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## Digital Anastylis of the Remains of a Portal by Master Builder Hernán Ruiz: Knowledge Strategies, Methods and Modelling Results

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## ABSTRACT

The portal of the forecourt of the old monastery of San Agustín in Seville (Spain) has been preserved in fragments. The notarial document specifying the conditions for its construction has been preserved, although the drawing that accompanied it has been lost. To a certain extent, this loss is remedied by other designs created by Hernán Ruiz. We also have archive photographs that bear witness to its state of repair some years before it was dismantled. Armed with all of this material, we attempted to carry out a virtual anastylis of the portal using new technologies such as digital photogrammetry, reverse engineering, BIM and visual programming. The creation of the 3D digital model was accompanied by the interpretation of the data obtained from documentary sources. The end result is a digital graphical model of heritage information (HBIM) which we hope will provide a useful tool for the analysis, promotion and anastylis.

## 1. Introduction

The principal aim of this investigation was to create a digital model for a cultural heritage asset in grave danger of being lost: the remains of the portal of the forecourt of the old monastery of San Agustín in Seville (Spain). This model, which serves as an open-ended and constantly updated system, offers a 3D visualisation of the strict physical reality while providing all the necessary information to permit a detailed knowledge of the object and therefore assist with any decisions taken about it. To create the model, we followed the recommendations and lines of work stemming from the *Carta del Rilievo* and the numerous experiments in the use of digital tools that have been carried out worldwide since then (Stefani et al., 2006; Simeone et al., 2009; Pinto, Guerrero and Angulo, 2011; Angulo, 2012; Brumana et al., 2013; Barazzetti et al., 2016).

The *Carta del Rilievo* was signed by a group of architectural survey experts at the Castel Sant'Angelo (Rome) in 1999 and was disseminated at the Seminario Internazionale di Studio “Gli strumenti di conoscenza per il progetto di restauro” (Valmontone, September 1999) and the international conference “Science et technologie pour la sauvegarde du patrimoine culturel dans les pays du bassin Méditerranéen” (Paris, 1999). It was first publicised in Spain at the 8th Architectural Graphical Representation Conference (Barcelona, 2000). This document was also

analysed in Jiménez and Pinto (2003).

Since the object of our study had been dismantled into fragments, the model was conceived as an anastylis (this is the term for the reconstruction of a ruined monument by methodically studying how its different components fit together). Consequently, our aims were to return the object to its whole state, avoid the decontextualisation of the fragments, facilitate the object's future management, and explore the possibilities of its material reconstruction and replacement of the gaps according to the criteria of formal integration and material differentiation.

The project was undertaken in a specific socio-economic context in which the funding to carry it out was extremely limited and there was no possibility of conducting a detailed examination of the preserved remains in situ, or of actually handling the pieces. These conditions are found all too often in the case of heritage assets that are scattered and located on private property with very limited access. However, in our opinion more favourable conditions would only have affected the exhaustiveness of the data collection and would have had no effect on the analysis carried out or the proven usefulness of the resulting model.

At present there is a pressing problem in the field of knowledge and management of architectural heritage: the tendency to disseminate information obtained from different areas (administration, scientific community and architecture professionals) and disciplines involved

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(archaeologists, historians, architects, Etc.), generating serious situations of loss or duplication of data. This reality has reverted in the lack of efficiency in the programming and execution of the various activities of maintenance, conservation and intervention in these architectures, as well as in the waste of important research work that hinders the disclosure and, therefore, the knowledge of them (Angulo, 2012).

In response to this problem, the methodology used (evolved from previous experiences through the application of reverse engineering and the inclusion of new connection flows with databases) aims to reinforce the use of BIM (Building Information Modelling) and other systems designed to facilitate the management and 3D visualisation of new-build properties to the field of heritage. As such, it is not so much about creating a 3D model to simply visualise the form, or a tool that absorbs and classifies all the available information automatically, but rather about developing a methodology that would generate knowledge, shed light on the complexity of the property, and facilitate the dissemination it deserves, all thanks to new technologies. In order to shed adequate light on the complexity of the property, the actual construction of the model was just as crucial as the end result since it demanded consideration of information from different documentary sources and the formal analysis of the architecture in a methodical, integrated manner. In this respect, technology was an essential aid in developing the thought processes about the object since it enabled us to interrelate the data provided by historiography, archaeology and geometric analysis.

## 2. The turbulent history of the portal

The origins of the portal can be traced back to 1563 when Brother Francisco Serrano, prior of the Augustinian monastery, commissioned the master builder of the city of Seville, Hernán Ruiz the Younger, to design a portal for the forecourt or entrance yard in front of the church (Hernán Ruiz the Younger, also known as Hernán Ruiz II or Hernán Ruiz Jiménez, was the son of the Córdoba master builder Hernán Ruiz, nicknamed "the Elder"). The terms and conditions for the commission were set out in a notarial document that has been preserved to this day, although the sketch or drawing that accompanied the design project has been lost (Archive of Notarial Records of Seville, Trade 20, Book II. Fol. 1148–1149; this document came to light following its transcription in full in Morales, 1985). The contract confirms the authorship of the design, the promoter's specifications, and the terms and conditions of the tender organised to select a builder from the various bids submitted. The process culminated in the approval of the lowest bid, which was submitted by the master builder Juan Rodríguez. Recorded as a moulder between 1549 and 1551, Rodríguez worked on numerous buildings in Seville, Morón and Carmona under the orders of Martín de Gainza and Hernán Ruiz himself (Morales, 1979; Rodríguez, 1998).

Most of the most monastery has been lost today, but we were able to identify the exact location of the portal thanks to the plan drawn up by the architects Ángel de Ayala and Balbino Marrón y Ranero in 1850 (Gómez de Terreros 2007), and the photographs preserved in the photo archive of the Seville University Art Laboratory (Fig. 1). This plan of the current state of the building formed part of the project to turn it into a prison, conducted between 1843 and 1873. We transposed the old plan and a historical map, specifically the 1868 map of Seville in which all the essential elements are still visible, onto present-day maps of the city. These documents confirm that the portal was located in the monastery wall, opposite the city gate known as "Puerta de Carmona". Between the two lay a relatively large urban space formed by the intersection of the external medieval wall and one of the main access roads into the city. This spatial node was delimited by the wall of the monastery, the monumental city gate and the aqueduct that had brought water from the nearby town of Alcalá de Guadaíra since the days of the Almohads (11th century), as shown in various drawings and engravings from the 19th century. There are two engravings in which the monastery is clearly visible, one by Pérez Villamil (1845) and the

other by Parcerisa (1850), both reproduced in Sáncho (1975).

The confiscation of religious properties in 1835 culminated in the expropriation of the Augustinian order, whose buildings passed into the hands of the state. As in other similar cases, the old monastery of San Agustín was used for a variety of public purposes before finally ending up in private ownership (Gómez de Terreros 2007). During this time the portal, stripped of the images that formed part of its symbolic programme, served several purposes: in 1837 it was the entrance to a prison, and in 1880, following the auction of the monastery buildings, it served as the entrance to a market, military barracks and a private storage facility. In the mid-20th century, following the new alignments generated by the urban reform of the city, the portal was dismantled stone by stone and stored in the old derelict monastery to await a buyer. Fortunately, what remained of the monastery was declared an Artistic-Historic Monument in 1964, which is why its remains have survived to this day (Fernández, 2013). Since then, there have been various declarations and recommendations regarding the recovery of the portal, but to date no significant contribution to the knowledge of its characteristics has been made, and much less to its conservation and dissemination. In 1985 the fragments were inventoried for a proposed anastylosis at a place nearby, and although this endeavour never progressed beyond an academic essay it nevertheless permitted the identification, mapping and classification of the preserved fragments on elevation drawings created for the purpose. The portal has only earned its rightful place in history thanks to the research conducted by Professor Morales in 1979, the organisation of the fragments in the middle of the cloister in 1993, and the research on the manuscript of Hernán Ruiz undertaken in 1997 for the publication of a facsimile of the document (Morales, 1979; Jiménez et al., 1998). Since then, its complex history has been characterised by both oblivion and lack of knowledge (Fig. 2) (the portal can be easily located in Google Maps at the coordinates 37°23'22.19" N, 5°59'1.85" W).

## 3. Methodology and development of the work

Based on the conditions described above, we launched two simultaneous and occasionally intersecting lines of work. The first consisted in creating a digital model, using photogrammetry to collect the data; the second, in analysing and systematising the documents to associate them with a database. The two lines of work ultimately converged in the creation of the HBIM model.

### 3.1. Data collection and capture of the metrics

To collect the data we visited the monastery and examined the portal remains in April 2016. Although the remains were still arranged on the ground, they presented an advanced state of decay and some of the fragments were in a different position from those shown in the images taken in 1993. After painstakingly clearing the vegetation that had colonised the spaces between the stones, creating the appearance of a Ruskinian romantic ruin, we collected the data very quickly as we were only allowed to stay at the site for a couple of hours. In view of the characteristics and disposition of the pieces, we decided to use a drone fitted with a camera (DJI Phantom 2 quadcopter with three Zenmuse H3-3D axes and integrated GoPro 3+ camera) to take intensive shots of the portal. Although this decision diminished the quality of the images (though in any case the quality was still sufficient for our purposes), it enabled us to carry out the field work in a very short time and provided us with general and aerial views, which made it easier to put them in order afterwards.

The photographs were processed with Agisoft PhotoScan, a multi-image photogrammetric application with SfM (Structure from Motion) technology, to obtain a thick point cloud (Fig. 3). In recent years there have been numerous methodologies and practical cases where this technology has been used in the field of heritage architecture (Pereira, 2013; Buill et al., 2015; Rodríguez et al., 2015). If the proper equipment

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