial distribution reflects the stylistic compositions modes adopted by designers of the time, using each time a different type of organization. That is more urbanization spreads through the city more designers are changing decorative motifs in their works. They employ a variety of decorative motifs that characterize their approach, their style, in an “ornamental dialectic”
(Baltrusaitis, 1986). The character of each area is actually a direct result of movements and stylistic trends that occur over time and not the selection or adaptation of designers to use such a decorative motif exclusively for such an area (Figure 6).

The study of the decor tries also to match decorative motifs classes to differentiated designers groups, maintaining them within these groups multiple special relationship, be it academic training received or comparable professional situations. The stylistic results are observed under that angle. Since this is to characterize architectural objects built at a given time, over a defined area, in a stylistic research purposes, relied on morphological characterizations of these objects. These are the analysis results and the treatment of its morphological informations that we try to use here; and looking particularly from the angle where they reveal the structure of the production field for the time, being through the homology of relations between respectively producers and products.

5. Discussion

The reconciliation of obtained morphological informations to dates, areas and architects allows giving them a stylistic scope and contributes to recognition of the composition rules of each era and in each city area. It is useful to know how a decor form participates in a stylistic classification. It can characterize a particular class, differentiate a specimen of a class or be common to all classes. Certainly, the study of the weight of each form in a stylistic classification is complex and lengthy, but calculations extracted from the database of the GIS can give significant indications.

Assuredly also, it must not ignore “the difficulty of classifying” (Parrochia, 1991) but it must admit that well-built classifications are likely to bring new knowledge of the studied objects and men who designed them and the conditions or the circumstances of their design. Direct examination of
empirical data not allows certainly neither to observe properties of studied objects nor to predict the result of the formal calculations which are essential to the understanding of observed phenomena.

The study of decorative forms allows using different methods, to model the phenomenon, analyze the data and formalize the results. These mediation means that fall mainly to mathematical formalisms and computer algorithms aided to objectify the taken steps and they proved as effective instruments for analysis and knowledge. While these methods are still laborious, if not repulsive, but it must not to lose sight of the content of their results, by confining these classification techniques to a simple role for instrumental mediation that reorganize the morphological informations and represents them under a new face. However, decor variations are all choices made by the designers, their motivations are multiple and often subjective, thus evading a reconstruction quantified of works. The richest results accordingly concern the historic character and the degree of correlation between the structure composition and the choice of decorative motifs.

6. Conclusion

The method adopted in the analysis of decorative forms requires many operations in which the work of the operator is important for formulating hypotheses segmentation and description, arising from his own observation and perception (Piaget, 1975). Modeling of decor forms aims to understand the need to consider a fairly coherent theoretical framework itself and enough strong to confront the proposed empirical facts.

The construction of the GIS allowed to store and map informations on observed decorative arrangements and to seek explaining them. This contributed to the development of a rational tool of knowledge and stylistic classification of a reference corpus of Tunis architecture from the late 19th to early 20th century and cognitive aid to its organized development and management. This updatable and interactive tool is an appropriate means of informations analysis and decision support. It could be an unifying instrument to others researches on the built environment and enable professionals and policy makers to have a state documented easily accessible for city buildings and their components.

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References


