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STEFANO BERTOCCI
FEDERICO CIOLI

Franciscan Landscapes

*Conservation, Protection and Use
of Religious Cultural Heritage
in the Digital Era*

vol. 2



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This volume collects the papers presented at the concluding conference of the European project 'F-ATLAS: Franciscan Landscapes: The Observance between Italy, Portugal and Spain' that took place in Assisi, May 11-13, 2023.

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Façade of the Basilica di Santa Maria degli Angeli, Assisi (Italy). Drawing by Stefano Bertocci.

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**THE USE OF HBIM AS A TOOL FOR DETECTING THE
HABITABILITY OF THE FRANCISCAN HERITAGE BUILDINGS.
THE CASE OF MONASTERY OF SANTA CLARA DE LA COLUMNA
(BELALCAZAR, SPAIN)**

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Abstract

The different technical and legal tools for heritage protection have made it possible for us, today, to enjoy important monumental complexes. The divergence lies in the artistic contexts in which, due to the genesis of their programmatic typology, they require habitation, as in the case of monasteries. This article collects the results of a long investigation, on which we have been working, and whose main objective has been to find a tool that allows us to continuously measure different indicators in which both the protection of the elements, and the capacity for habitation, are guaranteed. For this we have contextualized the research at the Monastery of Santa Clara de la Columna in Belalcázar (Córdoba), a monastery with the highest heritage protection in Spain, and which, in turn, accommodates a religious community. The results have allowed us to design habitability parameters, within protected heritage contexts.

Keywords: Monastery, heritage, convent.



Fig. 1
Aerial view of
the monastery
of Santa Clara
de la Columna
in Belalcázar
(Córdoba), object
of the study.

1. Introduction

The new graphic tools for the conservation of heritage have become fundamental instruments and increased in recent years with the appearance of both hardware and software patents; these tools are dedicated to meticulous data collection with exceptional detail. These technologies have allowed the documentation, analysis, detection and diagnosis of pathologies in heritage with a degree of accuracy never before seen. Parallel to graphic development, important database engines have made it possible to converge architectural systems and heritage realities with parametric structures, thereby supporting the accumulation and processing of objective data for the complex heritage reality.

These technological developments have had an important impact on the delimitation of heritage contexts as well as on determinations of degrees of conservation and deterioration. This objectification, accompanied by important graphic processes, has omitted essential elements such as habitability within protected areas. Being aware of the need to insert habitable contexts into the conservation of heritage and document, in parallel, the evolution of the conservation of these spaces, new and innovative incorporations

are needed. That is the objective of the research synthesized in this communication, i.e., to establish a graphical and parametric tool that allows, at all times, the study of the evolution of inhabited heritage contexts. For this, we study the Convent of Santa Clara de la Columna in Belalcázar (Córdoba), which in addition to being an Asset of Cultural Interest, has a community of Poor Clare nuns who must inhabit the protected spaces.

2. BIM representation systems in heritage

In 2000, according to the Rilievo Charter, surveys were declared fundamental. The knowledge gained from and digitization of survey are approached from the heritage protection perspective through graphic expression, where the drawings reflect a process that should not only be valued for the result but also as a tool and method for recording thoughts that are developed in the transversality of architectural facts through the intentionality of models, the selection of information and the diverse and new dimension collected from the elements (González Pérez, 2018). Murphy et al. (2009) defined HBIM as a new historical structure modelling system that creates complete 2D and 3D models capable of including relative information beyond construction methods and material composition. The addition of technical, qualitative and quantitative information and the relationships established inside and outside through links to external documents characterize the potential of its use (Logothetis, 2015). Despite the rapid evolution of BIM, challenging research opportunities have arisen with regard to adapting to the requirements of existing buildings (Volk et al., 2014). Recent research has focused on HBIM methodology beyond the result, including research management, conservation activities and information dissemination. The understanding of the complex heritage reality of spaces such as Cartuja de Jerez (Castellano Román, 2017) regarding landscape and historical and constructive identification has allowed not only the contemporary registration of this property but also generated new distinctive information with transversal contributions. Consequently, it is essential to reflect on how, in relation to an HBIM survey, the development of a library of interactive parameters is illustrated, subject to the variability of objects and spaces based on the historical dimension, their behaviour and the need for master plans to describe and protect them, as is the case of the Archaeological Ensemble of Itálica, whose research objective (Pinto Puerto et al., 2012) was justified in the need to create an exhaustive and flexible document that would codify the heritage reality and in turn allow the addition of properties included in the trace of the cartographic base. The needs of the interested parties are manifested beyond the professionals of the AEC industry, as HBIM studies have focused on the graphic point of view, containing the fluid participation of other professionals (Garagnani, 2013). The implementation of HBIM still requires

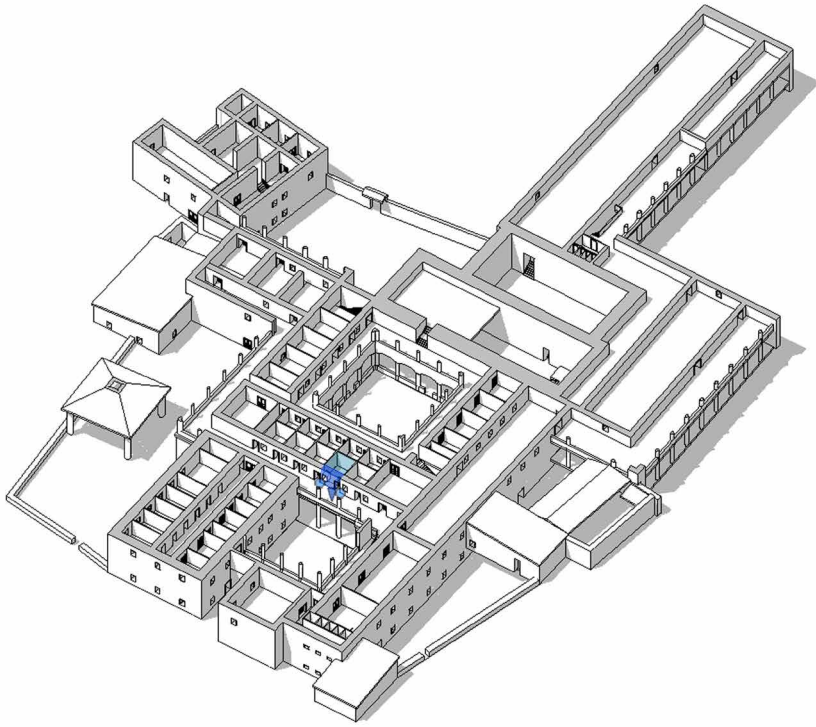
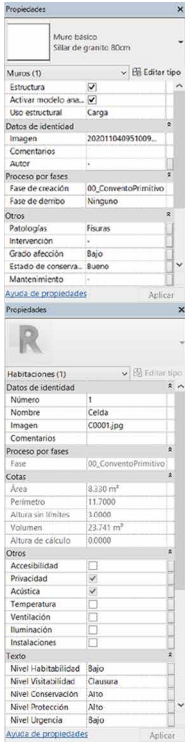


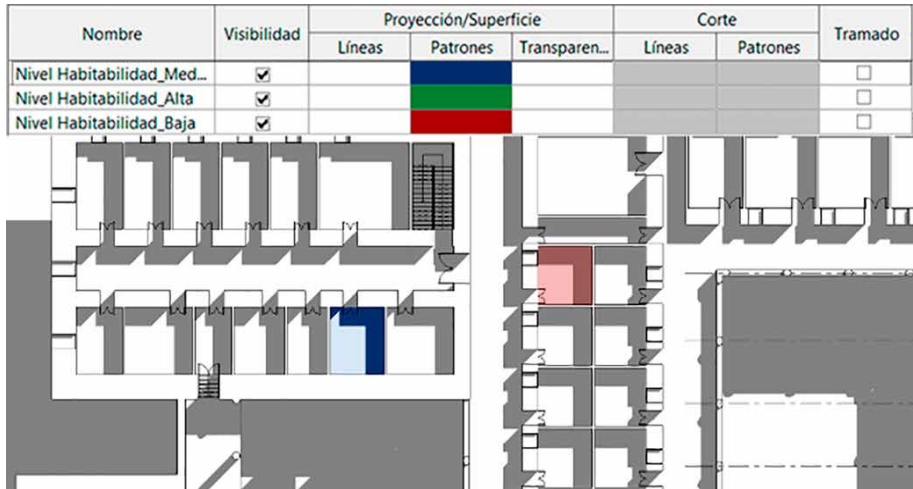
Fig. 2
Image of the process of digitization of habitability parameters in the heritage context of the Convent of Santa Clara de la Columna in Belalcázar (Córdoba).

opposite page
Fig. 3
Comparison through the visualization of the habitat level parameter in a monastery cell.

a methodological debate and practical experimentation to apply this type of documentation in a broader process of heritage conservation and maintenance (López et al., 2017).

3. Graphic support as an analysis tool

Therefore, the question that arises in this research is not the achievement of high-precision three-dimensional BIM modelling but the exploration of the possibilities of the tool in the field of architectural survey and representation as a way of knowing a heritage property in relation to its contemporaneity. In this way, it focuses on developing and implementing those parameters that allow managing patrimonial and habitability information. When modelling a new building, BIM-based systems provide parametric objects of generic shapes, ordered by type of family, which are easily adaptable to each specific case. In relation to heritage buildings, current object libraries are very limited and therefore make it difficult to achieve a satisfactory representation of architecture (Alcinia Zita, 2021).



To correctly analyse all the aspects related to the reality of the monastery, a constructive analysis is necessary given the traces and historical growth, the constructive solutions adopted and the behaviour associated with the forms of life in the space.

In relation to the method used, there are two aspects. First, several HBIM surveys were documented to carry out a critical analysis of the process used and the assignment of information, and then, we conducted our own survey. To erect the convent, the case made by Manuel Castellano Román (2017) has mainly been followed. Similar to the characterization of spaces by levels (urgency, conservation, vulnerability and visitability) being derived from a previous definition of the construction elements, this research proposes in parallel to carry out a characterization that allows evaluating the level of habitability of a space within a heritage context. The dimensional and constructive definition and the heritage characterization through the creation and assignment of parameters related to pathologies, state of conservation, interventions, etc., allowed an objective reflection on aspects related to the comfort, safety and accessibility of living spaces. These parameters are defined from the technical code that governs the requirements of living spaces and housing conditions that the WHO contemplates in its environmental consideration of the person.

4. Graphic parameters of coexistence between heritage and habitat

The parameterization of elements and spaces of the model has allowed the objectification of the technical characteristics to proceed to the parameterization of spaces. This succession allows a filtering and deep understanding of a reflection on the space of architecture and its



Fig. 4
Phase and
parameters
associated with
a cell (room).



behaviour through graphic representation. The parameterization of the patrimonial and housing levels of the convent have made it possible to demonstrate the already indisputable reality of guardianship and the domesticity and practicality of a space whose maintenance is not only based on its protection but also on its use derived from the complicity of the community that inhabits it.

As a consequence of this scalar definition of the material volume to the empty space that it encloses, deficiencies have been detected in the habitability of certain spaces directly related to factors such as the type of protection, the demand for environmental conservation of their finishes, the presence of elements that prevent accessibility and, in contrast, others that, despite being in the same patrimonial register, manage to converge in the common operation.

5. Conclusions

The representation and visualization of heritage beyond a traditional survey by means of parameterization as a method of the objectification of architectural realities and as a tool for identifying, cataloguing, measuring, visualizing and comparing aspects has allowed observations of the relationship between the construction and the interior behaviour of the complex 'city' that has governed its evolution. Through the development of new research vectors applied to heritage in parallel to habitable space, we have determined patterns of behaviour that have allowed us to make spaces for daily life compatible with maximum heritage protection. The graph of all these spaces, together with the deep development of new parameters, has been the main objective from which we have been able to analyse all the results obtained.

Credits

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Integrating historical research with technological progress opens exciting possibilities to create comprehensive digital archives, virtual reconstructions, and immersive experiences that can bridge the gap between the past and the present.

Stefano Bertocci is Full Professor at the Department of Architecture of the University of Florence. He led numerous research projects on the opportunities offered by 3D digital surveys and remote sensing in archaeology, architecture, and urban planning. His major works include research on Architectural Heritage in Europe and Latin America, wooden architecture in Russia and investigations of various archaeological sites in Europe and the Middle East.

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