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RECONSTRUCTION OF VILLINO FLORIO'S WOODEN CEILING USING 3D TECHNOLOGIES

One of the major problems affecting humanity is the progressive loss of the historical and artistic treasures that mark the cultural heritage of a nation. There are many reasons why this can happen, such as natural consumption, damage by natural causes or voluntary or involuntary actions caused by some people. The loss of this heritage is even more serious when it regards unique and unrepeatable forms of expression, possibly because they had been created by an artist's hand or because they are linked to historical events, or because they constitute a historical record that cannot be replicated (Gabellone 2009, 2012; Ferrari 2014). From these considerations derives the awareness of an impossibility, at least in theory, to reconstruct what was destroyed.

A clear example of this is Villino Florio in Palermo, one of the first buildings of Art Nouveau in Italy, considered a masterpiece at European level, designed and built by the architect Ernesto Basile on behalf of the Florio family of Palermo (Mauro 2000; Speziali 2015). Basile built the residential complex between 1899 and 1902, and his creativity went beyond the purely architectural aspects, designing each interior decoration and recruiting skilled workers for the artistic working of glass, wood, metals and fabrics, for the construction of all the furniture, according to an ordered and reasoned overall composition (Pirrone *et al.* 1989; Sessa 2002).

In 1962 an arson destroyed most of these finishes and a restoration was required by the Soprintendenza BB.CC.AA. di Palermo for the static and aesthetic recovery of the monument. This philological restoration has also interested the large wooden floral ramage that decorated the ceiling of the grand staircase. Of this masterpiece were absent original design references and there was only a poor photographic documentation in black and white, which led to examine the issues of its reconstruction following new and advanced scientific methods. So, this is a case study that tries to cope with the difficulty of finding skilled craftsmen today in woodworking and to resolve the high construction costs. Therefore, the technology, thanks to a Computer Numerical Control (CNC), takes over this project in an attempt to respond to these needs, trying to recreate elements originally built in a traditional way by non conventional methods.

The specialized contribution of the Information Technologies Laboratory of the Institute for the Archaeological and Monumental Heritage (IBAM ITLab) of CNR in Lecce, made possible the 3D reconstruction of the complex morphology of the decorative ceiling (Gabellone 2015). In this case an important role was played by the 3D operator, by his experience, by his technical skills and his sensibility in working in the 3D environment (Gabellone, Ferrari 2017).

Fig. 1 – Comparison between the originale photo of the ramage before the arson (left), and the 3D reconstruction of the wooden ceiling (right).

Fig. 2 – Two views of the final reconstruction of the ramage within Villino Florio.

So, this approach takes over the manual ability of the workshop master, with the great advantage to experiment and adopt methodological information and communication technology solutions most suitable for the purpose, ultimately obtaining a three-dimensional model that can be modified (even strongly) at any time and from which it is possible to produce an indefinite number of copies.

In the study case at hand, the need to create a 3D model as much similar to the original as possible, clashed with the lack of documentation available, which consisted of only two old photographs in black and white, and a planimetric drawing.

Therefore, it has been indispensable to evaluate which type of modeling could solve all the problems related to the particular and complex form of

the element, and have a three-dimensional process reconstruction provided with a balanced polygons/bit ratio, able on one hand to be easily operated and reproduced by CNC machines and on the other hand to ensure a final product in a 1:1 scale with the right level of detail. The modeling technique in subdivision surfaces was the one that best matched such scope. The use of Non Uniform Rational Basis-Splines (NURBS) allowed to precisely delineate the curvatures of the different branches through the interpolations of sections divergent from each other, with regard to shape, scale and location. The greatest difficulties emerged in the modeling of the endings of the individual elements, that appeared enveloped on themselves with a profile that tended to become irregular, which is a typical characteristic of Art Nouveau.

The 3D modeling of the ramage started from the realization of the great central branch, followed by the lateral elements, connected together only during the final phase of work. The stronger difficulties were undoubtedly linked to the great number of polygons of the final model, due to its complex shape (Fig. 1). This had in part prejudiced the manageability of the file itself: in fact, until it was composed of distinct levels – one for each branch modeled – it was easy to modify. However, this task could hardly be carried out after the connection of all the side branches to the central one. This obstacle was overcome by carrying out the remesh of the model, which led to the elimination of all the redundant polygons. The phase of polygonal "optimization" therefore ensured a good relationship between the quality of the model and its heaviness in terms of bits, such as to solve the problems related to its full manageability. For aesthetic and stylistic analysis of the final result, the 3D ramage was virtually returned to its original location after the relief of the environment, where also all the remaining wooden decorations were reproduced. Once shown the consistency of the three-dimensional philological restoration, the model has been exported using a suitable extension for the transmission of digital data to CNC machines: this has allowed the *ex novo* creation of the complex ramage and its relocation in the original position (Fig. 2).

A work of such importance and difficulty predisposes to the considerations of what skilled computer operators, also definable "digital craftsmen", could play within equipped "informatics shops", in contexts similar to that of Villino Florio. The most obvious advantages in this sense are the significant saving of time and the large contraction of development costs, which does not in any way affect the quality and the final yield in the process. Process that instead leads to an accurate philological reconstruction of the monuments.

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ABSTRACT

This work originated from a simple question: is it possible to reconstruct a destroyed architectural decorative element starting from documents that describe its details, shape and constitutive materials? An important limitation in the past was the lack of technologies and materials that could replicate an object like this in detail. Only a few years ago technology was not yet able to ensure accurate reconstruction characterized by an adequate formal aesthetic level both in terms of materials and finishes. Nowadays, this gap has been filled thanks to the development of Computer Numerical Control machines (CNC) in production processes. In this contribution, we present part of the restoration of Villino Florio in Palermo, built by the architect Ernesto Basile on behalf of the Florio family between 1899 and 1902 and partially destroyed by a fire in 1962: it is one of Italy's first architectural works in the Art Nouveau style, and is considered a masterwork within the European panorama. The restoration, directed by the Soprintendenza BB.CC.AA. di Palermo, also involved the monumental staircase, with a complex wooden floral pattern ("ramage") used to decorate the ceiling. Starting from the relief of the environment and from the old photographic documents, a 3D model of the ramage was retrieved. This formed the basis of information necessary for the subsequent reproduction of the subject with CNC machines on oak modules, assembled and finished just as they appeared in the photographs before the fire. A numerical approach made it possible to control the entire process by adopting structural solutions to avoid overloading the ceiling with excessive weight.