The Jerónimos Monastery (Lisbon, Portugal) and the Venice Charter: conservation and restoration challenges of a UNESCO World Heritage monument over the past 25 years

O Mosteiro dos Jerónimos (Lisboa, Portugal) e a Carta de Veneza: desafios de conservação e restauro nos últimos 25 anos de um monumento inscrito na lista de Património Mundial da UNESCO

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Abstract

As sixty years have passed since the drafting of the Venice Charter (1964), this study aims to assess the importance of the principles outlined in the document using the Jerónimos Monastery (Lisbon, Portugal), a UNESCO World Heritage Site (1983), as a case study. The focus is on the two major conservation and restoration interventions carried out on the monument since 1983, centred on the Cloister (1998-2002) and the Church vaults (2012-2026), which have been presented as examples of excellence in both methodological and technical terms at both national and international levels. The analysis is based on the documentation, some unpublished, produced on the works; as well as on in situ observation and dialogue with the conservators and restorers. The aim is to provoke a reflection on current trends in monument intervention, grounded in an integrated and sustainable perspective of managing a UNESCO-listed monument, where interdisciplinary dialogue is prioritised.

KEYWORDS
Jerónimos Monastery
Venice Charter
Late gothic architecture
Conservation and restoration projects
Maintenance

Resumo

Sessenta anos depois da redação da Carta de Veneza (1964), este estudo tem como objetivo avaliar a relevância dos princípios nela consagrados, tomando como caso de estudo o Mosteiro dos Jerónimos (Lisboa, Portugal), monumento inscrito na lista de Património da UNESCO desde 1983. O foco incide nas duas principais intervenções de conservação e restauro realizadas no monumento desde 1983, centradas no Claustro (1998-2002) e nas abóbadas da Igreja (2012-2026), que têm sido apresentadas como exemplos de excelência, tanto do ponto de vista metodológico, como técnico, a nível nacional e internacional. A análise baseia-se na documentação produzida no âmbito das intervenções, parcialmente inédita, na observação *in situ* e no diálogo estabelecido com os conservadores-restauradores envolvidos. Pretende-se, assim, promover uma reflexão sobre as tendências atuais de intervenção em monumentos, assente numa perspetiva integrada e sustentável da gestão de um bem distinguido pela UNESCO, na qual se privilegia o diálogo interdisciplinar.

PALAVRAS-CHAVE
Mosteiro dos Jerónimos
Carta de Veneza
Arquitetura tardo-gótica
Projetos de conservação e restauro
Manutenção

Introduction

The Jerónimos Monastery, whose construction began around 1501 under the patronage of King Manuel I of Portugal (1469-1521), is regarded as one of the most significant examples of sixteenth century Portuguese architecture. Its construction was financed through dividends derived from maritime expansion. The monastery's architectural and decorative features, which incorporate distinctive late Gothic elements, contributed to its recognition in the nineteenth century as a unique and national architectural style, subsequently named "Manueline" in honour of its founding monarch [1, pp. 52-53] (Figure 1).

Over the more than 500 years of its existence, the Jerónimos Monastery has been shaped through multiple construction phases that initially extended into the mid-sixteenth century, adapting to evolving challenges. Notably, from 1833 onwards, the monastery was affected by the dissolution of the religious orders, leading to the evacuation of the monks of the Order of Saint Jerome and the subsequent repurposing of the site to house the Casa Pia de Lisboa orphanage institution. Throughout its history, the monastery has undergone numerous modifications, additions, reconstructions, and alterations to its utilitarian and artistic features. Additionally, its surrounding environment has evolved in tandem with the development of the Belém area [2, pp. 200-208].

In this case study, we will not focus on the architectural evolution of the building itself over its five-century history, as this subject has been extensively addressed by numerous authors [3-7]. Instead, in the context of the Venice Charter's 60th anniversary - the International Charter for the Conservation and Restoration of Monuments and Sites - the objective is to examine the influence of its principles on the various interventions carried out at the Jerónimos Monastery since its inscription on the World Heritage List in 1983. Simultaneously, the aim is to assess the relevance and contemporary validity of the contents of this foundational document of the International Council on Monuments and Sites (ICOMOS) in the twenty first century, in terms of the conservation and restoration of the monument under study. This assessment is framed by current trends in monument interventions, aspects that have yet to be thoroughly examined and reflected upon.

Figure 1. South façade of the monastery, 2013 (photo: A. Serralheiro).

The focus will be on the two most significant intervention campaigns carried out on the monument, documented since 1964: the *Cloister Conservation Intervention* (1998-2002) [8] and the *Conservation and Restoration Plan for the Church Vaults* (2012-2026). The former, characterised by an aesthetic dimension and a more conspicuous visual impact; and the latter, with a subtler effect – partly due to its location away from the main vantage points frequented by visitors – yet of considerable importance for the stabilisation of the vaults and their preservation.

To this end, multiple site visits were conducted, including ascending the scaffolding during ongoing works, analysing documentation produced within the scope of these interventions (such as proposals, reports, drawings, and photographs), and engaging in discussions with the conservators-restorers to clarify certain aspects and deepen understanding.

Before and after the Venice Charter (1964): criteria for intervention in the monument

With an increasing concern and interest in the preservation of national monuments, Portugal ratified the Venice Charter, with architect Luís Benavente (1902–1993) serving on the drafting committee [9, pp. 229-300]. The interventions in national monuments, coordinated since 1929 by the Directorate-General for National Building and Monuments (DGEMN), an entity overseen by the Ministry of Public Works, would, from that point onwards, follow the principles of the Venice document, reflecting the monitoring of the international policies in conservation and restoration of monuments, which has been applied in Portugal since the 1950s. Prior to this, practices were predominantly empirical, with limited theoretical debate among DGEMN technicians regarding monument intervention principles [9]. The approach was characterised by efforts to restore monuments to their original form, often involving hypothetical reconstructions and the removal of architectural and decorative elements (such as tiles, carvings, and stucco), originating from different periods.

The overwhelming effects of the intense and devastating bombings that ravaged Europe during the World War II, and which Portugal was spared, prompted a national debate regarding the restoration of monuments and the criteria and methodologies to be adopted. At the time, an unprecedented programme of monumental restoration was underway under the auspices of the dictatorial Estado Novo regime, led by António de Oliveira Salazar (1889-1970), who gave monuments a key role in his ideological propaganda [10, pp. 94-95].

Regarding the Jerónimos Monastery, which had undergone extensive interventions in the nineteenth century and was classified as a National Monument in 1907 [11], the scope of work carried out by DGEMN was relatively circumscribed. Notable conservation and restoration activities included the cleaning of the western and southern façades of the church, the consolidation of sculptural elements, the repair of joints on the church portals [2, pp. 409, 417], and the construction of a controversial galilee connecting the church and the former dormitory. An ongoing intervention plan for the cloister aimed to address persistent infiltration issues, that involved slabbing the terraces, filling stonework joints, clearing the channels of gargoyles, and treating the vaults [2, pp. 427-428].

In the following decades, the construction of new west and north aisles, designed in a neo-Manueline aesthetic style, facilitated more suitable accommodation for the Ethnology Museum (now the National Archaeology Museum) and the installation of the Navy Museum. During this period, interventions on the original features of the building were primarily focused on preservation, rather than restoration. These efforts mainly aimed to maintain the roofs, guttering, vaults, and windows, to address ongoing infiltration issues. Additionally, cleaning works were carried out on the cloister and the west façade of the church [12]. Contemplating this period, it is important to mention the establishment of a special protection zone for the monument, in 1960 [13]; the result of an increased awareness of the importance of safeguarding the building's broader context and its surrounding environment (Figure 2).

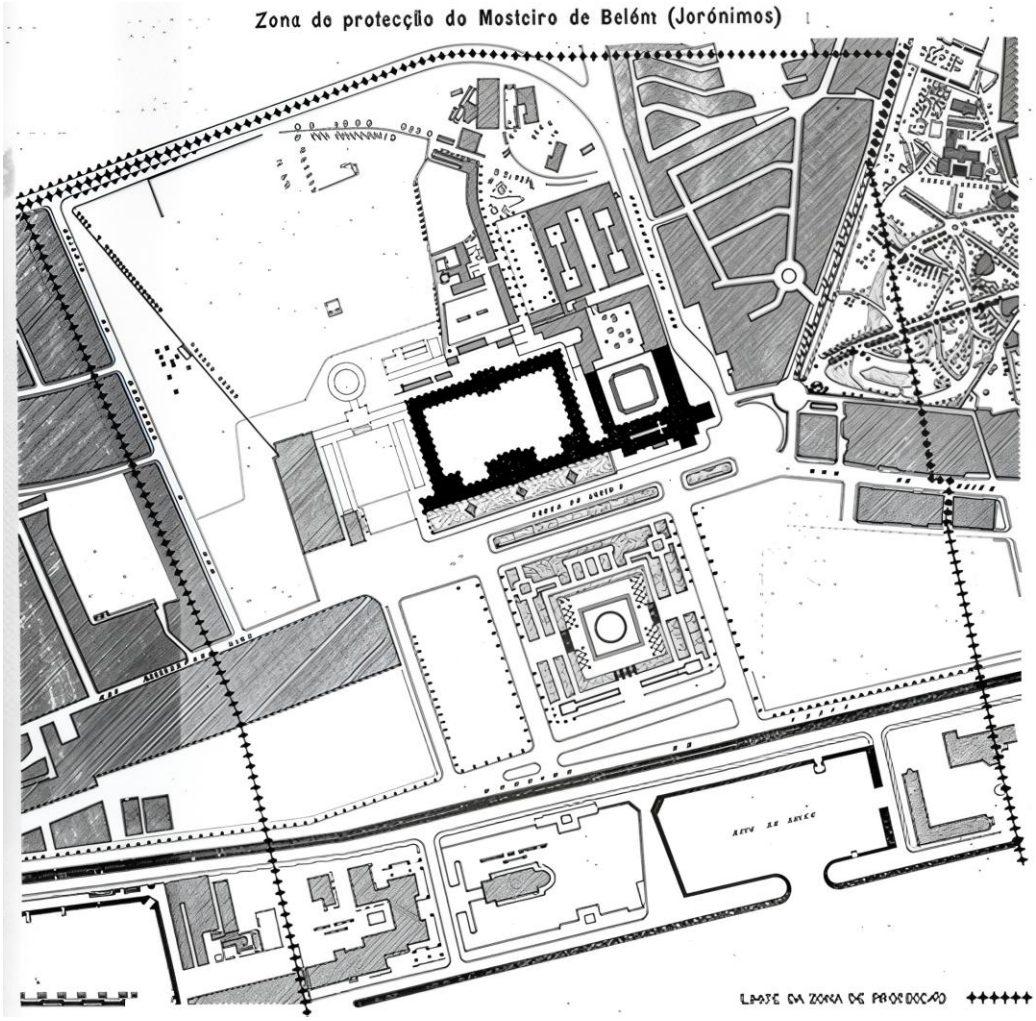

Figure 2. Special protection zone around the Jerónimos Monastery, 1960.

Between 1981 and 1983, in preparation for hosting the *17th European Exhibition of Art, Science, and Culture*, which featured the Jerónimos Monastery as a prominent highlight, several restoration and conservation measures were undertaken. These included the cleaning and washing of all decorative stonework in the cloister (first and second floors), as well as the sealing of joints and the creation of "stonework finishes to replace those that had deteriorated or disappeared" [14].

In summary, concerns are highlighted regarding the maintenance of the building, as outlined in Article 4 of the Venice Charter, and the utilisation of the monument, in accordance with Article 5 of the same document, which emphasises the safeguarding of its authenticity and respect for all that it represents. These principles extend to the relationship between the monument and its surrounding environment.

Following the inscription of the Jerónimos Monastery on the World Heritage List, conservation and maintenance activities have predominantly focused on the ongoing preservation of the monument, with occasional restoration interventions. These works include waterproofing the terraces to prevent water infiltration, cleaning the roofs, and the cleaning and restoration of the west and south portals of the church, as well as the stained-glass windows. A strong emphasis on preventative measures underscores the intention to preserve and enhance the architectural and artistic integrity of the original components of the monument, which comprise the church, sacristy, cloister, refectory, chapter house, and library. Notably, some of the restoration activities undertaken can be characterised as "preventive restoration", as Cesare Brandi defined it [15].

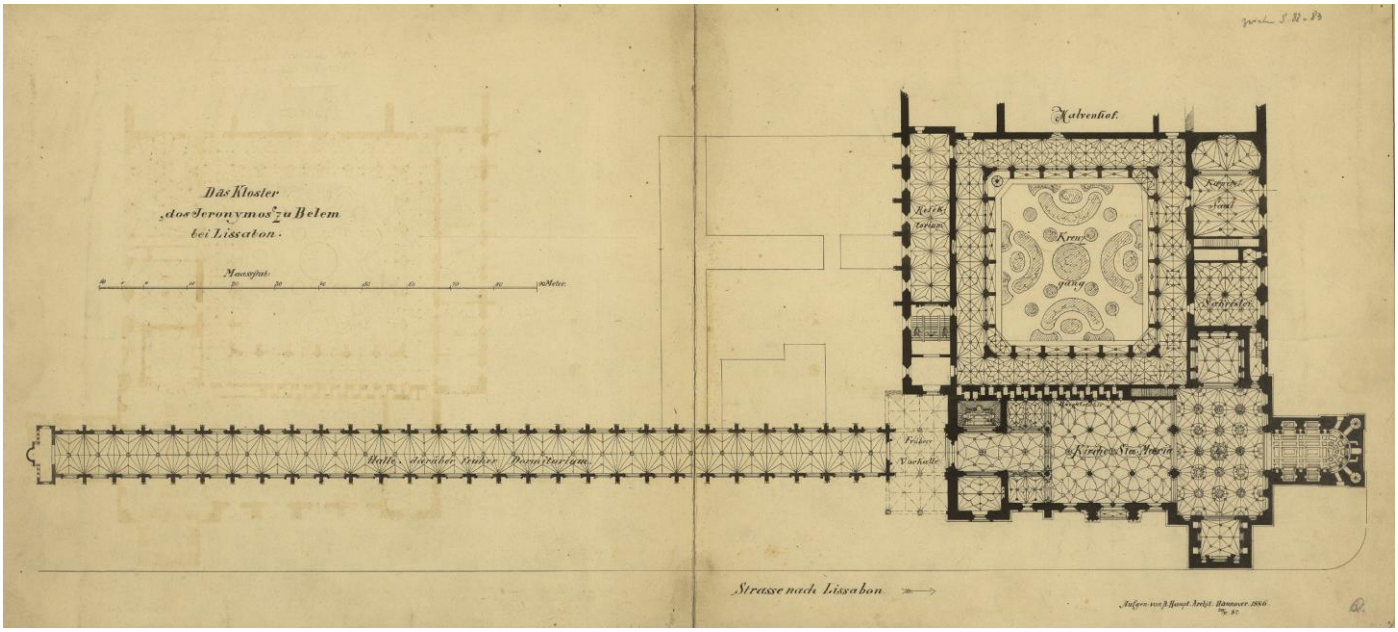

Figure 3. Albrecht Haupt, General plan of the Monastery of Santa Maria de Belém, Hanover, 1886 (Source's/UB, 32REPO-014).

These maintenance works aim to prevent major losses, such as the successful restoration and replacement of the church's stained-glass windows, or the restoration of its wooden doors, creating barriers against water, dust and other undesirable agents within the interior of the religious space.

The two most significant interventions recorded after 1983 were, as mentioned, the *Cloister Conservation Intervention* (1998-2002) and the *Conservation and Restoration Plan for the Church Vaults* (2012-2026). These will be the focus of the next sections of this study (Figure 3). Although restoration works were carried out during this period in the chancel, focusing on the conservation of the altarpiece by Lourenço Salzedo (1998-2000), this intervention has been excluded from the present study, as it concerned the restoration of a painted work and falls outside the scope of our architectural-focused approach [16].

Cloister Conservation Intervention (1998-2002)

The Jerónimos Monastery's cloister, situated to the north of the church, is often described as "a monument within a monument", consistently evoking high praise from visitors. In 1890, the German architect Albrecht Haupt (1852-1932) regarded it as potentially "the most beautiful cloister in the world" [17, pp. 98, 100]. This acclaim is attributed to the originality of its layout, which reflects the genius and technical mastery of the Biscayan master builder João de Castilho (1470-1552). Its sumptuous decorative features are particularly remarkable, contributing to its powerful scenographic quality within the architectural composition.

The cloister has undergone numerous interventions throughout its history. The most significant of these took place in the nineteenth century, during the period when the space was occupied by the Casa Pia de Lisboa orphanage, with the transformation of its aisles into student dormitories. When these were relocated to a newly constructed area in the 1880s, the cloister was restored to its former splendour [2, pp. 443-454].

By the end of the twentieth century, more than a century after the last major intervention to the cloister, its decorative qualities had been obscured by a layer of black stains. These were caused by excessive direct exposure to rainwater, resulting from alterations to the hydraulic system during the nineteenth century works [18, pp. 74-75] (Figure 4).

Figure 4. The cloister before the intervention, 1998 (photo: Nova Conservação, S.A.).

The issue, which DGEMN had been unsuccessfully attempting to address for decades, was subsequently resolved due to insights gained from research into the historic hydraulic system. Art historians, in the technical and scientific multidisciplinary team responsible for the intervention programme implemented at the cloister of the Jerónimos Monastery, played a crucial role in guiding and informing the understanding of both the cause of the problem and its potential solutions.

Project coordination and management

The intervention project conducted within the Jerónimos Monastery cloister is regarded as a pioneering case at the national level [8], owing not only to the significance of the site but also to the "quality of the organisation and working method" employed [8, p. 13]. As previously mentioned, a multidisciplinary team was assembled, incorporating experts from social sciences and the humanities, which ensured a comprehensive investigation and laid the foundation for informed decision-making throughout the process.

The importance of multidisciplinary teams is strongly recommended by the Venice Charter, which advocates a balanced group of humanists and scientists throughout conservation and restoration activities. Article 2 of the Charter states: "the conservation and restoration of monuments must have recourse to all the sciences and techniques which can contribute to the study and safeguarding of the architectural heritage" [19]. Nonetheless, this interdisciplinarity is not always fully realised, particularly regarding the involvement of social and human sciences. This case is remarkable for exemplifying restoration guided by historical studies and taking them into consideration in decision-making, which remains a rarity in Portugal. The 1964 Venice Charter emphasises that "the process of restorations is a highly specialised operation," and that it "must be preceded and followed by an archaeological and historical study of the monument," cautioning that interventions should cease where conjecture begins (Article 9). In the case of the cloister, restoration actions were highly targeted, primarily aimed at repairing broken or fractured features and stabilising structures using stainless-steel dowels.

In addition to the historical studies, between 1998 and 2000, research was also conducted to analyse the stone and comprehending the various alteration phenomena affecting the monument. It was based on these principles – grounded in the highest level of scientific,

technical, and historical knowledge – that the complex conservation intervention in the Jerónimos Monastery cloister was carried out.

This project resulted from a partnership between the World Monuments Fund-Portugal (WMF-P) and the Institute of Architectural Heritage (IPPAR): the second collaboration between the two entities, following the work on the Belém Tower [20]. The close cooperation between these organisations secured funding for a significant portion of the intervention through sponsorship initiatives, ensuring a work methodology based on preliminary scientific and historical studies capable of supporting future decision-making. This also guaranteed control of deadlines and budgets, hiring the best specialists considering relevant study fields, along with the most advanced technology; particularly that used in stone cleaning.

In terms of intervention management, the pioneering decision in Portugal to keep the space open to the public during the works, with all necessary safety measures in place should be highlighted [21]. This was achieved through a phased approach, addressing one elevation of the cloister at a time [22, p. 85]. Concurrently, small documentary exhibitions were organised, allowing the public to observe the ongoing work and to perceive directly the intervention's progressive effects (Figure 5).

Following two years of preparatory work, the initial scaffolding was erected in February 2000 within the northern wing of the cloister. The project was completed two years later, in February 2002, with the conclusion of works on the western wing. This intervention transformed the appearance of the Belém cloister, characterised by a distinctive golden hue, typical of Lisbon's lioz stone, and of which there was no prior memory.

Over the course of four years, all activities undertaken were meticulously recorded in accordance with Article 16 of the Venice Charter, which stipulates that "there should always be precise documentation in the form of reports (…) placed in the archives of a public institution and made available to research workers. It is recommended that the report should be published" [19].

Figure 5. Ongoing works in the cloister, with visitors contemplating the intervention, c. 2000 (photo: D. Caldeira).

Four years after the conclusion of the works, an extraordinary publication was produced, extensively illustrated and featuring texts from the various intervention teams, providing a comprehensive account of all the actions carried out on the cloister, with technical sections translated into English [8]. This document serves as a significant record of the work accomplished and functions as a methodological, scientific, and technical reference for future projects of similar scope and nature.

Intervention and works carried out

The interventions, conducted by Nova Conservação, S.A., were divided into six major operations: the elimination of primary water infiltration issues; realignment and stabilisation of displaced stone blocks; re-mortaring and filling of joints; cleaning and removal of extensive bio colonisation; consolidation of deteriorated areas; and the application of surface protective finishes.

The initial operation was fundamental, as it facilitated subsequent procedures and was critical to their overall success, given that water ingress significantly accelerates the deterioration of stone, masonry, and mortar materials. Following this, two operations were particularly significant: the cleaning of the stone (covering approximately 22,000 m^2) and the re-mortaring of the joints (approximately 15 km of joints).

The stone cleaning process was characterised by considerable complexity, given the various types of dirt, the necessity to preserve traces of patinas or superficial orange layers, remnants of historical treatments [23, pp. 117-118], and the conservation status of the materials present in the monument. As documented, "each method used must be applied in such way as to be as effective as possible in removing the soiling while preserving the surface of the stone as well as its historic changes" [24, p. 103].

Consequently, an innovative approach was implemented, employing Laser Ablation for Material Analysis (LAMA) technology, which utilises fibre optic laser technology through ablation [25, pp. 156-159]. This method had not previously been applied in Portugal.

Approximately 800 m^2 of surface area were cleaned using laser technology, representing one of the largest areas cleaned with this advanced technique worldwide [22, p. 86]. This approach was deemed the most suitable, particularly for the external arcades of the ground floor of the cloister, which feature delicate sculptural tracery and where traces of colour from historical treatments needed to be preserved. The use of this method also allowed for reductions in costs and labour [26].

For the remaining areas, traditional methods were employed, including dry cleaning, wet cleanings and, in specific cases, chemical cleaning. The selection of appropriate methods was based on the nature of the dirt and the conservation status of the materials within the monument.

Regarding the re-pointing of joints, "one of the most intensive phases of the entire intervention" [24, p. 112]: open joints were filled, deteriorated mortar was removed and replaced, and joints previously filled with Portaland cement were corrected. For the re-mortaring, binders previously tested in the context of the Belém Tower intervention were utilised: a specialised white binder suitable for conservation and restoration purposes, combined with an aggregate composed of sand and ground marble. In the internal wall joints, a pigmented limewash patina was applied, employing earth-tone colours to approximate the natural hue of the stone.

Following cleaning and re-pointing, a protective coating was applied to all surfaces within the cloister. This coating consisted of a translucent pigment-based layer designed to incorporate only the necessary pigment to harmonise with existing chromatic traces. The primary objectives of this treatment were to slow down further deterioration of the stone materials, while achieving visual harmony with the monument's historic appearance.

The methods and materials employed in the conservation of the cloister are fully consistent with Article 10 of the Venice Charter, which advocates the use of traditional intervention

techniques. Where such techniques are impractical or deemed unsuitable, they should be replaced by modern methods if "the efficacy of which has been demonstrated by scientific data and proven through experience" [19]. Additionally, the overall approach was founded on the principle of minimal intervention, restricting actions to necessary cleaning, the application of essential mortars for re-pointing, and highly targeted restoration efforts, as previously outlined. Although the Venice Charter does not explicitly mention this principle, it emphasises that reintegration materials "should be the least that will ensure the conservation of a monument and the reinstatement of its form" (Article 5).

In pursuit of a long-term preventive conservation strategy, consistent with the recommendations for "ongoing maintenance" outlined in Article 4 of the Venice Charter, the technical team responsible for the project formulated specific guidelines for the ongoing maintenance and monitoring of the cloister. These measures were designed to anticipate potential issues and reduce the likelihood of more extensive and costly interventions in the future [27].

Conservation and Restoration Plan for the Church Vaults (2012-2026)

The monumental church of the Jerónimos Monastery, conceived as a *hallenkirche* with three naves of equal height, features a vault characterised by a complex reticulated rib system, which was unprecedented in Portugal at the time and executed by the already mentioned João de Castilho [28]. In the transept vault, the Biscayan architect reached the apex of his daring design approach, presenting an exceptionally ambitious technical solution that differs from that of the naves. He devised a single vault with a lowered profile, intended to span approximately 29 × 20 m and reaching a height of around 25 m above ground level.

The technical excellence, visual impact, and contribution to the overall monumentality of the space rendered by the vaults of the church makes them unique (Figure 6). However, concerns regarding their conservation status have persisted for many years, with documentation dating back to at least the early twentieth century. Severe infiltrations, akin to those observed in the cloister, have resulted in deterioration of the joint fillings and stone materials, leading to the detachment of fragments. Over time, various interventions have been undertaken to waterproof the roofs and ceilings, as well as to consolidate the vaults and seal the joints [29]. Nonetheless, despite recognising the problem, its underlying cause remained elusive, resulting in the implementation of solutions that primarily mitigated rather than resolved the issue.

In the 1990s, a comprehensive systemic study, analysis, and monitoring of the issues were undertaken, involving laboratories, universities, and recognised specialists. The primary objective of these studies was to produce a specification document to initiate a tender process [30, p. 3]. At the time, an architectural and structural survey was conducted, incorporating topographical mapping, photogrammetry, radar sondages, endoscopic examinations, and ultrasound investigations to clarify the structural condition of the nave vaults. These investigations identified a combination of factors contributing to the observed problems: the construction methodology of the vaults, heterogeneity in the stone blocks used, the quality of restoration mortars, moisture and condensation accumulation, all compounded by the building's age [31-33].

As the contest schedule for the late 90s was interrupted, the issues observed in the Jerónimos Monastery church vaults, namely infiltrations and the detachment of some stone fragments and mortars, were addressed on an ad hoc basis [30, p. 4].

Figure 6. Church, nave vaults, 2013 (photo: A. Serralheiro).

Given the persistence of these problems and the potential risks associated with their progression, the responsible authorities for the monument, advised by specialists in stone conservation and pathology, recognised the necessity and urgency of implementing a structured, phased programme for the vaults' conservation and restoration. This process was initiated in 2012, when, based on art historians' prior engineering and architectural studies [34], the main phenomena of alteration and degradation present in the structure was identified, and an action plan for the church vaults was established [35]. The intervention work began in May 2013. The circumstances, which will be broadly outlined below, needed modifications to the original action plan, and resulted in some delays. It is currently estimated that the church vaults' conservation and restoration work will extend until the end of the first quarter of 2026. Unlike the works on the cloister, which have already been completed and for which multiple studies have been published, the vault interventions are still ongoing, and available technical information for research is subject to some understandable limitations. Nonetheless, this study underscores that these extensive conservation efforts, initiated following the monument's inscription as a UNESCO World Heritage Site, should be viewed within the broader context of heritage preservation initiatives. Many of these efforts have already yielded significant results, contributing to the monument's long-term preservation.

Project coordination

Between May and November 2013, the first phase of the plan (I1) was begun. This initial stage encompassed the bell tower vaults, the southern section of the high choir, the northern chapel of the transept, and the chancel. This phases' report explicitly outlined the predominant pathologies observed during the works, highlighting issues such as dirt accumulation, moisture resulting from infiltrations, bio colonisation, empty joints between blocks, fissures at

contact zones, displaced elements, detachment and loss of stone material, localised pulverisation of stone, and salt efflorescence within joints [30, p. 5].

During the execution of the first phase of the plan, it became evident that the alterations affecting the stone extended beyond the vaults, also impacting the church walls, both internally and externally. Consequently, in 2016, as the external Phase E1 was nearing conclusion, the *Conservation and Restoration Plan for the Church Vaults* was re-evaluated, leading to an expansion of the intervention area to include the church walls [30]. The revised plan subsequently comprised six stages for the interior (I1 to I6), and four for the exterior (E1 to E4), with the following distribution:

- Phase I1 (2013) – bell tower vaults, the southern section of the high choir, the northern chapel of the transept, and the chancel;
- Phase I2 (2014) – four vaults of the northern nave, the vault of Vasco da Gama's tomb space, the northern and western walls, and the corridor/staircase leading to the high choir;
- Phase E1 (2015) – bell tower, the tower's body, the western elevation and galilee, and the axial portal;
- Phase E2 (2016) – southern elevation (between the bell tower and the transept), including the portal;
- Phase I3 (2017) – vault and walls above the choir stall, southern and western walls of the high choir, vaults and southern wall of the nave on the Epistle side, and the choir stalls;
- Phase I4 (2018) – central nave;
- Phase E3 (2019) – façades of the southern transept chapel and crossing;
- Phase E4 (2020) – chancel façade and eastern façade;
- Phase I5 (2021) - southern transept chapel, crossing, and walls of the northern transept chapel;
- Phase I6 (2022) – interior of the bell tower, multimedia room, and education service room (walls).

The COVID-19 pandemic, which occurred between 2020 and 2022, impeded the timely completion of the schedule phases outlined in the plan, justifying its extension until 2026. The phases E1, E2, I2, and I3 were funded, as had previously been the case with the cloister works, by the World Monuments Fund-Portugal. The pandemic and subsequent suspension of activities prompted the formation of a new partnership with the Portuguese Government, with the remaining phases (E3, E4, I4, and I5) being financed through the Recovery and Resilience Plan (PRR). Adopting a methodology that had proven highly effective during the cloister intervention, the project also embraced an open-site approach, allowing visitors to access the construction site without compromising safety conditions for all. Given that the site is a church open to worship, maintaining regular religious services during the various phases of intervention was also prioritised.

Under the motto "open for works" [36], special guided visits have been organised for professionals and researchers (architects, engineers, conservators-restorers, art historians), providing, through access to scaffolding, a privileged view of the vaults and the upper sections of the columns. Simultaneously, with engaging daily visitors to the monument in mind, various informational panels have been installed to explain the ongoing works (Figure 7).

The extensive documentation produced throughout the project (encompassing archival, graphic, and photographic materials), ranging from preparatory research for the intervention plan to the execution of the works, will culminate in a publication, as was done for the cloister. This will serve to disseminate and share in greater detail the methodologies adopted, and the criteria followed during the intervention.

Figure 7. Panel explaining the intervention areas, both in Portuguese and English, 2024.

Intervention and conducted works

All completed phases were executed by the company Nova Conservação, S.A., to whom the various contracts were awarded.

In general, the different phases have shared common methodologies, such as observation, monitoring, and diagnosis, culminating in conservation and restoration interventions. The primary objectives have also been consistent across phases, aiming to eliminate or mitigate deterioration factors and restore the architectural clarity (Figure 8). The following paragraphs will systematically outline the actions undertaken and the conservation and restorations practices adopted, with the intention of identifying the underlying principles and their criteria.

The first phase of the works consisted of surveying the conservation state of the intervention area, with the corresponding photographic and graphic documentation. This included markings from the quarrying process, tracing marks, and inscriptions. Following this, conservation and restoration interventions were carried out, which included a cleaning process. These comprised dry methods, wet methods, chemical methods, and mechanical ones, the latter being applied to darkened areas where the other techniques proved ineffective. For the vaults, the use of laser technology for cleaning was deemed unsuitable, as the dirt was superficial, and the surfaces were minimally ornamented.

Figure 8. Southern transept chapel façade: *a)* before and *b)* after the intervention, 2024.

Structural reinforcements, stabilization of various elements, fixation and adhesion of displaced components, as well as the treatment of stone and metallic elements and joints, have constituted the primary interventions carried out. Concerning the joints, the actions have included the removal of degraded materials, filling with mortars that replicate traditional techniques, such as lime and sand-based mixtures, using injections, resealing of the joints, and finishing with micro-plastering. These efforts were made to achieve chromatic harmony of the surfaces through the application of natural pigments [37]. Externally, an inspection of the roof and covering system was conducted, along with the rectification of the drainage system, including the gutters (Figure 9).

Figure 9. Chancel's roof: *a)* before (photos: Nova Conservação, S.A.) and *b)* after the intervention, 2023.

Once again, the entirety of the principles outlined in the Venice Charter are reflected in this intervention. Principles and methodologies characterised by rigorous scientific standards are adopted, which respect the integrity and authenticity of the monument, restricting interventions that are deemed unnecessary or excessively invasive.

The focus on conservation, maintenance, and sustainability

The two intervention projects discussed serve as important methodological examples when it comes to conserving and/or restoring monuments, even if they do not possess the same historical, artistic, and symbolic significance as the Jerónimos Monastery.

Careful planning and management of the work, based on preliminary technical and historical studies and involving a multidisciplinary team, are, as highlighted by the Venice Charter, undoubtedly essential. These practices facilitate funding processes, enhance the credibility of the work carried out, support decision-making, prevent errors, and minimise costs in both time and budget. This results in benefits for all, particularly for the monuments themselves [38-40].

However, whether upstream or downstream of a conservation and restoration intervention, the commitment to conserve, especially in a preventive manner, and to preserve the monuments, through maintenance actions, should be a priority. Article 4 of the Venice Charter advocates this by stating that "It is essential to the conservation of monuments that they be maintained on a permanent basis" [19]. Despite an awareness that the popular adage "prevention is better than cure" is entirely applicable to the reality of monuments. The truth is, in many cases, another popular saying: "A house that has been broken into, needs a lock afterwards"; meaning that problems are only addressed after they occur, reflecting a limited engagement in prevention, whether due to budgetary constraints or lack of planning.

The reports of the interventions carried out at the Jerónimos Monastery clearly demonstrate the need for a "conservation of conservation" efforts, in order to reduce costs and, most importantly, to minimise the impact that large-scale works can have on the monument. Consequently, strategies have been developed and maintenance actions designed to preserve the existing conservation state. These actions, based on regular inspection and monitoring, enable prompt intervention without compromising the progression of any issues.

For the church, within the scope of maintenance interventions, activities included cleaning walls, treating biological colonisations, filling joints, restoring the chromatic balance of the stone surfaces, clearing out gutters, cleaning and removing organic deposits from the roof and terraces, replacing broken tiles and re-seating displaced pieces.

Regarding the cloister, because of periodic inspections, numerous maintenance actions have been conducted over the past 20 years. The aim has been to mitigate the presence of biological colonisation and the darkening of the stone surfaces, which would otherwise lead to further loss of the carved decorations' readability [41]. Additionally, treatments have been undertaken to address water infiltration points, fill joints, restore the chromatic balance of the surfaces, clear all the gargoyles (where paper, plastic, and residual dirt have accumulated), and inspect the waterproofing condition of the drainage pipes.

Figure 10. Falcon and falconer hand, doing its rounds on the cloister's roof, May 2024.

Regarding maintenance activities in the cloister, it is noteworthy that, from 2021 onwards, an innovative ecological conservation practice has been adopted. This method was tested at the Vatican Museums and was employed for the first time in Portugal at the Jerónimos Monastery by the company Nova Conservação, S.A. It involves a cleaning procedure that is more environmentally friendly and less invasive to the monument, as well as more cost-effective compared to traditional biocide treatments. The process utilises 70 º alcohol, whose volatility is not absorbed by the stone but effectively targets bio colonies. Subsequently, essential oils based on cinnamon, thyme, and clove are applied, not only to assist eliminating biological agents, but also to contribute to the preservation of the stone material. Certain bacteria present within these oils, when associated with algae and lichens, produce calcium carbonate, which facilitates the consolidation of the weakened stone [42].

Furthermore, regarding the preventive conservation measures across the entire building complex, efforts have been undertaken to address one of the major issues affecting water drainage systems: seagulls. This is due to their nests, debris, carcasses of other animals, and similar obstructions; as well as stone corrosion caused by their excrement [43]. Additionally, the presence of these birds within the cloister has caused significant impediments to visitors and hindered the organisation of events in that space.

Recently, bird control measures have proven to be effective in deterring seagulls, as they help to protect the monument without causing harm to wildlife. The ineffectiveness of the previous employed method, which was based on an electric repellent system installed in 1994 and subsequently destroyed by the seagulls themselves, led to the adoption, in 2020, of a practice involving the use of raptors, such as eagles and falcons. This approach does not involve capturing or hunting prey, rather, it aims solely to dissuade the birds from inhabiting the territory occupied by the predator (Figure 10). The method has previously been utilised

successfully in Portugal at the Convent of Mafra, the Alcobaça Monastery and the Peniche Fortress. It has also been adopted in various countries around the world, with positive results, although it entails significant costs.

Final considerations

It can therefore be stated that both the *Cloister Conservation Intervention* (1998-2002) and the *Conservation and Restoration Plan for the Church Vaults* (2012-2026) demonstrate a renewed approach to intervention, characterised by rigorous studies directed at understanding the causes of issues, assessing their damage, and implementing solutions to address them. Overall, these projects maintain a strong alignment with the principles and values outlined in the Venice Charter, attesting to its continued relevance 60 years after its formulation.

Despite ongoing debates regarding the contemporary applicability of this Charter and the existence of numerous other charters, conventions, and recommendations that complement it, the principles enshrined in the 1964 Charter remain steadfast. These enduring values have evidently guided both interventions discussed in this study.

Interdisciplinary collaboration in the monument intervention process (Article 2), with particular emphasis on the integration of art historians; the conduct of preliminary historical studies to determine the appropriate actions to be undertaken (Article 9); the pursuit of compatibility between traditional techniques and modern materials (Article 10); concerns regarding the maintenance of the monument (Article 4); and producing and disseminating documentation related to all stages of the intervention process, has been fulfilled in relation to the cloister, and the same is currently being prepared for the vaults' intervention.

With a strong emphasis on maintenance actions and preventive conservation, as rightly stated by Article 4 of the Venice Charter, the safeguarding of the Jerónimos Monastery currently faces additional challenges, with mass tourism (the monument receives approximately one million visitors annually), and climate change on the forefront. Achieving a balance in visitor numbers to reduce their impact on the monument and on the quality of visits; being aware of the effects of climate change and seeking control and mitigation solutions aimed at protecting the building, its visitors, and the environment; as well as investing in knowledge and its dissemination, improving communication dynamics (with researchers, the general public, companies, public and private entities, among others), are some fundamental measures to preserving a monument like Belém's. These should not be underestimated in comparison to large-scale restorations. These challenges are undoubtedly complex, and they should be reflected on, discussed and integrated into the Monument Management Plan [44-45], an obligatory document for heritage assets inscribed on UNESCO's World Heritage List, and an essential tool for ensuring sustainable, integrated, preventive, and successful management.

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RECEIVED: 2025.9.4
REVISED: 2025.12.11
ACCEPTED: 2026.1.5
ONLINE: 2026.5.29

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