REUNION WITH THE LOST MONASTERY.
VIRTUAL TOUR TO THE MONASTERY OF MADRE DE DEUS

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INTRODUCTION

The use of digital platforms by cultural institutions will continue to grow over time, creating new ways of disseminating knowledge about heritage assets. This dissertation focuses on one of these ways – a virtual tour to the past – exploring the educational potential of juxtaposing past and present. This study searches for the capacity of new technologies to create a dynamic, interactive, and informative virtual tour of the 16th century Madre de Deus Monastery, currently known as the National Tile Museum. The monastery was founded by Queen D. Leonor in 1509 and its history was marked by several changes of function and expansions over time.

The dissertation is based on work developed in the curricular unit of Information Modelling of Historic Buildings (MIEH, taught in the 5th year of the Integrated master's in architecture, at Instituto Superior Técnico), where a study was carried out on the foundational core of the 16th century Monastery of Madre de Deus, through the creation of BIM models. In this investigation, there are several hypotheses about the same space, all of them duly based on different historical sources and analysed with the help of experts. It is based on these works that a virtual tour is created, joining all the elements done in the Autodesk Revit tool by the students, and then exporting them to the Shapespark tool. So, a visit that takes place in the current National Tile Museum was developed with the particularity that, in certain rooms, the visitor is transported to the same space, but in the 16th century, acquiring or deepening knowledge about the monastery and its history.

1. DIGITAL HERITAGE

Digital heritage is a broad and rapidly developing field which consists in the use of new media in service of cultural heritage. The purpose of digital heritage in the context of this dissertation is to recreate or reconstruct ancient artefacts using 3D modelling, allowing their visualisation through digital representation. This happens without forgetting the importance of sharing an artefact's cultural meaning and not only a reproduction of shape (Champion, 2008). Digital heritage must acquire information about objects and their cultural meanings, transmitting them in an accurate and faithful way, in formats accessible to all and in order to promote learning.

Within the scope of digital heritage, we find virtual reconstruction. Virtual reconstruction is defined as a digital process that uses a virtual model to visualise a building or object produced by human action. This visualisation takes place at a certain point in the past, based on studies carried out by several experts such as archaeology, architecture and history, supported on physical data of the object under analysis and its comparison with similar objects. (Principles of Seville, 2017). An

advantage of the virtual reconstruction is the possibility to move within the model as we want and the freedom to observe from different points of view.

For virtual reconstructions, 3D models can be generated in two different ways. Through the current existing condition of the building, through digital techniques such as photogrammetry, laser scanning, lidar, closer range scanning, mobile mapping (Antonopoulou et al, 2017), or the models can also be created according to information gathered from historical drawings (Guidi and Russo, 2011). It is also possible to combine these two forms, using various methods to obtain more complete and more accurate information of the past and present. This combination of methods was used in the reconstruction in the case of the Monastery of Madre de Deus, using point clouds as basis for modelling, but adding information and details through the knowledge acquired from historical texts and from discussions with experts.

Given this, it is concluded that virtual reconstruction is a component of the digital heritage. Reconstruction is the digital process that deals with the 3D model of the artefact under study, with all its visualisation and with all the research necessary to reach different conclusions or different hypotheses. All this, then, converges in digital heritage which, based on the visualisation of the model, adds the informative and explanatory part and introduces its cultural meaning.

New technologies are now part of many industries, forcing design processes to quickly adapt. In the context of architecture, initially projects were based on paper drawings. In the second half of the 20th century, these drawings were moved to the computer, through the CAD (Computer Aided Design) system. This new system brought greater rigor to designed objects, however, CAD software is limited to generating drawings on the computer, instead of on paper. Furthermore, CAD software is limited in terms of its capacity to store information about digital objects and to facilitate the management of construction projects through numerous stages of development.

The evolution from CAD to BIM is thus not an upgrade of the CAD system, it is a complete change in the AECO (Architecture, Engineering, Construction and Operations) industry (Antonopoulou et al, 2017). In recent years, the limitations of CAD for emerging demands in these industries have been overcome with BIM (Building Information Modelling). BIM is a set of technologies, processes and policies that allow collaborative work between the different project stakeholders, throughout all phases of the life cycle of a building (design, construction and operation) (BIM Dictionary, 2021).

Due to its growing evolution and usefulness, BIM methodologies can also be used to create reliable models of heritage assets. This is possible due to the fact that, in addition to BIM using geometric data, it also allows the integration of non-material information, such as cultural, historical, architectural values, in spaces or elements of the model, allowing their organisation in a spatial hierarchy. In other words, it consists of non-geometric information associated with geometric information (Antonopoulou et al, 2017).

The use of BIM in heritage assets generated the creation of HBIM as a new field within this methodology. HBIM (HistoricBIM), in its original definition, is a methodology that uses interactive parametric objects to represent architectural elements according to historical data and point cloud

surveys or image-based surveys (Murphy, 2009). Historical information introduces new data into the model, allowing a greater understanding of its construction methods and materials (Sgarbi and Rafeiro, 2022).

2. DIGITAL HUMANITIES, PARADATA AND DISSEMINATION

New technologies enable the development of alternatives for the preservation of cultural heritage, through new digital media. In architecture, this is possible because the reconstruction and creation of databases of historic buildings are based on computational modelling processes which have a variety of visualisation outputs. This form of digital media offers new ways of representing and disseminating cultural heritage.

Historical reconstruction is a process that contains many uncertainties and contradictions and with digital media technology it is possible to work with several databases that can be stored separately but linked together. Digital processes can support large amounts of information and be made easily accessible, something that is physical objects are limited by. These contradictions also allow the existence of different interpretations, which can be analysed and studied by the students for a better understanding of the building and its preservation process (Champion, 2008). The so-called term, “new heritage” refers to the way in which the end user of the digital heritage is influenced by the evolution of technology, that is, how the new media are applied to the digital heritage and how they help to better understand and experience the tangible and intangible cultural heritage (Champion, 2018). New media is an expression used to refer to the various types of electronic communication, as a result of innovation in computer technology (Techopedia, 2022).

On the other hand, Digital Humanities is another important concept following the previous one. This one focuses on the development of digital tools and the creation of files and databases for texts, works of art, among others. With the digital evolution, computers provide new ways to manipulate and research the digitised culture, allowing a new way of communicating (Berry, 2019). For Champion (2015, p.5) the digital humanities reflect on how computing can be incorporated into the humanities, seeking to understand how they must change, implying an exchange of academic and technological knowledge. The digital humanities signal a movement beyond writing, highlighting graphic methods for knowledge creation and formation, admitting design as a complementary part of the research. These are based on the exchange of information, there must be a collaboration between the academic and technological environment for a better result, and not one depending on the other. The digital humanities and cultural heritage sector must work collaboratively to create better content, both in terms of digitization, documentation, dating and curation, as well as in the development of research networks that integrate both areas (Ross, 2018).

Another fundamental theme for the understanding of any object is paradata. These, according to the London Charter (2009) consist of information about human methods focused on

understanding and analysing data. In a database, the paradata should include clarification on the use of different interpretations of an artefact or data to analyse the ideas of a scientific publication. The paradata create tools that demonstrate the research guideline, the cultural assumptions and reasoning behind each element, i.e., describe the decision process, making their choices and their understanding transparent to the public. It can be related to metadata, but metadata is limited to communicating the interpretations of an object and not the interpretive process.
Paradata, within the scope of heritage visualisation is very interesting for researchers, curators, teachers and even for the general public, as it enhances the understanding about an artefact under study (Bentkowska-Kafel, Dernard and Baker, 2012). In this way, through the sharing of paradata with the public, cultural heritage is easily disseminated, creating a close relationship between the object and the visitor. Through paradata, the visitor is able to have a broad and justified knowledge of all decisions related to the object.

The public's interaction with virtual heritage is enhanced by the wide dissemination that is possible through digital infrastructures, which offer new techniques to disseminate information in an attractive and stimulating way for society. The digital condition is created by processes that use digital infrastructures, with the aim of giving shape to the way we see the world and our action in it. Cultural institutions must rethink their way of communicating with the introduction of new digital infrastructures and with the development of information and advertising, making it now possible to see, think and share, allowing the public to share and transform it, giving their own vision, in order to catch more visitors and public’s attention (Stalder, 2021).
Nowadays, both museums and libraries are looking for ways to reinvent themselves through their inclusion in digital technologies, disseminating their collections to the general public. With these new technologies the knowledge of the past can be acquired in many ways. Of particular relevance for linkages between the field of architecture and cultural institutions like museums are 3D modelling technologies. By creating applications that allow the active participation of users, the creation of a 3D environment gives the illusion that we are, in fact, on site while also hybridizing our experiences of what exists with other types of knowledge.

3. DIGITAL STORIES, CLARISSAS, INTANGIBLE HERITAGE AND DIGITAL MUSEUMS

In the past, the experiences lived by the population were passed on through storytellers. But the art of storytelling is increasingly distant from today. Stories can have a moral purpose, practical advice, can be in the form of proverbs or maxims. Usually, the storyteller tells an experience of his own or described by another, with the intention of making it of the reader, through the experience of the narrative. Therefore, narration must guarantee the listener's enthusiasm and interest in the story, in order to perpetuate it in their memory and not only on paper. This understanding of the story allows it to be retold, filling in its gaps with its own interpretation. Thus, each verbal repetition of the story acquires new layers, given by each narrator, something that does not happen when we read a book (Pybus, 2018).

The history of the Monastery of Madre de Deus is no exception. It has been under constant investigation as early as the 17th century nuns who attempted to recall its history (Sacramento 1639). Perhaps because a conclusion has not yet been reached about its original configuration, it has remained a topic of debate across several generations. It consists of a narrative in which there are different views and options and, perhaps, this will be a way of reaching the public's attention for its dissemination: the continuous attempt to reach a final solution.

To better understand the history of the Madre de Deus Monastery, it is necessary to briefly introduce the history of the Poor Clares, how Saint Claire, its founder, manages to create her own rule and how the values of this tradition are reflected in the Monastery of Madre de Deus.
Beginning in 1211, the Order of Poor Clares emerged when Clara, at the age of 18, after meeting St. Francis of Assis and his way of life based on extreme poverty and service to others, decided to follow his religious vocation. Claira, who belonged to a noble family, ran away from the family, who had prepared a marriage for her. The purpose of this was to find St. Francis, so that he would help her to dedicate her life to Christ, since Claire aspired to a life of total evangelical poverty. She went through several monasteries and rules, but none corresponded to her goals. So, she wrote a letter with her own rule, which ends up being approved on August 9, 1253, by Pope Innocent IV (Franciscans Conventuals, nd).

These kinds of stories help to better understand a place or monument and have been added to cultural heritage as it changes over the years, giving importance to the conservation of intangible themes, not only tangible ones. The theme of heritage began as a discussion in the Athens' Charter of 1931. This document presents general principles and doctrines regarding the conservation of monuments, with the aim of underlining the need to create international restoration organisations. From the 1950s onwards, there was a rise in international documents, where the basic concepts of heritage conservation were expanded (Vecco, 2010). Later, in 1970, documents began to define general criteria covering tangible and intangible expressions of human action (Vecco, 2010). It's at this point that the value of heritage is recognized, in addition to the physical fabric and form, it also consists of its immaterial dimension - in constant evolution. It recognizes the importance of the memory of places, associated with their traditions, which aims to ensure that the messages inherent to the traditions are transmitted to the younger generations (Araoz, 2011).
In the case of the Madre de Deus Monastery, the stories about D. Leonor, Saint Auta and Cassandra are part of the monastery's intangible heritage, as they help to understand what once happened and show the important role they played as female figures of that time.

The act of storytelling now finds in the digital a new form of expression. An example of this is the way in which museums currently use these new information technologies to communicate their own narratives. Museums have been able to take advantage of new media in a transparent way

in their exhibition spaces, making them invisible from the participant's view due to their constant use (Parry, 2011).

New media transform the ethics of museums into questions about the responsibility and durability of public knowledge, which exists in a different way than the physical. Museums are highly dependent on the public and their receptivity to the information provided. Each museum must have its ethics, according to its function and particular situation, and it must be in constant discussion (Marstine, Bauer and Haines, 2013).

4. THE MONASTERY AND THE MUSEUM

The history of the Madre de Deus Monastery begins in 1508, when Queen D. Leonor – wife of D. João II – spent a season in Xabregas. It was there that she decided to build a monastery, on land belonging to the widow of D. Álvaro da Cunha, where initially existed few houses and vegetable gardens. From these pre-existing houses, the chapel of Queen D. Leonor or Arab room is one remaining (Lx Conventos, 2018). The monastery, founded in 1509 by D. Leonor, suffered several renovations and expansions until what we can find today, the Museu Nacional do Azulejo (MNAz), founded in 1965 and became autonomous in 1980 (Lx Conventos, 2018).

It was based on this monastery that, in the class of Historic Building Information Modelling (HBIM, 5th year, 1st semester 2021-2022, Integrated Master's in Architecture, IST) students were challenged to model hypotheses focused on the reconstruction of the foundational core of the Monastery of Madre de Deus, the 16th century. These works were carried out based on a laser scanning survey of the current building, with the support of multiple references, most of them kindly provided by the MNAz, and also with the help of specialists in Art History.

The students were distributed among the following digital reconstruction projects – which were defined according to the extension and/or research complexity involved:

1 Arab Room (Roque and Salvador, 2022);
2 Primitive church – hypothesis 1 (Fabião, Guia, Alves and Aparício, 2022);
3 Primitive church – hypothesis 2 (Santana, Rodrigues and Almeida, 2022);
4 Lower choir – volume (Krzywdzińska, 2022);
5 Lower choir – internal key elements (Gallais, 2022);
6 3D Chronology – 16th century phase (Primitive Church – hypothesis 3) (Mendonza, 2022);
7 3D Chronology – 17th century phase (Friebel, 2022);
8 Nepomuceno 3D (Cruz, 2022);
9 As-Found (Cordeiro, Braz, Pereira, Silva, Nazário, Camilo and Vasco, 2022).

Projects 1 to 6 essentially focused on exploring the possibilities of rebuilding the 16th century foundational core. In the current building, these spaces correspond to the Arab Room or D. Leonor Chapel, D. Manuel Room, Low Choir and Claustrim, the latter already modelled (IPTI, 2021) following previous scientific collaboration with the MNAz. Projects 6 and 7 made more global approaches, seeking to describe, in volumetric terms, the constructive evolutions of the building

in the 16th and 17th centuries. Project 8 focused on the 3D interpretation of the architect José Maria Nepomuceno's project, which, following the extinction of religious orders in Portugal in 1834, it was possible to convert the former monastery into Casa Pia asylum. Project 9 aimed to model the building in its current state, an important basis for the reconstruction of the past.

In figure 1, we find a plan of the MNAz with the identification of the monastery's foundational nucleus, in red, and the convent's boundary in the 17th century.

Fig. 1 – Plan with the limits of the foundational core (red) and the limits of the monastery in the 17th century (orange).

This work consisted of a study of how certain spaces of the MNAz were found, in its initial period, the 16th century. So, through the interpretation of different hypotheses and various historical documents and conversations with experts, it was possible to arrive to various hypotheses that are used in this dissertation. The aim is sharing them with the public, creating the possibility of knowing a part of the museum that, until now, wasn't shared.

Thus, there was a need to create a virtual tour to the Monastery of Madre de Deus. Taking advantage of these works developed by the students, a virtual tour to the past was developed. The tour consists of a promenade through the current MNAz (having as a starting point the virtual reconstruction project "As Found"), in which, in each division, the visitor is transported to the respective space, but in the initial phase of the Monastery of Madre de Deus.

For the virtual tour, all projects were developed in Autodesk Revit software, modelling all spaces, from the building in its current state to the different hypotheses of the 16th century monastery. It was possible to rebuild the building and give it materiality, making it as real as possible. After all the projects were completed, they were gathered in a single file and this was exported to a virtual tour software, namely Shapespark, for dissemination.

Shapesspark is a tool that transforms 3D elements into dynamic environments. Here, it's possible to walk in a space and walk in it freely, as if it were an actual space. Shapespark allows the import of the model multiple times, maintaining its previous data, like views and some definitions already settled, allowing for the model and the visit to evolve at the same time according to the introduction or alterations of research data as well as according to the user experience of the tour.

But it also has some limitations, like the fact that it's not possible to travel between different models: the model of the Monastery of Madre de Deus and the different models of the 16th century. So, because of that, it was necessary to join all the models in one single Revit file, to then export it to Shapespark.

In this way, the projects were organised in a functional way to make a better and smoother transition between spaces. The projects were organised in three levels, with two visual barriers – vertical and horizontal (as shown in Figure 2), with the objective of hiding the models of 16th and 17th century. The tour starts in the actual museum and then, in each space, the visitors dive to that same space but in the 16th century version (the models under the horizontal barrier) and to the 17th century version (model after the vertical barrier).

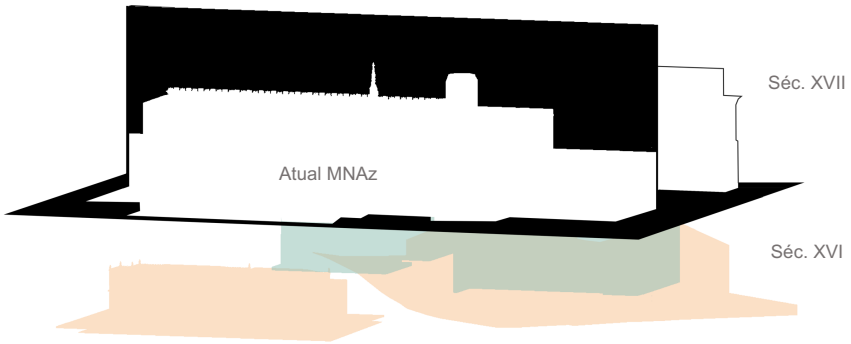

Figure 2 – Scheme of organisation, in 3 levels: 2 virtual barriers (black plans) and the models of 16th and 17th century. 1st level: White; 2nd level: green; 3rd level: orange

The visit can be done in an autonomous way, or the visitor can follow the guide on the menu in the right superior corner, precisely identified (Figure 3). But the only way to access the past is by selecting the respective options on the menu.

Figure 3 – Shapespark – Menu that allows to navigate in the models following a specific order.

Beyond the special experience, the visit has a lot of information about the spaces and their history, ensuring that the visitors get some knowledge about the building and its living. All the information in the visit is very well funded, having as basis historical documents and some discussions with specialists to a better understanding of the spaces. This visit shows the entire process students went through until reaching the final models, transmitting to the public its entire research with total data transparency. The purpose of this visit is to show the visitor the various hypotheses created and how they are based, allowing them to create their own hypothesis, as they have all the necessary information to question or agree with the work carried out.

In this way, the information is divided in two types of icons. A bigger pink sphere with an “i”, which is in every entrance space and has more general information about the room; and a blue sphere with an eye, that can be seen in specific elements and has more detailed information.

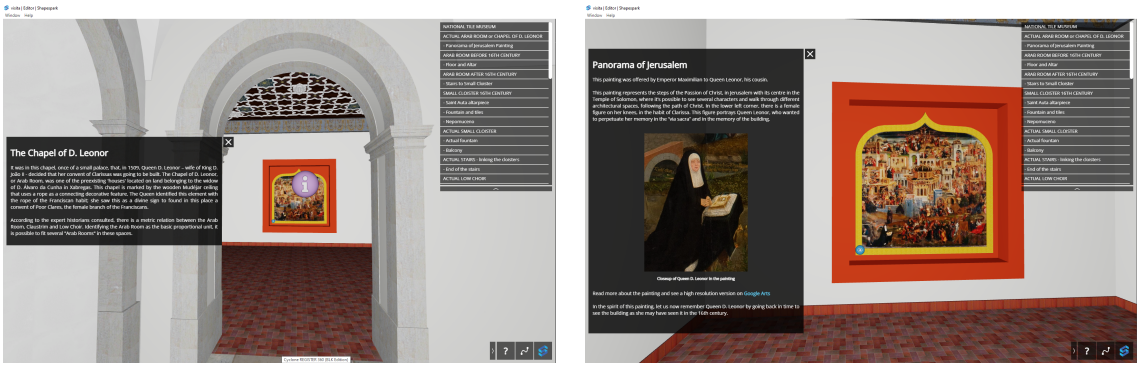

Figure 4 – Example of the icon with the general information (left) and the detailed information (right) Shapespark.

Therefore, the visit can be made in a more general way or, if there is interest in getting to know the site better, there is more detailed information. Some of this information takes us to sites that go deeper into the topic in question, which allows a greater enrichment of the visitor.

The Virtual Visit to the Monastery of Madre de Deus can be accessed and experienced through the link: https://ipti.pt/virtual-visit-to-the-monastery-of-madre-de-deus/

CONCLUSION

Virtual tours are increasingly evolving with the development of digital infrastructures, which are today a very important way of communication and dissemination. This dissertation aimed to understand how virtual tours can help educate and experience the past. The study revealed the importance of giving visitors all the information regarding the building and its history, as it allows new perspectives and new way of sharing it on digital platforms, stimulating the curiosity of more people.

From the research and analysis carried out, it’s understood that this virtual tour corresponds to a virtual reconstruction that will help to create digital heritage. For the creation of the model there was a need to find the best method that would combine the 3D models with the information related to them. Due to the growing evolution of the BIM methodology, its study was important, as it allows the integration of information and physical objects, providing a general understanding

within the same platform, corresponding to the intended purpose. Within BIM, this theme focuses on HBIM, a field dedicated to heritage assets, which proved to be quite important in this case, as it allows the investigation of historic buildings, integrating the 3D model, construction methods, materiality and even historical investigations.

The study of these methods revealed that the users' experience grew with the development of new technologies. These have created a new way of preserving cultural heritage and, with the use of new media, it is possible to disseminate all the information to the public. Thanks to these new methods of creating knowledge, museums have been increasingly joining new technologies as a way of disseminating content, promoting various experiences and sensations to the visitor through created visits, adapting themselves to new social concepts, without forgetting its social responsibility and ensuring the veracity of its contents.

The study referring to the Monastery of Madre de Deus, currently the Museu Nacional do Azulejo (National Tile Museum), had as reference all the factors mentioned above. Based on the historical analysis of the building, such as expansions, uses and experiences, a virtual tour was initiated. This visit goes beyond what currently exists, it doesn't try to replace a physical visit, but to complement it, transforming the visitor's view of a museum that was once a cloistered monastery. The visit is an element that aims to make people aware of possible interpretations of the spaces, giving them the opportunity to see the process that has taken place. This way of communicating allows the visitor to be an integral part of the visit, being able to have their own opinion. So, it isn't a closed topic, there's always things to develop.

By integrating this virtual tour with the visit of the National Tile Museum, we are raising awareness among visitors who, in addition to visiting a space full of tiles from Portuguese history, are in front of a building with a lot of historical value, which once had other uses.

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