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# ARCHITECTURES OF THE SOUL

## Diachronic and Multidisciplinary Readings

Rolando Volzone  
João Luís Fontes, eds.





ARCHITECTURES  
OF THE SOUL.  
DIACHRONIC AND  
MULTIDISCIPLINARY  
READINGS

*Editors*

ROLANDO VOLZONE  
JOÃO LUÍS FONTES

Lisbon 2022

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# Integrated 3D survey of the first Franciscan Observance settlement in Portugal.

## The convent of Santa Maria de Mosteiró in Valença (Alto Minho, North of Portugal)

*Rolando Volzone<sup>1</sup>*

*Roberta Ferretti<sup>2</sup>*

### **Abstract**

The continuous abandonment of convents in Portugal, culminating with the 1834 decree of dissolution of religious orders, led to the loss of their original function and values.

This study analyzes the physical legacy – mostly altered, abandoned, or in a ruinous state – of the first Franciscan Observance settlements (1392) in the Portuguese territory at the Northern border with Spain, with focus on the convent of Santa Maria de Mosteiró (Valença, north of Portugal).

This paper aims to understand the historical and current values of these sites through a knowledge-based approach by conducting historical research and surveys. The methodology combines traditional and innovative techniques: historical research with current analysis of the built structures through integrated digital survey techniques.

These first results constitute a support tool for the conservation, protection, and enhancement of this cultural heritage. They also enable comparative analysis with the other case studies in Portugal, Spain, and Italy in order to understand the typological model at the basis of the Franciscan Observance in Southern Europe.

### **Keywords**

Franciscan Observance; 3D survey; historical analysis; religious heritage; Portugal.

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## 1. Introduction

Study of the Franciscan Observance in Alto Minho, the border area between Spain, in Galicia, and Portugal, was carried out by the historian García Oro<sup>3</sup>. More recently, historical analysis has been undertaken of the Franciscan reformation<sup>4</sup> and its expansion<sup>5</sup> in the Portuguese Late Middle-Ages. On the basis of the current evidence and taking into account specific Franciscan branches, a typological analysis of the conventual structures was carried out by Medinas<sup>6</sup> regarding the Strict Franciscan Observance in the *Province of Piedade*, south of Portugal, and by Figueiredo<sup>7</sup>, concerning the *Province of Conceição*, which incorporated the convent of Santa Maria de Mosteiró in the 18<sup>th</sup> century. Recently, Master's and PhD theses have aimed to valorize some of the convents that once belonged to the first Franciscan Observance<sup>8</sup>. The results of research carried out by students of the University of Porto on these case studies have been presented in two books<sup>9</sup>.

However, an in-depth analysis through the production of digital documentation was missing. The models, resulting from the 3D surveys, constitute an important

<sup>3</sup> GARCÍA ORO, José – “Los “Frades Da Pobre Vida”. Un Nuevo Franciscanismo En Galicia y Portugal”. In JIMÉNEZ, Gonzalo Fernández-Gallardo (ed.) – *Los Franciscanos Conventuales En España. Actas Del II Congreso Internacional Sobre El Franciscanismo En La Península Ibérica*. Madrid: Franciscanos Conventuales – Asociación Hispánica de Estudos Franciscanos, 2006, pp. 245-274.

<sup>4</sup> RODRIGUES, Ana Maria S. A.; FONTES, João Luís; ANDRADE, Maria Filomena – “La(s) Reformas En El Franciscanismo Português En La Edad Media”. *Hispania Sacra* LXXII 145 (2020), pp. 51-63. Available at <https://doi.org/10.3989/hs.2020.004>.

<sup>5</sup> TEIXEIRA, Vítor Gomes – *O movimento da observância franciscana em Portugal, 1392-1517: história, património e cultura de uma experiência de reforma religiosa*. Porto: Centro de Estudos Franciscanos; Braga: Editorial Franciscana, 2010.

<sup>6</sup> MEDINAS, Victor Joaquim Fialho – *A arquitectura capucha da província da Piedade*. Lisboa: FCSH -Universidade Nova de Lisboa, 1994. Master's degree in History of Art.

<sup>7</sup> FIGUEIREDO, Ana Paula Valente – *Os conventos franciscanos da Real Província da Conceição : análise histórica, tipológica, artística e iconográfica*. Lisboa: Universidade de Lisboa, 2008. PhD Thesis in História (Arte, Património e Restauro),

<sup>8</sup> With regards to the convent São Francisco do Monte, see: AFONSO, Miguel T. M. – *Valorização e renovação do convento de São Francisco do Monte*. Vila Nova de Cerveira: Escola Superior Gallaecia, 2018. MSc thesis in Architecture and Urbanism; CARVALHO, Luísa D. S. – *O contexto na determinação do (re)uso dos conventos: o Convento de São Francisco do Monte*. Vila Nova de Famalicão: Universidade Lusíada, 2019. MSc thesis in Architecture; FONSECA, Mariana M. P. V. – *A Ruína, uma Circunstância Programática: Intervenção no Convento de São Francisco do Monte em Viana do Castelo*. Porto: Faculdade de Arquitectura da Universidade do Porto, 2020. MSc thesis in Architecture. With regards to the convent Santa Maria da Ínsua, see: NETO, J. L. G. S. – *[Re]thinking the Fort of Ínsua. The meeting between the Sea, History and Belief*. Coimbra: Faculdade de Ciências e Tecnologia da Universidade de Coimbra, 2019. MSc thesis in Architecture; LIMA, S. M. M. N. 2015. *Intervenções de conservação e restauro do património edificado: o Forte da Ínsua*. Porto: Universidade Fernando Pessoa, 2015. MSc thesis in Architecture and Urbanism; LOUÇÃO, C. S. C. P. – *O património conventual do concelho de Caminha e o seu percurso após a extinção das ordens religiosas, em 1834*. Lisboa: Universidade Aberta, 2021. MSc thesis in Heritage Studies.

<sup>9</sup> FERREIRA, Teresa Cunha; NETO, Rui – *Património na Paisagem. São Francisco do Monte./ Heritage on the Landscape. São Francisco do Monte*. Guimarães: EAUM/Lab 2PT/IPVC, 2019. FERREIRA, Teresa Cunha; NETO, Rui – *Património na Paisagem. Santa Maria da Ínsua/Heritage on the Landscape. Santa Maria da Ínsua*. Guimarães: EAUM/Lab 2PT/IPVC, 2019.



support for future rehabilitation works, as well as the dissemination of this religious heritage, which most of time is unknown or inaccessible, even for local communities.

This study aims to fill this gap, developing knowledge-based methodologies that combine historical research and integrated 3D surveying<sup>10</sup>. In particular, it analyses the physical legacy of one of the first foundations of the Observance Franciscan in the Portuguese territory, dating back to 1392: Santa Maria de Mosteiró.

The gradual abandonment of convents, until the ultimate dissolution of the Portuguese religious orders in 1834, has led to the loss of their original function and value. Several convents are in an advanced state of degradation today, as visible in this case study. The 3D survey campaign is therefore essential in order to document the current state of conservation.

We shall begin by examining the genesis and historical evolution of the Franciscan Observance movement in the north of Portugal. Then we'll focus on the convent of Santa Maria de Mosteiró, carrying out an overview of its historical evolution and the analysis of its components of built structure. We then discuss the digital methodologies for the 3D survey of the current evidence. Finally, the results of the combination of these two knowledge-based methodologies are displayed.

## 2. The origin of Franciscan Observance in Portugal: historical framework

The Order of Friars Minor, commonly known as the Franciscan order, is a mendicant religious order founded by Saint Francis of Assisi, approved in 1209 by Pope Innocent III, and confirmed during the Fourth Council of the Lateran in 1215.

During the 13<sup>th</sup> century, the Franciscans expanded from Italy throughout Europe, reaching Portugal in 1217 and founding conventual settlements. The Franciscans had a centralized government organized into provinces, including *Hispânia*, which covered the whole Iberian Peninsula and was divided between 1232 and 1239 into Aragon, Castile, and Santiago. The latter corresponded to the Portuguese territory. Each province was formed by custodies. From 1272, the Portuguese province was divided into Lisbon, with seven convents, and Coimbra, with six convents. A third division was created in Évora, in southern Portugal, in 1330.

A reformation movement arose within the Franciscan order, aimed at returning to the rigorous observance of the model defined by Saint Francis through his rule

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<sup>10</sup> The in-depth analysis of these case studies, including the digital documentation of the current evidence, is ongoing, within the JPI Cultural Heritage project "F-ATLAS. Franciscan Landscapes: Observance between Italy, Portugal and Spain". The work is funded by the European Union's Horizon 2020 research and innovation programme under grant agreement n° 6995237. Additional information at: <https://www.f-atlas.eu/>.

and his testament, most importantly returning to the ideals of poverty. Franciscans left the large convents for this reason in the mid-14<sup>th</sup> century, retreating to isolated, poor, austere places, renouncing pastoral activity and gathering in small groups with a strong presence of laymen. This movement is well known as Observance, in opposition to Conventualism. It originated in Italy, with Friar Pauluccio da Trinci, through the approval of Pope Gregory XI.

The Franciscan Observance reached Portugal in 1392 through the Galician group led by Gonçalo Mariño<sup>11</sup>, who founded the first observant hermitages in the Portuguese territory south of the Minho river. The first foundations settled in isolated places propitious to a solitary and penitent life: Santa Maria de Mosteiró in Valença, Santa Maria da Ínsua in Caminha, São Francisco de Viana in Viana do Castelo, and São Paio dos Milagres in Vila Nova de Cerveira (fig. 1). In the same year, São Clemente das Penhas was founded on the coast of Matosinhos, less than 100 km to the south. Starting from these foundations, and with the support



Fig. 1 – The first Franciscan Observance settlements in Alto Minho. Location map (top), pictures (bottom). ©Rolando Volzone, 2021.

<sup>11</sup> TEIXEIRA, Vítor Gomes – *O movimento da observância franciscana em Portugal*. RODRIGUES, Ana Maria S. A.; FONTES, João Luís; ANDRADE, Maria Filomena – “La(s) Reformas En El Franciscanismo Português.

of the royalty, existing convents were reformed within the Observance and new ones were built.

The Franciscan Observance gained an increasing visibility in the second part of the 15<sup>th</sup> century; several works took place in the hermitages and convents founded in the previous phase. At the same time, some of these were abandoned, as happened in São Clemente das Penhas, whose Franciscan community moved to a more central location in Leça da Palmeira.

In 1517, Pope Leo X issued the bull *Ite vos*, decreeing the division of the order into two. In Portugal, two branches were created: *Província de Portugal da Regular Observância*, which integrated the settlements of the island of Madeira, and *Província de Portugal dos Conventuais* (or *Claustrais*), integrating five settlements from Azores islands. However, in 1584, the Conventual Franciscans were definitively suppressed by Pope Pius V through a brief dated 1567, being integrated into the Observants.

At this point the Franciscan order was divided into two groups: the *Regular Observance*, which included the *Province of Portugal* and the *Province of Algarves*; and the *Strict Observance*, more rigorous than the first one, which included five provinces: *Piedade* (1517), *Arrábida* (1560), *Santo António* (1568), *Soledade* (1668), and *Conceição* (1705).

With the dissolution of the Portuguese religious orders in 1834, the Franciscan communities left the conventual settlements. These became property of the state and, after being evaluated, were mostly sold at public auction. The main components of the settlements – land assets, churches, and conventual dependencies – were usually sold separately, taking on different functions.

The Franciscan order was the most representative mendicant order in Portugal<sup>12</sup>. Nowadays, their buildings are profoundly altered, due to the new functions, abandoned, in advanced state of conservation – sometimes ruined – or totally disappeared. This hampers the historical analysis of the structures, which is nevertheless sometimes made possible by archival documents: written, iconographical, or photographic sources.

Joint analysis of the historical documentation and the survey of the physical structures<sup>13</sup> constitutes a first step for a deeper understanding of the Franciscan movement and how this was translated in spatial terms.

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<sup>12</sup> Analysis of the data collected by CAMPOS, Fernanda Maria Guedes – (*A Ordem das Ordens Religiosas. Roteiro Identitário de Portugal (Séculos XII – XVIII)*). Casal de Cambra: Caleidoscópio, 2017) indicates that about 44% of the religious houses settled in the Portuguese territory between the 12<sup>th</sup> and the 18<sup>th</sup> centuries belonged to the Franciscan order.

<sup>13</sup> VOLZONE, Rolando; NIGLIO, Olimpia; BECHERINI, Pietro – “Integration of knowledge-based documentation methodologies and digital information for the study of religious complex heritage sites in the south of Portugal”. *Digital Applications in Archaeology and Cultural Heritage*, Volume 24 (2022), e00208. Available at <https://doi.org/10.1016/j.daach.2021.e00208>.

### 3. The Convent of Santa Maria de Mosteiró: an overview

#### 3.1 Historical Framework

The convent of Santa Maria de Mosteiró originated from a previous hermitage founded in 1392 by the friars Diogo Árias, Gonçalo Martinho, and Pedro Dias<sup>14</sup>. Similarly to the first settlements of the Franciscan Observance movement in Portugal, this hermitage was founded in an isolated place named *Godim* or *Gondim*<sup>15</sup>, close to important waterlines, surrounded by brush and near an existing chapel<sup>16</sup>. A first hermitage was built south of a chapel dedicated to Nossa Senhora, on flat land<sup>17</sup> in Cerdal, Valença do Minho, on the Santiago itinerary.

Santa Maria de Mosteiró was probably the first settlement to be founded within the Franciscan Observance, as highlighted by the chronicler Lisboa<sup>18</sup> and taking into account its location. Indeed, considering that the friars came from Galicia and that Valença was the territory closest to the borders with Spain, it is possible that they started from here before proceeding south to the other foundations<sup>19</sup>.

In 1491 the community was integrated into the Observance of the *Province of Portugal*. The structure of Santa Maria de Mosteiró expanded, developing into a convent since 1557, and integrated the *Province of Santo António* in 1568. In 1706 it became part of the *Province of Conceição*, until the dissolution of religious orders in 1834.

The church of Santa Maria de Mosteiró was unused for 50 years. Only in 1884 was it donated to the Confrary of Nossa Senhora de Mosteiró. In 1980 the Confrary renovated the churchyard and carried out conservation works of the church, repairing its roof.

With regards to the other components of the settlement: the conventual dependencies were sold to D. Miguel Pereira Forjaz; the enclosure, kitchen gardens, and part of the land assets were acquired by António José Garcia for \$12,000; the movable assets were sold to Inácio José da Silva for \$28,000<sup>20</sup>. In 1884 the conventual

<sup>14</sup> SOUSA, B. V. (dir.) – *Ordens religiosas em Portugal. Das origens a Trento – guia histórico*. 3<sup>rd</sup> ed. Lisboa: Livros Horizonte, 2016.

<sup>15</sup> NOGUEIRA, Ibérico – “Santa Maria de Mosteiró – Cerdal”. In *Arquivo do Alto Minho*. Vol. 4, tomo I. Vila de Punhe: Escola Tip. da Oficina de S. Jorge, 1951, pp. 55-59.

<sup>16</sup> This was strictly linked to the origin of the Franciscans – indeed, Saint Francis founded the convent of Santa Maria della Porziuncola close to the chapel dedicated to Santa Maria degli Angeli in Assisi, Italy. According to frei Santo Agostinho de Santa Maria (1712), a (probably monastic) structure was inhabited by the Hermits of Saint Augustin, from the time of the Goths to the Muslim period, that led to its abandonment. In the first half of the 10<sup>th</sup> century, it was donated to a community of Benedictines who then left the settlement due to the unfavorable conditions of the land. The chapel was the only built structure still standing after a fire in the 14<sup>th</sup> century.

<sup>17</sup> TEIXEIRA, Vitor Gomes – *O movimento da observância franciscana em Portugal*.

<sup>18</sup> Lisboa, Frei Marcos de – *Crônicas da Ordem dos Frades Menores* (Facsimile Edition, 2001). Porto: Faculdade de Letras da Universidade do Porto, 1570.

<sup>19</sup> FIGUEIREDO, Ana Paula Valente – *Os conventos franciscanos da Real Província da Conceição*.

<sup>20</sup> Lisboa, TT, *Arquivo Histórico do Ministério das Finanças, Conventos extintos, Convento de Santa Maria de Mosteiró*, cx. 2258.

dependencies were sold to Manuel Pereira Azevedo Gama: this family is still the owner. Both the conventual dependencies and the church were classified as “Assets of Public Interest” in 1983. In the 1990’s, Dalio Gama developed a project for the refunctionalization of the space and its physical adaptation into a tourist accommodation. However, this project was not actualized. This area is completely in ruin today, with exception of the part adjacent to the church, which is currently used by the Cerdal Parish (fig. 2).



Fig. 2 – Santa Maria de Mosteiró: top view (top), ©Google Earth; aerial view by drone (bottom). ©Anastasia Cottini, 2021.

### 3.2 Description of the building and space-function distribution

The convent of Santa Maria de Mosteiró is located in an isolated area about 5 km from Cerdal, in Valença. The conventual complex is set on the slope of the Gondelim Hill Chain, west-facing, at about 240 meters high.

The convent is surrounded by an enclosure, a physical boundary between the interior, the sacred place, and the outside world. Similarly to other monastic-conventual experiences, orchards and kitchen gardens were cultivated inside the enclosure. These were indispensable for the community's self-sufficiency. However, analysis of an 18<sup>th</sup> century document discloses the presence of woods here<sup>21</sup>, where beehives allowed the production of honey<sup>22</sup>. The enclosure and few elements of the hydraulic system are still standing in the place (fig. 3).



Fig. 3 – Physical evidence of the conventual enclosure: section of the wall (left), and detail (right).  
©Rolando Volzone, 2021.

<sup>21</sup> In: JOSÉ, Frei Pedro de Jesus Maria – *Chronica da Santa, e Real Provincia da Immaculada Conceição de Portugal da mais estreita e regular Observancia do Serafim Chagado S. Francisco*. 2nd edition, volume 1, pp. 334-339. Lisboa: Oficina de Miguel Manescal da Costa, 1760. The document has been transcribed by Ana Paula Figueiredo (2008).

<sup>22</sup> Lisboa, TT, *Arquivo Histórico do Ministério das Finanças, Conventos extintos, Convento de Santa Maria de Mosteiró*, cx. 2258.

This component of the landscape was very important, so much so that the extracted firewood also met the needs of the convent of Santa Maria da Ínsua, belonging to the same religious order, about 35 km away. Moreover, the wide availability of water in this place is evident thanks to the documented presence of four natural springs and a waterline that crossed the enclosure, allowing the operation of two watermills.

With regards to the built convent, the current morphology of Santa Maria de Mosteiró is the result of several reforms and rebuilds over the centuries, mostly starting from 1557, with strong impact from the integration into the *Province of Conceição*. Despite the alterations, the original trace is still evident. Indeed, this convent, as well as the others which evolved from medieval settlements – Santa Maria da Ínsua in Caminha and San Francisco do Monte in Viana do Castelo – did not achieve the formal regularity prescribed by the *Province of Conceição*. Even in its plan, the analyzed convent is not a regular rectangle, with a small distortion in the northeast corner.

The evolution of this convent from a medieval structure is proven by the east-orientation of the church and the presbytery, as was common in that period – east-by-southeast in this case.

The architecture is guided by an austere style in keeping with their pauperistic intent, with exception of the interior of the church, which presents baroque gilded woodcarving that later included neoclassical elements. The façades are mostly without ornaments, in some cases plastered, with the exception of the main façade, which received a more careful treatment (fig. 4).



Fig. 4 – Different treatment of the façades: main façade of the church (left), north façade (right).  
©Rolando Volzone, 2021.

The church is preceded by a churchyard with a cross. The religious space was accessed through a galilee – a porch. The nave is entered axially through a narthex. In the case of Santa Maria de Mosteiró it is an endonarthex, an architectural element that develops in the interior of the church. The galilee and narthex are topped by the high choir (fig. 5).

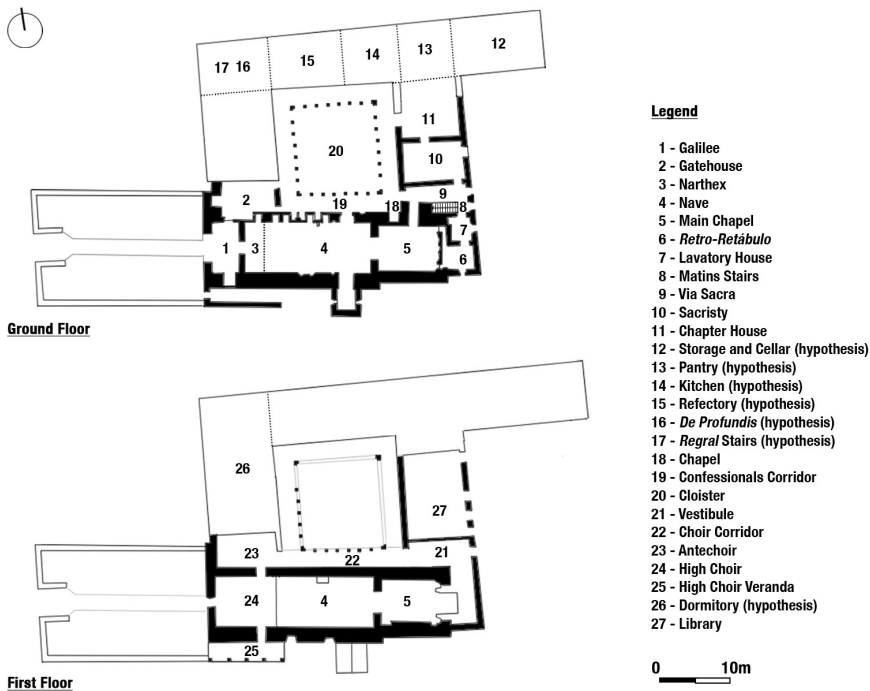


Fig. 5 – Planimetric survey and spatio-functional distribution. ©Roberta Ferretti, 2021.

The church is longitudinal in shape and composed of a single nave with a pseudo-transept and a straight termination presbytery – the main chapel that is narrower and lower, compared with the nave. This is a simplified typology, reduced to the minimum, typical of the plain architecture style (*arquitectura chã*)<sup>23</sup>, by respecting the poverty and humility fundamental to the order. This formal architectural solution is typical of the mendicant orders, especially of the Franciscan convents of the Observance.

The passage to the presbytery runs through a triumphal round arch, with two lateral altarpieces in gilded woodcarving situated at 45 degrees, painted in white,

<sup>23</sup> KUBLER, George – *Portuguese Plain Architecture: Between Spices and Diamonds, 1521-1706*. Middletown, Conn.: Wesleyan University Press, 1972.



blue, and gold, in which Baroque, Rococo, and Neoclassical elements intertwine (fig. 6a). The presbytery has a retable in Joanine Baroque style, copiously decorated. It was transferred from the extinct monastery of Bom Jesus in Valença, having been crafted by the carver Marceliano de Araújo in the 18<sup>th</sup> century.

From the presbytery, the *Via Sacra* is accessible through a door to the left. This is a space dedicated to reflection and to penitence that is connected to the sacristy, the cloister, the *Casa do Lavabo* (Lavatory House) (fig. 6b) and the *Escadas das Matinas* (Matins Stairs)<sup>24</sup>. These stairs connected the two floors, leading to the wing of the choir corridor (fig. 6f).

The sacristy (fig. 6c), a room for storing liturgical implements, vestments, and relics, where the priests prepared for religious celebrations, is completely altered today. The Lavatory House, a room adjacent to the sacristy, takes its name from the lavatory where the friars made their ablutions before the ceremonies. This was assembled on a wall with a window, for the entrance of water from the exterior.

Surrounded by covered corridors, the cloister (fig. 6d) is quadrangular in shape and located against the church's north side wall, serving as a hinge between the church and the conventual dependencies. It is the main distribution center for the surrounding spaces: chapter room, refectory, kitchen, and chapter house on the ground floor; dormitories and the library on the first floor. The cloister comprises covered galleries on the ground floor, in which pseudo three-centered arches are sustained by Tuscan columns. This element opens through seven arcades per wing. In this way, the cloister was accessed through the central arch.

The best-preserved wing of the cloister is the confessional corridor (fig. 6e). Confessionals are embedded in the wall that divides the church from the cloister. A few are accessible from the church, and the others from the cloister, strictly used by the friars.

The chapter house is adjacent to the sacristy in the east wing. In this space the community gathered to address religious or administrative matters.

The refectory, kitchen, pantry, storage, and cellars were likely located in the north wing. Indeed, traces of a fireplace and evidences of a kiln have been identified. According to Figueiredo<sup>25</sup>, the *De Profundis*<sup>26</sup> and *Escada Regral*<sup>27</sup> should be located in this wing too. Their location, nowadays hampered due to the state of conservation of the space, could be inferred by the daily habit of the friars who, after the last meal of the day, gathered in the *De Profundis* before going up to the dormitories on the first floor.

<sup>24</sup> In the conventual complexes, these stairs connected the space of the *Via Sacra* (on the ground floor) to the choir corridor (on the second floor). This way, friars could quickly go down to the sacristy.

<sup>25</sup> FIGUEIREDO, Ana Paula Valente – *Os conventos franciscanos da Real Província da Conceição*.

<sup>26</sup> This was a gathering space for the friars, close to the refectory, for the theological readings before and after the meal. This was also the place where deceased friars were veiled.

<sup>27</sup> In the conventual complexes these stairs connected the *De Profundis* (ground floor) to the dormitories (first floor).



Fig. 6 – Photographic survey: church's nave (a), lavatory house (b), sacristy (c), cloister (d), confessional corridor (e), and choir corridor (f). ©Rolando Volzone, 2021.

The first floor, accessible through the *Escada Regral* in the west wing held the dormitories. A corridor crossed the entire length, allowing distribution to the various cells, which were mostly rectangular in shape and were the smallest units of the convent.

Each friar had his own cell, providing privacy and a space to live, pray, meditate, and contemplate. The dormitory of the choir likely had this configuration, with one line of cells opening on the west wing of the cloister and the other on the exterior west façade of the convent. Counting the windows of these two façades suggests a number of 12 cells. However, this would be half of the total number of the cells, as 24 cells were built during the renovations and expansion works of the 18<sup>th</sup> century<sup>28</sup>.

On the opposite side of the *Escada Regral*, the other stairs (*Escadas das Matinas*), led to the choir corridor and to the library, located on the first floor of the east wing<sup>29</sup>.

<sup>28</sup> JOSÉ, Frei Pedro de Jesus Maria – *Chronica da Santa, e Real Provincia da Immaculada Conceição de Portugal*

<sup>29</sup> Despite the references in the document sources, the infirmary, as well as the linen room, have not been identified *in loco*.

## 4. Integrated digital survey

The survey campaign was carried out by integrating two digital survey techniques for data acquisition: Terrestrial Laser Scanner (TLS) and Terrestrial and Aerial Digital Photogrammetry (Structure from Motion – SfM). This methodology takes on essential importance for developing a framework of knowledge, in order to: i) retrace the construction process of the architectural complexes; ii) find typological analogies in terms of distribution and architecture; and iii) carry out fundamental research to conserve and enhance this important but little-known heritage. The laser scanner survey is particularly helpful for understanding the morphological and dimensional aspects of the built structure. In addition, the photogrammetric survey makes it possible to obtain an overall image, including the chromatic and material data.

### 4.1 Laser scanner survey

The laser scanner survey aims to produce a 3D model of the object under examination with reliable metric data. During the survey campaign of the convent of Santa Maria de Mosteiró in June 2021, the survey operation was conducted through a Faro Focus M70 terrestrial laser scanner, a Lidar (*Light Detection and Ranging*) instrument. Its compactness and portability made it possible to proceed quickly and to carry out the operations even when the surveyed architectural structures were in a state of disrepair. This instrument is also equipped with an HDR camera: in this way, a highly descriptive point cloud in color was obtained. From this was possible to elaborate bi-dimensional drawings compatible with traditional representation techniques for floor plans, elevations, and sections.

A total of 142 scans were made during the survey campaign. Their positions were planned according to the architecture's morphology, in order to ensure complete documentation and the closure of a fundamental polygonal that would tie the architectural complex to its surroundings. The laser scanner survey operations mainly concerned the exterior of the complex, the church, and the cloister, which were the only ones in a good state of preservation. The remaining areas in ruinous state were therefore inaccessible. The scans were carried out sequentially, in order to obtain the most complete and accurate documentation. This working method allowed us to obtain a large amount of data quickly. The data were then processed using point cloud processing software (*Autodesk Recap*), by which the individual scans are aligned to get a general point cloud (fig. 7). Control and verification operations are carried out on the point cloud registration to ensure adequate data reliability by evaluating the maximum alignment errors.



Fig. 7 – Ground floor plan with the position of the scans made with Faro Focus M70 (top). Three-dimensional visualization of the point cloud: exterior view of the convent (middle) and inside view of the church (bottom). ©Roberta Ferretti, 2021.

## 4.2 Photogrammetric survey

In concert with the laser scanner survey campaigns, we conducted terrestrial and aerial photogrammetric analysis. The acquisition campaign was organized on different scales of detail: from general to particular. Firstly, the general scale was documented in order to obtain the morphology of the built structure. Secondly, documentation of the individual decorative elements was carried out. The data acquisition took place by collecting a series of specific images, consecutive and reasonably overlapped. After the acquisition phase, the images were processed through a specific photo-modeling software (*Agisoft Metashape*) to obtain a three-dimensional photogrammetric model and export orthographic images with textures in high-definition. The capture of chromatic and material data made it possible to carry out significant analyses regarding the state of conservation of the architectural complex. In this case, aerial photogrammetry was important for acquiring data on areas for which this would not have been possible through terrestrial means alone, such as the entire roof covering, and for reaching inaccessible areas. Each photographic set was designed in relation to the object to be documented, taking into account its morphological characteristics and the light conditions present at the moment of the shot. It was therefore necessary during the fieldwork to evaluate the environmental conditions and to calibrate the camera parameters properly.

As in the other Portuguese case studies, a UAV (*Unmanned Aerial Vehicle*) equipped with an integrated camera – in this case a DJI Mavic Mini drone – was used for the aerial photogrammetric operations carried out in Santa Maria de Mosteiró. Due to the position and the characteristics of the conventual complex, this equipment was chosen for being the lightest and easiest to handle.

To generate a three-dimensional photogrammetric model, the necessary set of images consists of different inclined photographic acquisitions at a constant or variable height, depending on the camera's performance, the object's morphology, the light condition, and the desired level of detail. As in the case of terrestrial photogrammetry, it is necessary to capture shots that completely cover the object's surface with an adequate overlap between successive images. Considering these acquisition requirements, planning the flights for photogrammetric acquisition is fundamental for a successful survey.

In this case, 247 photographs by drone were collected during two flights lasting 20 minutes each. In accordance with the acquisition requirements, the photographs were shot with different inclinations following a steady path (fig. 8). The high number of pictures taken ensured an adequate overlap between the images, resulting in a rigorous final result.



Fig. 8 – Photogrammetric survey of the convent carried out by UAV, with the indication of the acquisition points. ©Roberta Ferretti, 2021.

The first phase of development of the photogrammetric model involves the alignment of the photographs, which, in the case of aerial survey, takes place through GPS coordinates. From this process, a sparse point cloud is obtained. Through further algorithms it is given density and then meshed, creating a surface. The texture taken from the photographic data is finally applied to the mesh model, thus producing a three-dimensional mapped model (fig. 9).

The model obtained is subject to surface noise or gaps due to lighting conditions, the presence of vegetation, or reflecting surfaces, as well as to the conditions of preservation of the building itself, which in some cases made it difficult to carry out survey operations.

Regarding the terrestrial photogrammetry, general and detailed were carried out in order to obtain complete documentation of the architectural complex and its decorative apparatus. In this case too, it was necessary to capture the images in sequence to ensure that each element of the object is taken from at least three points of view, and the overlap between two successive shots had to be at least 1/3. Following

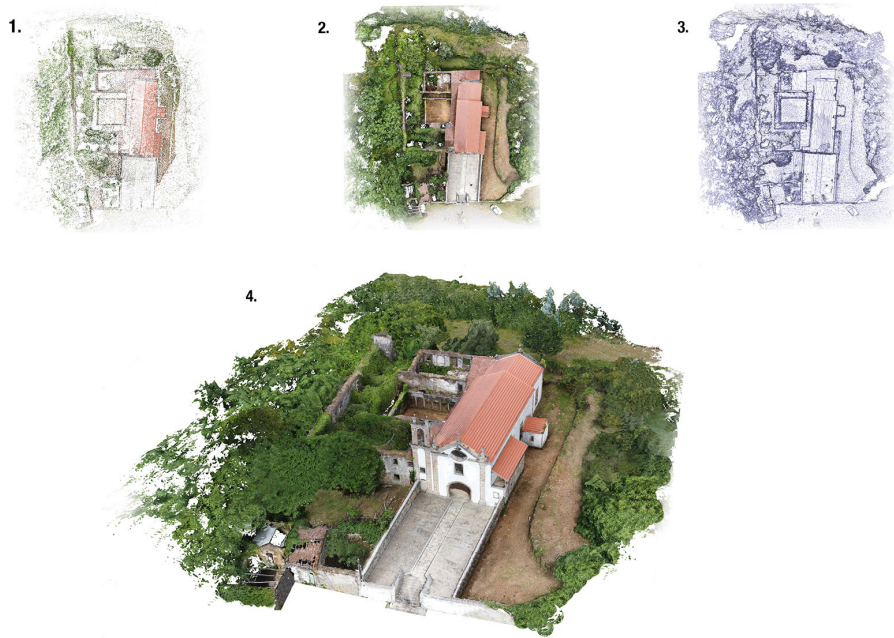


Fig. 9 – Photogrammetric model processing steps: 1. Sparse point cloud; 2. Dense point cloud; 3. Mesh; 4. Texture. ©Roberta Ferretti, 2021.

the elaboration process, it was possible to obtain very detailed three-dimensional textured models of the individual decorative elements and of the surfaces of the architectural artifacts.

The most important decorative piece in the church is the carved wood *retábulo* – an ornamental panel behind the altar. For the documentation of the altar, it was necessary to use both terrestrial and aerial photogrammetry. Using a Nikon D610 camera with a 12-24mm lens, 151 photographs were taken, divided into several sets. Due to light conditions and the complexity of the object in terms of morphology and materials, it was necessary to use a tripod to stabilize the camera and increase the shutter speed. Thanks to this first acquisition, a documentation of the lower part was obtained. However, the photogrammetric model revealed some gaps. For this reason, in order to fill these gaps and to obtain a rigorous documentation, 116 additional photographs were captured by drone. The integration of terrestrial and aerial pictures made it possible to obtain a complete photogrammetric model and to reduce the gaps in the upper part of the *retábulo* (fig. 10).



Fig. 10 – Orthographic images exported from the photogrammetric model of the retabulo: reflex acquisition (left), drone and reflex acquisition (right). ©Roberta Ferretti, 2021.

## 5. The importance of the digital surveys in the study of Franciscan Observance convents

The integration of different techniques in the digital survey of cultural heritage made it possible for us to produce digital documentation of the current state of conservation of the built structures.

The photogrammetric model, obtained by processing close-range and aerial images, combined with the data from the laser scanner survey campaign, made it possible to overcome the weaknesses of each technique in constructing a rigorous 3D model. Indeed, the parts missing in one cloud are perfectly collected by the second one.

The final point cloud can be used to extract multiple graphic elaborations helpful for analyzing both the architectural complex and the surrounding environment.

The production of 2D digital documentation, including technical drawings at different scales, such as plans, elevations, and section, together with the production of 3D models, constitute a novel resource and a support tool for various activities of: i) research; ii) conservation; and iii) dissemination of this religious heritage.



Regarding the 2D documentation, these graphic outputs can be produced in a wireframe version or as orthomosaics, with important data about the material component.

These contribute, firstly, to the scientific knowledge of the analyzed case studies, in some cases remedying the lack of technical drawing in the historical documentation. Research about the typological and architectural characteristics of the primitive nucleus, even if the building has been deeply altered, can be carried out. For example, a comparison of the morphological characteristics of the different convents belonging to the same mendicant orders, at regional, national, and international levels – among Italy, Portugal and Spain – can be developed. This could reveal important data, in order to understand the architectural model at the basis of the Franciscan Observance in Southern Europe. Moreover, analysis of the building stratigraphies is lacking, as already noted by Amonaci<sup>30</sup>. Secondly, the drawings with data from the SfM technique can result in a support tool for the conservation, protection, enhancement, restoration, and new uses of the religious heritage sites. Thirdly, these can be introduced into inventory assets, in order to disseminate this knowledge among a broader audience.

For their part, 3D models contribute, firstly, to research activities through reverse design or digital reconstruction: starting from current evidence, it is possible to retrace the building's diachronic evolution and arrive at a virtual reconstruction. Secondly, the models can help in the monitoring and management of the buildings. Finally, they can be the basis for the development of virtual visualization and real-time navigation – e.g. through virtual reality (VR), augmented reality (AR), and mixed reality (MR). Moreover, Geographic Information System (GIS) maps can be designed and made accessible online via websites or smartphone apps. GIS maps can provide a complete experience that will encourage virtual or physical visitors. Indeed, the close link with their territory is a characteristic common to many settlements of Franciscan Observance that often makes them critical strategic points for the development of tourist routes and hiking trails – projects that contribute to the rediscovery of these places rich in history and culture<sup>31</sup>.

This methodology of integrated and multidisciplinary investigation therefore allows the creation of a specific digital database for knowledge and enhancement of the conventual sites, providing an adequate representation of their complexity.

<sup>30</sup> AMONACI, Anna Maria – *Conventi Toscani dell'Osservanza Franciscana*. Milano: Silvana Editoriale, 1997.

<sup>31</sup> BERTOCCI, Stefano – “Paesaggi francescani: la regola dell'Osservanza tra Italia, Portogallo e Spagna” In BERTOCCI, S.; PARRINELLO, S. (eds.) – *Architettura eremitica – Sistemi progettuali e paesaggi culturali. Atti del Quinto Convegno Internazionale di Studi. Certosa del Galluzzo*. Firenze: Edifir, 2020, pp. 302-307.

## 6. Conclusions

The methodology applied to the analysis of the case study combines traditional and innovative techniques – historical research and 3D surveys – in order to assess the mendicant network from Portugal through Spain and Italy. We are producing an atlas of documentation and knowledge for the conservation, protection, and promotion of this often-neglected religious heritage.

Today, especially in Portugal, many of the conventual complexes have lost their original function or are abandoned. For this reason, together with historical and archival research, we have carried out digital survey campaigns on three case studies paradigmatic of the first Franciscan Observance settlements in Portugal: Santa Maria de Mosteiró, São Francisco de Viana and Santa Maria da Ínsua.

After the dissolution of the religious orders, the convent of Santa Maria de Mosteiró lost its function. While the church maintained its functions with the arrival of the Confraria de Nossa Senhora de Mosteiró and has since been conserved in use, the conventual dependencies are in an increasing state of degradation, with exception of the cloister wing adjacent to the church.

This study, integrated into a broader project on the Franciscan Observance in Portugal, Spain, and Italy, represents an initial step for the valorization of the conventual network and stimulation for awareness on the part of local communities, public administrations, private owners, and other stakeholders. Awareness of the convents is often lacking due to their being mostly inaccessible because of private ownership or difficulty of physical access to the isolated places.

Future studies will focus on the comparison of these convents from the local to the European level. Once the historical analysis, architectural study, and 3D surveys of the other two convents of the same region and chronology are completed, comparative analysis could be particularly fruitful for the historical reconstruction of the missing physical parts.

“The search for the wilderness as a space and possibility of a more radical religious experience accompanies and marks the development of Western culture, with multiple declinations, from voluntary seclusion or eremitical life to solitary life in more communitarian forms. The search for solitude and eremitism remained and marked the main moments of crisis and renewal in the Western world throughout the Middle Ages and the Early Modernity. All these experiences influenced and accompanied both the development of the city and the peri-urban landscape, with a particular importance in the transformation of territorially more isolated or peripheral areas. At the same time, the seek for solitude and seclusion, either through monastic or hermitic experiences, also flourished in other cultures and religious traditions, from Buddhism to Islam, giving interesting perspectives on the understanding of such religious phenomena in larger terms”.

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