Conservation and dissemination of painted architecture: Technological challenges in the city of Malaga (Spain)

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Abstract

The painted architectures constitute an urban landscape that has been altered over time and the successive accumulation of planning and management instruments that have addressed them, be they General Urban Planning Plans or Special Protection Plans, which, although they have made possible the guarantee for prolong their existence, they have not always the capacity to make this valuable heritage known. The research we present lies in the inclusion of New Technologies inin the baroque-painted architecture of Malaga to publicise the cultural heritage in an applied way, qualify urban environments, and promote recognition of the cultural value of the city.

The conservation of the mural paintings, their influence on colour plans, and the didactics and new technologies incorporated into the discourse of cultural tourism are the elements that constitute the axes on which our work is based. We propose to create a transversal discourse encompassing the cultural legacy of baroque-painted architecture in a highly modified urban landscape subject to the demands that mark contemporary dynamics. On the other hand, it is evident that the planning of a quality cultural tourism development model must keep in mind the principles of quality and sustainability, contributing to the maintenance and conservation of cultural heritage, avoiding the deterioration of cultural assets, and respecting conditions of habitability.

Our case study and project apply to the painted architecture of Malaga. They are the result of the project awarded to the HUM1050 research group of the University of Seville in collaboration with the architecture studio 360BIM in 2022.

Keywords: Heritage, Painted architecture, BIM, Technology, Urban landscape.

1. Introduction

When researching the influence of tourism on the recovery of historical centres, it must be borne in mind that this process is currently being analysed from a wide range of disciplines and points of view. The birth of the historic core of cities by heritage precedes concepts such as, for example, sustainability. It can be affirmed that, in an official context, the first time that such problems, as the care of the historic landscape of cities, are mentioned is in the Venice Charter of 1964, while the Norms of Quito of 1967 states that the need to reconcile the demands of urban progress with the safeguarding of environmental values is already today an inviolable rule in the formulation of regulatory plans on a local and national level. In this sense, and within the framework of its management, any development plan must be carried out in such a way as to integrate the urban development of historic centres or complexes of environmental interest (UNESCO, 1967). The concept of environment in urban planning had already been introduced by Giovannoni in 1931. Thus, in 1978, UNESCO declared Quito's historic centre the first on the World Heritage List. Several decades after that context, sustainability continues to be a guiding thread in a process that can be linked to the Nature Charter (1982), the Bruntland Report (1987), or various meetings such as the Rio Summit and the Earth Charter (2000).

The profusion of documents and research that have subsequently been carried out on them may be due, among other things, to the fact that it is in historical centres where the problems typical of any urban agglomeration are exacerbated: the concentration of tertiary activities in some areas, as opposed to the lack of them in others or the ageing of the population, can be cited as examples. In this path of work, the rapid advances in technology and communication, as well as certain effects caused by the massification, interrelation, and homogenisation of current cultures (Camacho, 2010), have led to the loss of the identity character that was previously evident in certain urban spaces. However, despite the blurring of distinctive features within today's essentially Western-based culture, there are still pockets with certain peculiarities and characteristics that remain and evolve (Llopis et al., 2015).

2. On the principles of cultural tourism and sustainability: Historic centres

The historic city centres correspond to these urban redoubts that maintain their singular character, remaining as remains of the living memory of the identity of the cities, since "in the city, the historic centre is configured as a paradigm of our background of all kinds, our past, the heritage, and the long journey until today," one of its most interesting values being the "fidelity to its belonging: its belonging to a geography, to a landscape, to coordinates within the great territories," which is reflected, among other things, in a determined use of colour and matter.

The delicate relationship between cultural tourism and sustainability speaks of the correct planning and management of our historical, cultural heritage linked to tourism, and it has become a key to action on heritage. The planning of a model for the development of cultural tourism in a historic city must bear in mind that tourist activity must be an economic activity, governed by the principles of quality and sustainability, capable of contributing to the maintenance and conservation of cultural heritage, avoiding the deterioration of cultural assets and respecting conditions of habitability. Innovative cultural strategies and quality tourism promotion are representative factors for Cultural Tourism in historic cities (Royo, 2019).

During these years, tourism was integrated as a relevant issue in the urban agenda; an express tourist policy was formed, and the rest of the urban policies assumed the tourist discourse as their own. Along the same lines, the World Tourism Organisation (WTO) defines cultural tourism as "any movement of people motivated by the need to satisfy the human need for diversity, giving rise to an elevation of the individual's cultural level and encouraging new knowledge, experiences, and encounters." In a positive sense of the definition, it has been considered that cultural tourism should facilitate knowledge of one's own culture as a means of enrichment. Still, it does not leave behind the tensions caused by the sector's industry associated with consumption, as on occasions, tourism becomes a source of problems due to poor or lack of management that can cause populations or historical areas to become products of mass. Consumption and loss of their authenticity and identity value is the extreme commodification of heritage, especially of its traditions and customs, which can go so far as to strip them of their true meaning and provoke a process of deculturation (Figure 1).

Figure 1. Tourists in the historical centre of Málaga. Source: Royo, L. (2023)

This is both the upside and the downside of the phenomenon of cultural tourism, which has a large academic bibliography, very interesting manuals, and recent experiences in tourism planning and management, which have been included in the plans for historical centres.

With the emergence of the new heritage category of cultural routes and itineraries in the city, we are offered the possibility of creating a new form of tourism management that goes beyond the traditional route or itinerary, encompassing new concepts applied to historical-cultural heritage and introducing new technologies. To pursue this objective, all those tangible or intangible assets that are linked to the different cultural landscapes must be taken into account; in this specific case, we refer to the painted architectures, where the context becomes an essential element to explain, give meaning and understand a story: ways of life, artistic heritage and cultural baggage of a town or city (Pinto, 2018).

3. Protection and recovery of historic centres. Malaga under debate

The recovery of historical centres, specifically Malaga's, has become a key to reviving tourism and the economic development that results from it for the municipality's benefit. Thanks to the demand for activities to do, places to visit, and places to rest, eat, stay overnight, and invest, Malaga is positioning itself as a city for new uses and its recognition in an urban space that is being transformed to meet new cultural and tourist objectives associated with the values of the historic city. However, we must go back a little in time to find out the reasons for this recovery and, above all, for the marked physical, functional, and symbolic degradation into which the historic centre of Malaga has fallen at a certain point in its history. In its most critical and, at the same time, a most important period in terms of economic development (1955-1975), the city of Malaga was subjected to rapid and uncontrolled urban growth, accompanied by an inoperative instrumentation that began with a PGOU approved in 1950 by the Central Commission for Local Health but which was never applied. The reasons for this were economic interests and speculative processes, which, in favour of development, led to the inoperability of restrictive urban planning measures (Olano, 1972).

We would have to wait until 1971 for the new PGOU of Málaga to be approved. At that time, the main objective was to guide and control the new growth inherited, leaving out of this regulation any mention of the state of conservation, rehabilitation, or recovery of the historic centre. These issues would worsen over time and would be

taken up in the following PGOU of 1983 when it stated the need for the "recovery and conservation of the urban structure and its building typology through rehabilitation processes; control of tertiary activities, maintenance of the population, etc...". For these purposes, specific regulations were drawn up for the city centre, which included the historic centre as a sub-zone. Two years after the approval of the PGOU, on 18 July 1985, the Directorate General of Fine Arts initiated the official processing of the file for the declaration of the Historic-Artistic Ensemble of the Centre of Malaga as an Asset of Cultural Interest (BIC), which was published in the BOJA on 2 August of the same year. A file that was born under the figure of the Central Nucleus of the Property of Cultural Interest "Historic-Artistic Ensemble of Malaga" and that would end definitively 27 years later by Decree 88/2012, of 17 April, by which the delimited sector of the city of Malaga was inscribed in the General Catalogue of Andalusian Historical Heritage as a Property of Cultural Interest, with the typology of Historic Ensemble.

The fact of initiating the declaration process in 1985 would entail, as stated in Article 20 of the Heritage Law, the obligation to draw up a Special Protection Plan for the area in question and, to this end, a Special Protection Plan (PEP) was approved in 1988, to which a Plan for Internal Reform (PEPRI) was incorporated in the same document, approved for all legal and urban planning purposes in 1990. As a consequence of all the above, the historic centre of Malaga was plunged into a long period characterised by abandonment, degradation, and the substantial loss of an urban and architectural heritage to which it would not be possible to return. This situation is where different cultural, tourist, and strategic policies have recently approached in an effort and interest in its recovery, perhaps too late.

4. Colour schemes and their management: the cataloguing of baroque wall paintings

With regard to the role of colour in the process of heritage recovery in historical centres, the cultural legacy of painted façades is represented in a wide area of central, northern, and southern Europe. In an approach to the different territorial areas of Italy, Spain, and Central Europe, one can "notice the importance that the integration of these painted architectures has had, making them participants in the historical construction of their urban image" (Royo, 2022). However, with few exceptions, urban rehabilitation plans do not show much interest in this cultural heritage (Figure 2).

Figure 2. Tourists in the historical centre next to the Church of El Sagrario in Malaga, with mural paintings on its exterior.
Source: Royo, L. (2023)

The recovery and conservation of these spaces should have led to the understanding and preservation of the principles underlying the very image of the city. This fact is what imposes the need to establish a scientific methodology for systematic studies of architectural and urban colour that will make it possible to endorse the most suitable conservation and treatment criteria for each case in order to maintain the unique characteristics of the urban environment, especially in areas of historical interest such as historic city centres. These methodologies of colour studies for their integration into protection plans have only been applied in a few Spanish cities, such as Barcelona, Malaga, and Valencia, among others. (Collado y Medina, 2002).

In the field of the conservation of exterior painted architecture and its inclusion in colour plans, Barcelona was a pioneer with its slogan "Posa't guapa," transforming a very different reality, thanks to Joan Casadevall and his team, which would later be incorporated in Andalusia (Casadevall, 2005). This was followed by Granada, and especially Malaga, whose PGOU has granted specific protection to painted architecture.

In general, except for specific restoration or rehabilitation interventions linked to nationally relevant research work, there is no interest in internationalising this cultural legacy, which, due to its peculiarity, makes it a unique opportunity to resize the cultural tourism image of Spanish cities. Perhaps with the help of new technologies, we can achieve this purpose.

5. Cataloguing wall paintings in Malaga. A project based on sustainability

There are many examples of how Malaga was a painted, colourful, and very baroque city. On this occasion, we are moving forward from what is currently in force and what users demand, that we interpret and make known this cultural legacy with new technology applied to virtual reality, augmented reality, and 360º videos with the development of texts that allow us to create experiences that captivate the public to such an extent that they want

It is the Town Council of Malaga that has its competencies in its municipal area regarding "Protection and management of Historical Heritage" (Law 7/1985, art. 25.2.a) and, at the same time, must conserve, protect, and guard, in particular, those of its property (Law 16/1985, art. 36.1). To guarantee the conservation, protection, and custody of its assets most effectively and efficiently, it is necessary to coordinate the management of all the aspects that affect it, in coordination with the rest of the City Council and the context of the rest of the city's historical heritage. Motivated by the need to establish effective protection measures for the mural paintings, it was established from that time onwards that, when applying for a building permit, a prior report was requested from the Archaeology Section, which established a condition in building renovation projects to document, protect and recover the pictorial repertoire and original treatment of façades. This procedure completed the work carried out since 1995 by the Municipal Housing Institute through the Office for the Rehabilitation of the Historic Centre. (Royo y Prado, 2023).

In the development of the Renovation of Historic Centres project, carried out in 2003, various studies, analyses, diagnoses, and recommendations were drawn up to assess the state of conservation and observe the management dynamics in the PEPRI area. Among others, it was proposed to enhance the value of the Painted Architecture of the Modern period, mainly corresponding to the last stage of the Malaga Baroque period in the 18th century. In this work, the Planning Department took on this initiative, drawing up a proposal in 2005 specifying the need to carry out parietal studies before granting a license in those buildings where remains of mural paintings were located. The year 2011 saw the incorporation of historical-artistic heritage protection into municipal regulations and management with the General Urban Development Plan (PGOU), Title X, Section 6, which initially allowed 192 walls to be protected. In 2012, Decree 88/2012 of 17 April established a further step forward in protection, with the inscription in the General Catalogue of Andalusian Historical Heritage of the Historic Ensemble of Malaga as a BIC, also pointing out the new criteria for the valuation and protection of cities and highlighting in the justification of the delimitation, the recovery of numerous buildings with mural paintings as one of "the most interesting images of the city." In 2013, the Provincial Historical Heritage Commission approved the documentation submitted by the City Council regarding the "Structural Modification 7" of the Urban Development Regulations of the PGOU in force, and the protection of mural painting was included in the architectural regulations of Title XII, being also regulated in art.12.4.12 of chapter four, updating the list of buildings with mural

paintings. The current PGOU of Malaga includes Title XII, Mural Paintings: "as an instrument to regulate the defence and protection of the group of buildings with mural paintings and/or ornamental repertoires on façades belonging to the Baroque period in Malaga, incorporating a list of properties in which their presence has been confirmed or which are likely to contain them" (Figures 3 and 4).

Figure 3. Street Arco de la Cabeza two on the corner of Plaza Virgen de las Penas 5. Source: Royo, L. (2023)

Figure 4. Santísimo Cristo de la Sangre, plaza 2, Museo del Vidrio. Source: Royo, L. (2023)

6. Methods and procedure

Applying new technologies to the protection of Historical Heritage has, in the formative stages of heritage studies, a guarantee of involvement in future generations of professionals. Many institutions and companies in the public and private sectors and university research groups have already opted for these instruments to complement comprehensive rehabilitation, restoration, customisation, and knowledge projects of our cultural legacy. When approaching the application of new technologies in the field of Historical Heritage, we must bear in mind that this is nothing more than the object of study or action of protection, so it is this that scientifically defines the heritage action. Hence, its methodology, objectives, and foundations should determine the characteristics of the application of new technologies (Gómez & Quirosa, 2009).

In this part of the journey, where the use of Information and Communication Technologies (ICT) plays a leading role, tools with which to work on the heritage project and in the construction of measures with which to design and improve the conditions of accessibility and dissemination in the interests of sustainable tourism. (Peral y Royo, 2018). This is a process of no return to which different administrations are committed, with greater or lesser success, to increase profits by reducing the depletion of the resources of the Cultural Heritage immersed in the tourist circuits of the 21st century.

Linked to the first phases of heritage work, cataloguing and its subsequent protection, it is important to identify those technologies that allow them to be applied with greater versatility to the knowledge and identification of cultural assets. It comes as no surprise that recently, and with increasing prominence, we have seen examples and research that demonstrate the scope of knowledge in interventions on cultural assets of different magnitudes and that attempt in a certain way to discover information through technology that was hitherto unknown or unavailable to us. In this way, we consider it a priority to refer above all to the elaboration, monitoring, and access to all that information and/or research relating to the knowledge of the assets, which in some way constitute the main body of the general catalogues and inventories of Historical Heritage, both national and those drawn up by each Autonomous Community (Royo, 2014)

ICTs are currently a vital tool for the dissemination of cultural heritage as they have undergone a strong process of diversification in recent years and, along with traditional web channels, a multitude of tools and other aspects, such as augmented reality, have been developed that are vital for its dissemination (Caro et al., 2015). The application of instruments and new technologies, in this case, digitising documents or creating tools that facilitate their direct consultation or virtually recreating pieces, constitute an instrument that directly relates new technologies and the conservation of these assets, making it possible with their development to have an agile tool that is easy to update and accessible for consultation in documentation centres, museums, and cultural institutions (Ortiz, 2007).

In recent decades, BIM (Building Information Modelling) technology has become the most widely used collaborative work methodology in the architecture, engineering, and construction industries to create and manage digital representations of the physical and functional characteristics of buildings and other structures with a very direct application to the field of heritage (Baraibar et al., 2022). Its direct use in the heritage field also allows collaborative tools and 3D modelling to optimise asset design, construction, and maintenance, such as buildings in our field (Valdespino Tamayo, 2016).

BIM methodology is at the heart of the digital transformation of the construction sector, and Public Administrations across Europe are taking proactive steps to promote its use. The use of BIM in the management of Cultural Heritage projects allows us to achieve the following objectives (Martín, 2018):

- Adequacy and organisation of the information system according to the specific characteristics of the cultural assets and the fields of knowledge involved in their analysis, guardianship, and dissemination;
- Adequacy of graphic documentation and modelling of cultural assets according to their formal and constructive characteristics.

Within the life cycle of cultural heritage assets, the optimisation of the digital use of information facilitates the management control of the execution of actions that are carried out (Ruiz Torres, 2013) The recently developed Building Information Modelling (BIM) technique combines 3D modelling and information management. One of its modern applications is heritage documentation, which has generated a new concept of historical/heritage building information modelling (HBIM).

In the practical case of Malaga and the digitised façades, the methodology used has opted to work with the Leica-RTC360-3D Reality Capture Solution laser, capable of allowing scanning at 2,000,000 points per second and advanced HDR imaging system, in the creation of 3D point clouds in colour, allowing completion in less than 2 minutes, a range of up to 130m and an accuracy of 1mm at 10m. with 3 HDR 360 cameras that generate a combined image of 345MPx. (Ruiz Torres, 2017).

For the captures, at least three positionings were made for the building to achieve an accuracy of 1mm. The point cloud created by laser scanning allowed a BIM model of the current state to be created (a process known as Scan to BIM). This model has been used to establish the current state and the main dimensions of the paintings and elements to be analysed, which would be difficult to obtain by other means. Some significant examples can be seen in the images rescued as point cloud models obtained (Figures 5 and 6).

Figure 5. Arco de la Cabeza, cl. 2 –Virgen de las Penas, Plaza. 5. Source: 360 BIM.

Figure 6. Constitución, plza. 13-14. Source: 360 BIM.

Concerning the number of positions used to obtain the images scanned in BIM, it is important to point out that the same number of points has not always been required in the works delivered to Malaga City Council. For example, we can point out the scanning of the mural paintings of c/Arcos de la Cabeza (Figures 7 and 8), which presented the complexity of needing more positions than usual until now.
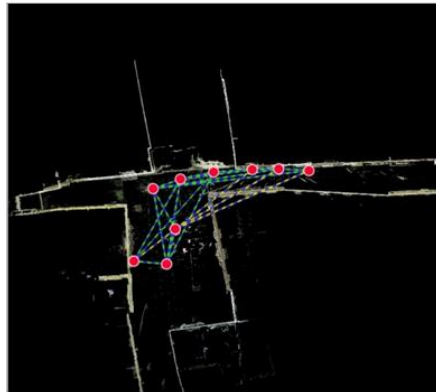

Figure 7. Taking of scanning points Arco de la Cabeza, cl. 2 –Virgen de las Penas, Plza. 5. Source: 360 BIM.
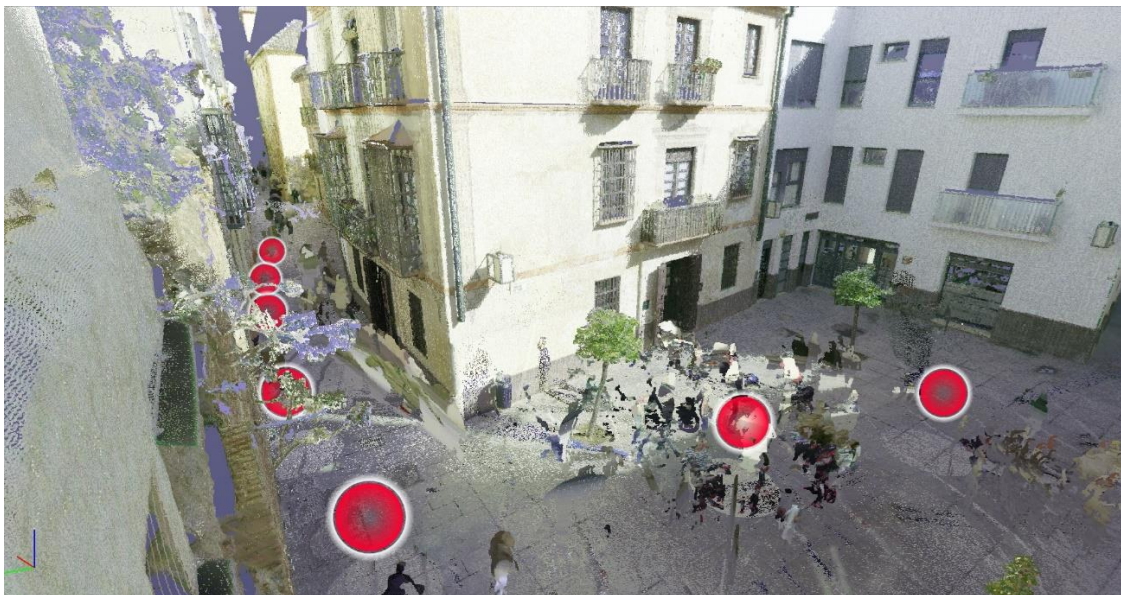

Figure 8. Taking of scanning points Arco de la Cabeza, cl. 2 –Virgen de las Penas, Plaza. 5. Source: 360 BIM.

As can be seen in the image, in this case, nine reference points were taken due to the urban position of the support building on a corner and very close to a wall, which made it more difficult to obtain a quality result with a smaller number of positions.

Although, indeed, the scanning of façades usually includes a percentage of shadows, as a consequence of the different architectural projections or elements that can be found, such as corbels, entablatures, closures, or balconies, their use acquires greater information in the final result than that obtained from a high-quality photographic image.

The scanner used, even without being calibrated, obtains, together with the BIM, an HDR photograph (high dynamic range images) whose quality is not at all questionable. Thus, when the laser scanning is carried out, we obtain an acceptable quality in the resolution of the possible changes, with an overall error of 1 mm (Figures 9 and 10). This margin of error allows us to control slumps or remains of pathologies in the future while allowing us to repeat the exercise soon and check the possible changes that the strata may have undergone, which would not be possible with another tool.

Figure 9. Calidad de los puntos en escaneo Arco de la Cabeza, cl. 2 –Virgen de las Penas, Plza. 5. Source: 360 BIM.

Figure 10. Scanning data collection details Arco de la Cabeza, cl. 2 . Source: 360 BIM.

7. Conclusions

The recovery of architectural and urban heritage in historic centres has become a priority, acquiring great value as a cultural product for cities as it supports local identities and is an important asset for growth (Armenta & Royo, 2017). This being so, the recovery of historical centres and their conversion into tourist destinations positions cities for new uses as urban spaces that must be transformed to meet cultural and tourism objectives associated with the values of the historic city. However, the thin and delicate line that separates tourist enjoyment and, therefore, those positive effects received also generates a series of dark and negative issues associated this time with phenomena such as the touristisation of heritage and the historic city (Grevtsova y Sibina, 2018).

The conservation of mural paintings, their effect on colour plans, and didactics and new technologies incorporated into the discourse of cultural tourism, are the elements that constitute the axes on which our research is based. We propose to create a transversal discourse encompassing the cultural legacy of painted architecture in a highly modified urban landscape subjected to the demands of contemporary dynamics. The vulnerability of this heritage is so great that it is doomed to disappear if joint action is not taken, and this type of research and knowledge initiative is a manifestation of the implementation of strategies that demonstrate its high heritage potential. The planning of a development model for quality cultural tourism must bear in mind that tourism activity must be an economic activity governed by the principles of quality and sustainability, capable of contributing to the maintenance and conservation of cultural heritage, avoiding the deterioration of cultural assets and respecting conditions of habitability (Caro et al., 2015).

About the intervention work, the incorporation of new technologies plays an increasingly relevant role, being an essential reference in all methodological processes of knowledge, treatment, and enhancement of cultural property, given the high degree of technification acquired by conservation and restoration in recent years, both at the level of scientific instrumentation and the increasingly precise and sophisticated analyses (Bellido, 2018).

As a complementary working tool in disseminating and interpreting heritage, ICTs facilitate general access to knowledge for society and, therefore, protect and conserve our heritage. This aspect of guardianship is not only related to the consultation of databases or digital documentation but also to access to all types of information, which, in turn, heritage research allows us not only to visit or consult, thanks to the digitalisation of documents or databases, but also to the use as a support for dissemination and reconstructions and virtual recreations in 3D of the assets which have become one of the most important tools for research, conservation, and dissemination of cultural heritage, allowing us to understand graphically part of our history in the different spaces provided: museums, documentaries or information sheets. (Quesada, 2019). Although the field of cultural heritage is full of intentions related to digital approaches and community participation, there is still a lot of work to be done, especially when trying to include both aspects of heritage conservation in the same experience.

Finally, and in relation to the level of innovation in the work presented, it is important to point out that never before had studies like the one we present been carried out in the specific case of the previous studies carried out on mural painting in the city of Malaga. Until now, data had always been collected to obtain information related either to illustrate the type or as part of the studies before a future intervention related to the state of conservation of the outer layer, ignoring the actual building supporting the mural painting and focusing on obtaining details that would provide more information for future intervention or consolidation. It should be noted that, at least in the city of Malaga, this type of analysis had never been carried out before, nor had this type of result been obtained, where the internal layers and/or the pathologies obtained could be collected and identified to complete the current state of conservation of the entire property.

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