‘EXPANDED’ EXPERIENCES OF KNOWLEDGE OF CULTURAL HERITAGE: THE CASTLE OF ROCCARAINOLA, A CASE STUDY

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ACCESSIBILITY
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EQUIRECTANGULAR IMAGES
VIRTUAL TOUR

This paper offers a detailed exploration of significant advances in the field of studies aimed at preserving and making accessible virtual experiences related to the Cultural Heritage of small urban centers.
Through the use of the latest digital methodologies for virtual tours, the fundamental importance of the use of equirectangular imagery as a primary tool in the creation of virtual itineraries is highlighted, thus enabling an in-depth understanding and appreciation of the historical legacy represented by the majestic castle of Roccarainola.
The evolution of visual recording techniques over time, from the earliest hand-painted panoramas to monochrome panoramic photographs and, more recently, to high-resolution equirectangular images, illustrates the surprising path and increasing attention paid to digital preservation of Cultural Heritage. Analog panoramic images, although limited compared to the quality and accuracy of today's digital images, have considerable documentary value, offering a unique glimpse into the past and allowing interesting comparisons with contemporary representations.
So, this study focuses on the implementation of innovative techniques for the documentation and enjoyment of cultural heritage, effectively demonstrating how high-quality visual representation plays a crucial role in making tangible, through immersive virtual environments, the cognitive and appreciative pathways related to this important historical record.

INTRODUCTION

In the current context, characterized by the pervasive diffusion of knowledge through Digital Culture, a pressing need emerges to explore and promote innovative methodologies for the valorization and communication of Cultural Heritage. Scientific research in the field of Cultural Heritage has as its primary objective the creation of paths aimed at understanding the historical-cultural heritage.

This contribution aims to examine in depth the experiences, processes and methods aimed at facilitating interventions aimed at understanding and protecting this central aspect of scientific research[1].

Within the context of an epochal transformation driven by digitalisation, this research draws inspiration from an initial reflection by the author, then extending to consider the significant contribution offered by the discipline of Drawing in this transition. In the European context, initiatives such as *NextGenerationEU* and, more specifically in the Italian context, the *National Recovery and Resilience Plan* with particular reference to programming for Tourism and Culture 4.0, underline the crucial importance of digitalisation, involving not only large cultural centers but also the patrimonial riches of small urban centres.

In an era in which the digitalisation of content plays an increasingly predominant role, it becomes imperative to act without delay to guarantee the free use and accessibility of even minor cultural realities, eliminating any form of barrier in the implementation of actions to this end.

Images, especially through advanced technologies such as equirectangular photography and interactive virtual tours, play a key role in the valorisation and enjoyment of cultural heritage (Zerlenga, 2018). These tools allow a detailed and in-depth analysis of architectural sites, allowing specialized and non-specialist users to explore the architectural, artistic and historical elements in a comprehensive and engaging way.

The interactive visualization, supported by high definition and immersive images, offers an experience that goes beyond mere photographic viewing. Through virtual tours, users can explore the details of works of art, architecture, historical finds or archaeological sites, allowing for an in-depth understanding of their complexity and intrinsic cultural value.

These advanced visual tools not only provide a detailed and accurate vision of cultural heritage, but also offer remote access and enjoyment without spatial or temporal limits. This implies that users from any part of the world have the possibility of accessing these cultural resources without necessarily having to physically visit the place, significantly extending the interested audience and ensuring a wider dissemination of knowledge.

In this context, the essential importance of the equirectangular image and the digital methodologies of the virtual tour is underlined (Figure 1). These tools are essential for the creation of a virtual path aimed not only at revealing the authenticity and importance of the castle of Roccarainola (NA), but also at preserving and recovering the historical memory contained therein.

This approach offers a unique opportunity to enjoy and learn about an architectural heritage imbued with meaning, for the benefit of current and future generations.

'IMMERSIVE' IMAGES FOR THE REPRESENTATION OF CULTURAL HERITAGE: BETWEEN ANALOGUE AND DIGITAL

In exploring and interpreting the world, humans rely on their senses, but it is the visual language that has a particularly strong and lasting influence on conscious actions. The brain regions dedicated to vision, more extensive and intricate compared to other senses, impart a considerable impact on an individual's interactions with the surrounding environment through visual perception.

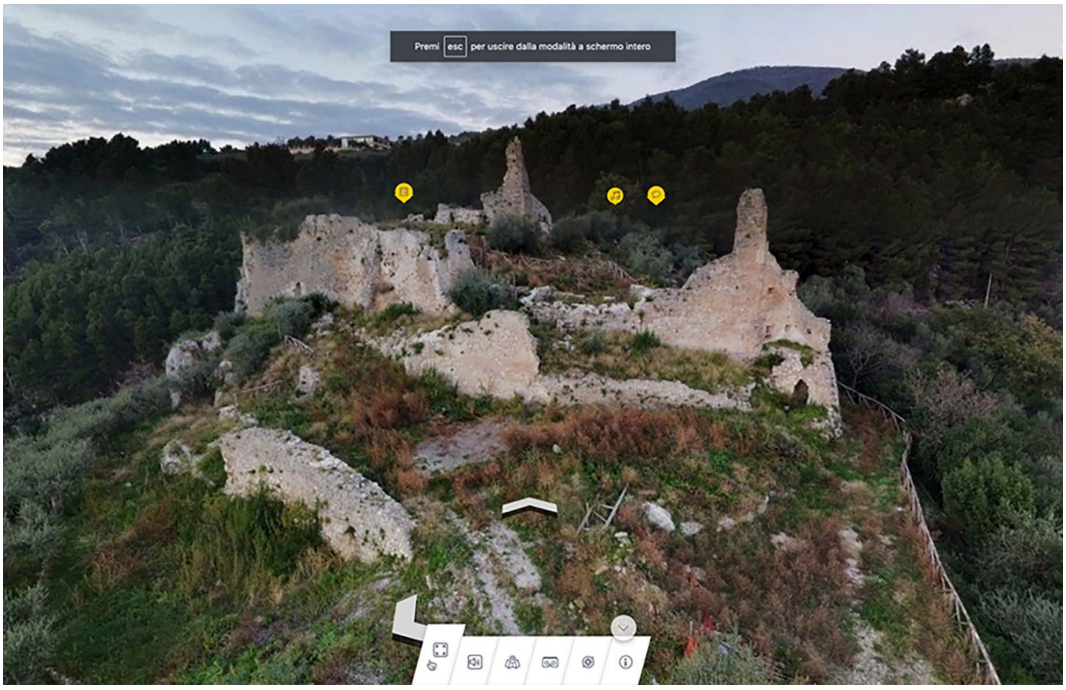

Fig. 1 Roccarainola Castle. The Virtual Tour, (by R. Miele).

As emphasized by Grote, "the sight of a landscape is to mentally travel through it", a concept that retains its validity even when three-dimensional landscapes or environments are reproduced through digital technologies (Unali, 2003). Digital images depicting a landscape become essential tools not only for understanding the place, discerning shapes, distances, and colors, but also for creating a mental connection with it. These images provide stimuli that contribute to "restoring a coherent image to our consciousness" (Grote, 1901).

The ability of digital images to represent an environment in a detailed and precise manner enables mental exploration of those places from a distance, facilitating the experience of an imaginary journey that promotes understanding and connection with the depicted context. In other words, through digital images, we are able to mentally explore real or imagined places, assimilating information and creating cognitive connections that expand our understanding and interaction with the surrounding world.

Fig. 2 Rock art, Caves of Chauvet (top) and Lascaux (bottom), France (Retrieved April, 22, 2023 from https://www.focus.it/).

The theme of 'augmented' reality visualization, understood as an image that surpasses the natural limit of the human visual field, although seemingly linked to digital culture, has roots in much older times. In this regard, the drive to experiment with a pseudo-panoramic or pseudo- spherical vision, hindered by the 'limited' extension of the human eye's visual field, has consistently led humans to experiment with graphic techniques capable of expanding its boundaries, as evidenced in the extensive graphical production inherited from the history of art and cartography. Consider the example of Paleolithic cave art found in the *Chaveaut* and *Lascaux* caves in France (Figure 2). In these caves, mural paintings followed the natural profile of the caves, where prehistoric authors ingeniously utilized their characteristics, employing their shapes, protrusions, and recesses to create scenes and representations that seem to envelop the observer in a 360-degree panorama, thus creating an almost panoramic vision.

This mode of spatial representation then began to spread from the 15th century in an extensive artistic production, which only between the 19th and 20th centuries introduced the concept of 'curvilinear perspective.' Undoubtedly, the initial hints of cylindrical perspective are delineated in specific

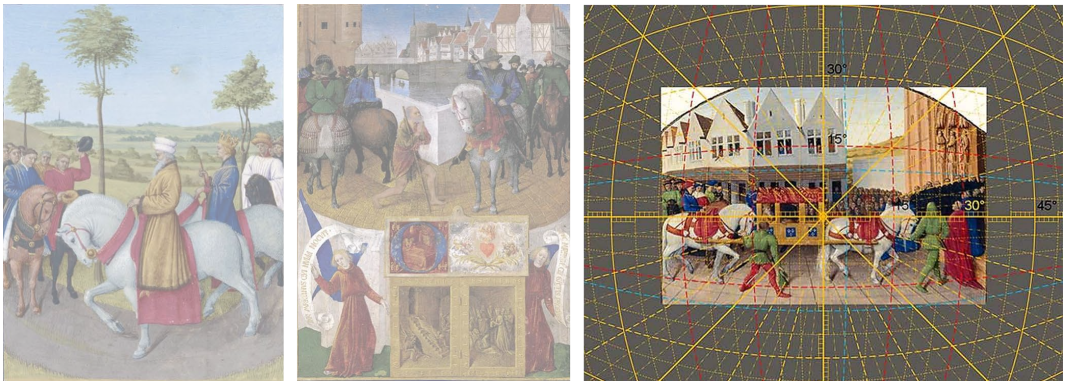

Fig. 3 From left: J. Fouquet, *L'empereur Charles IV et les dignitaires de Paris*, 1455-1460; J. Fouquet, *La charité de Saint Martin*, 1455-1460; J. Fouquet, *Entrée de l'empereur Charles IV à Saint-Denis*, 1455-1460 (Retrieved September, 27, 2023 from https://www.studioargento.com/immersiva/foto-immersiva1.html).

paintings by Jean Fouquet (1420-1481), highlighting the early experiments in this (Figure 3).

However, it's in the subsequent works of artists such as Carel Fabritius (1622-1654) with the view of Delft, Joseph Mallord William Turner (1775-1851) with the view of Petworth Park, and John Vanderlyn (1775-1852) with the panoramic view of the gardens of Versailles that we find a more in-depth exploration and progressive development of cylindrical perspective. (Avery & Fodera 1988) (Figure 4).

These artists expanded and deepened the use of cylindrical perspective through their works, employing this technique to represent landscapes and spaces in a more extensive and engaging manner. Their experiments contributed to the understanding and advanced application of 360-degree vision in art, broadening the possibilities of visual and spatial representation. Meanwhile, the initial steps towards spherical representations can be traced back to the majestic works of Flemish masters who adeptly employed the use of reflective convex mirrors. This technique notably manifested in the artistic production of artists such as Van Eyck (1390-1441), Robert Campin (1378-1444), and Petrus Christus (1410-1475) (Figure 4). Undoubtedly, Flemish artists of the 15th century stand out as pioneers in the use of convex mirrors to achieve more realistic and intricate pictorial representations. Techniques that would undergo improvements implemented by artists like Girolamo Francesco Maria Mazzola, known as Parmigianino (1503-1540),

Fig. 4 Examples of panoramic and spherical representation in painting. a) J. Fouquet, *La charité de saint Martin*, 1455-1460; b) J. Fouquet, *L'empereur Charles IV et les dignitaires de Paris*, 1455-1460; c) J. Fouquet, *Entrée de l'empereur Charles IV à Saint-Denis*, 1455-1460; d) J.M.W. Turner, *Petworth Park*, 1828-1830; e) C. Fabritius, *View of Delft*, 1652; f) J. Vanderlyn, *Panoramic View of the Palace and Gardens of Versailles*, 1818; (Retrieved September, 27, 2023 from https://www.studioargento.com.html).

with his work *Self-portrait in a Convex Mirror* from 1524, as well as by Sandro Botticelli (1445-1510), with his work *Madonna of the Magnificat* from 1483 (Figure 5).

The deliberate use of this reflective technique allowed them to acquire a broader and distorted visual perspective of the painted scenes, resulting in a pictorial rendering that accentuated the perception of depth and spatiality in the artwork. The expansion of these early experiments toward a more spherical vision played a fundamental role in the subsequent development of painting techniques and in the progressive understanding of visual implications in representation. From what has been presented, it is evident that immersive representations of space

Fig. 5 Van Eyck, *Portrait of the Arnolfini spouses*, 1434 (top left); R. Campin, *Saint John the Baptist and the Franciscan master Enrique de Werl*, 1438 (bottom left); P. Christus, *Saint Eligius in a goldsmith's workshop*, 1449 (top centre); Q. Metsys, *Le Prêteur et sa femme*, 1514 (bottom center); Parmigianino, *Self-portrait within a convex mirror*, 1524 (top right); Botticelli, *Madonna of the Magnificat*, 1483 (bottom right) (Retrieved September, 27, 2023 from https://www.studioargento.com/immersiva/foto-immersiva1.html).

are not a modern concept; rather, they have their roots in ancient times. The origins of this concept can be traced back to distant periods, indicating human interest in creating immersive environments since ancient times. In fact, the desire to immerse oneself in the surrounding space and represent it in an engaging and enveloping manner is not a novelty of the contemporary era but reflects humanity's ancient quest to interpret and understand the surrounding world through different visual modalities.

In this regard, tracing back to the previously mentioned Paleolithic cave art in the caves of *Chaveaut* and *Lascaux*, it is evident that from these representations of the ancient Stone Age, a crucial point emerged introducing a significant change in the proportions of the graphic representation framework, favoring a different horizontal ratio, such as 5:4, 4:3, 3:1, 2:1, and so forth (Figure 1).

This change in proportions not only highlights a transformation in artistic approach but also a desire to bring the representation of space closer to human visual perception. This choice aims to establish a more immediate connection between the artwork and its observer, seeking to involve the observer more deeply in the graphic representation. These novelties in the proportions used in art can be understood as among the earliest examples of a graphic approach that

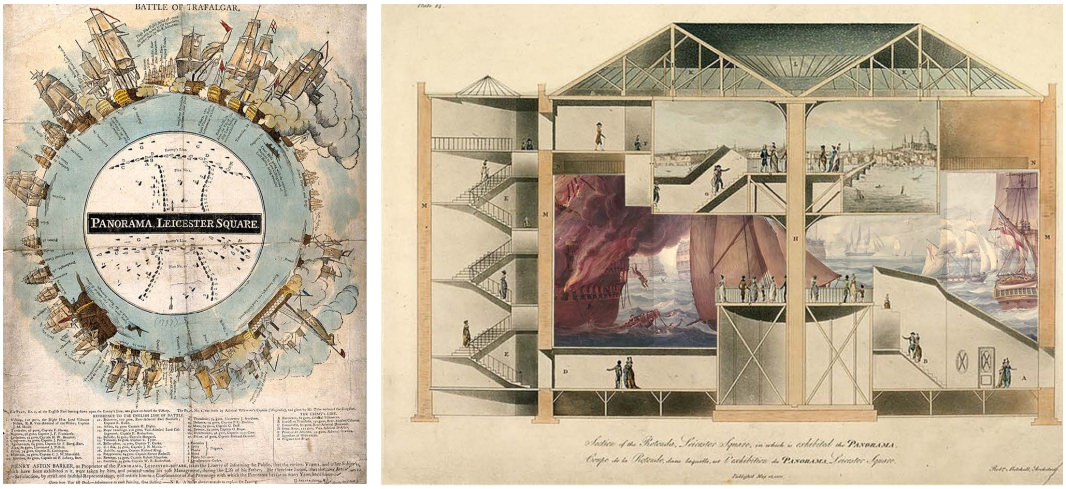

Fig. 6 Robert Barker, *Panorama Brochure of the Battle of Trafalgar*, 1806; R. Mitchell, *Vertical section of R. Barker's Panoramic Rotunda in Leicester Square*, London, 1801; Simulation of the panorama display of the Battle of Trafalgar (1806) by the authors (Retrieved August, 8, 2023 from https://wellcomecollection.org/works/).

explores and exploits the horizontal relationship to broaden the vision and engage the observer more actively in the represented space. It marks a turning point in artistic conception, as it paves the way for a more 'expansive' representation of space, giving rise to a new perspective that aims to involve the viewer more deeply in the reproduced environment.

Closely connected to the theme are also the 'panoramic' views of cities by Robert Barker (1739-1806), from which in 1792 emerged the patenting of a new method to rearrange paintings along a curved surface. This event precisely associates the significance of the term 'panorama': 'pan' (πᾶν) meaning 'all,' and 'orama' (ὅραμα) meaning 'view,' to the concept of a comprehensive vision and the production of spherical, immersive, and augmented images (Figure 6).

In fact, these works consisted of paintings or images arranged along the inner surface of a cylinder, allowing, from a central point of view, a complete 360-degree vision of the artwork. This innovative approach enabled viewers to explore and fully immerse themselves in the artwork because they could rotate around the cylinder and perceive the entire representation from every angle, thus allowing for a deeper and more engaging understanding of the work itself. From the 19th century to the early 20th century, panoramic represen-

Fig. 7 Simulation of the panorama display of the *Battle of Trafalgar* (1806) (elaboration by the authors).

tations, also known as 'cycloramas' or 'dioramas,' became a mass cultural phenomenon in many parts of Europe. Temporary cylindrical environments were created to accommodate large-scale paintings (Figure 7) (Pulvirenti, 2021).

The ability to immerse oneself in 360-degree scenes, embracing images of historical battles, natural environments, or exotic worlds, aroused strong interest and pleasure among the public. These representations offered the opportunity for intense visual experiences, allowing the audience to mentally immerse themselves in distant and fascinating scenarios. The capacity to explore distant places through these panoramic views provided an engaging and unique experience, enabling observers to connect with otherwise remote and unknown worlds. In parallel with cycloramas, promotional brochures for panoramas also began to circulate, such as the well-known Brochure for the Panorama of the Battle of Trafalgar in 1806 by Robert Barker (Figures 7, 8).

In this context, these brochures are significant as they are geometrically connected to current and widely circulated

Fig. 8 Simulation by the authors of different panorama scenes of the *Battle of Trafalgar* (1806) inserted in the vertical section of R. Barker's *Panoramic Rotunda in Leicester Square*, London, 1801 (elaboration by the authors).

spherical photos with the 'tiny planet' effect, derived from images captured at 360 degrees (Figure 6).

From the panoramic paintings of the 18th and 19th centuries, the evolution of technology has opened and continues to open new horizons in the approach to representing the cities and their architectures.

Technological advancements have represented a significant turning point in how we explore and represent urban environments. New techniques and tools, such as photography and digital graphics, have expanded the possibilities of capturing, interpreting, and communicating the complexity of cities and their architectural structures. These advancements have not only enabled faithful documentation of environments but also exploration of new perspectives, visualization of intricate details, and more interactive and engaging communication with the audience. In this way, modern technologies have paved the way for new modes of exploration and understanding of cities, offering increasingly detailed and engaging visions of their architectures and the urban environment as a whole (Cirafici & Zerlenga, 2020).

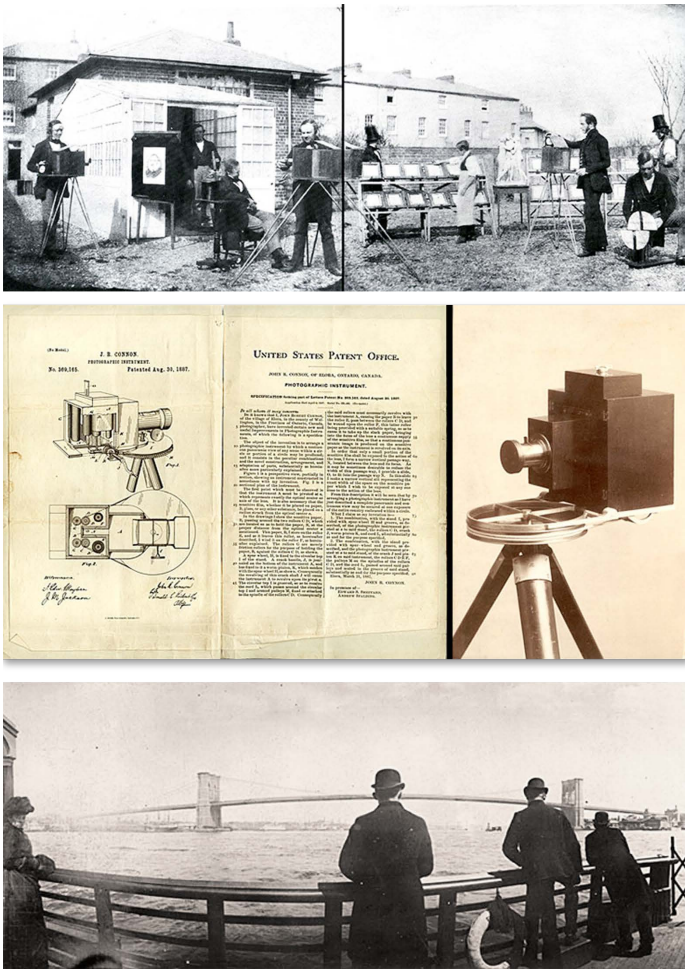

Fig. 9 W.H Fox Talbot, *Talbot's printing establishment at Reading*, c.1845; John R. Connons, patented 360° camera; *Brooklyn Bridge*, 1980 (Retrieved May, 6, 2023 from https://www.metmuseum.org/art/collection/search/283065).

Indeed, the epochal advent of photography marked a significant transformation from painted panoramic views in the 18th and 19th centuries to the early photographic experiments by Fox Talbot (1800-1877) (Carbasso, 2023), the first photographer to conceive the technique of the photo-mosaic (the combination of multiple sequentially taken photos) as a method for panoramic photography (Figure 9).

Therefore, photography marked a significant turning point in the history of visual art, as it introduced a new medium that allowed for a more precise, accurate, and detailed representa-

Fig. 10 . Eadweard Muybridge, *San Francisco*, 1877-1980. (Graphic elaboration on the photo by M. Cicala) (Retrieved May, 6, 2023 from https://www.nyhistory.org/blogs/-muybridges-spooky-panorama).

tion of the world. This innovation not only enhanced the ability to capture reality with an unprecedented level of realism but also transformed the way artists and society viewed and understood their surroundings, influencing various artistic movements and visual culture as a whole.

The initial experiments by Fox Talbot and other photography pioneers paved the way for new ways of capturing images, allowing the immediate and faithful immortalization of reality. Panoramic views, previously hand-painted, found in photography a new form of expression, offering the possibility to document landscapes and cities with an unprecedented level of precision and detail (Figure 10) (Pillsbury, 2023). These experiments opened new horizons in visual exploration, introducing a photographic perspective that changed the way we perceive and interpret the surrounding world.

Nevertheless, despite rapid technological evolution leading to the production of increasingly specific and high-per-

formance machines (rotating cameras, Arthur C. Pillsbury's circuit panoramic camera with a rotating lens) (Scott, 2006), it was with the development of digital imaging in the 20th century that the transition to the new stitching methodology occurred, with images mapped in equirectangular projection.

The digital sphere, particularly through the production of equirectangular images, opens new horizons for the exploration and understanding of cultural heritage, especially when there are limitations in accessing cultural assets.

These images enable a 360-degree visualization, revealing details and contexts that might otherwise be inaccessible (Di Luggo & Zerlenga, 2020).

This type of imagery allows for the examination of intricate relationships between the observer and the represented space. Exploring a 360-degree image enables the simultaneous engagement of multiple dimensions of the human experience: embracing physical, emotional, intellectual, and social aspects. These representations offer a 'virtual experience' that allows users to fully immerse themselves in the cultural and historical context, even when physical presence in these places is impossible or limited. In this way, digital technology amplifies the potential for knowledge and engagement with cultural heritage, leading to an enrichment of historical and cultural experiences without physical boundaries.

VIRTUAL ITINERARIES FOR THE DIGITAL ENJOYMENT OF ROCCARAINOLA CASTLE

This contribution aims to prefigure the intrinsic and multifaceted meaning of a study aimed at enhancing and effectively communicating the cultural heritage and historical memory associated with the ancient remains of Roccarainola Castle. The primary objective of this research is to adopt an innovative approach focused on promoting accessibility and inclusion, aiming to generate interest among diverse users and engage them in immersive virtual interactive experiences.

Fig. 11 . From left: G. Mocetto, *Ager Nolanus cum adjacentibus Regionibus*, in A. Leone, De Nola, 1514; Unknown, *Topographic plan of the city of Roccarainola*, 18th century, Naples, BNN, Sec. Manuscripts, B°5 C 93; *View of the castle from via G. Matteotti* (Drone photography by R. Miele).

In this context, the synergy between images and virtual reality within an expedient approach emerges as the most suitable mode among those feasible and implementable.

In this specific context, this investigation focuses on the significant role played by equirectangular images in the context of digital access to Cultural Heritage.

This type of imagery, commonly known as 'spherical' images due to their ability to represent the projection of a spherical surface onto a rectangular plane, allows users to or-

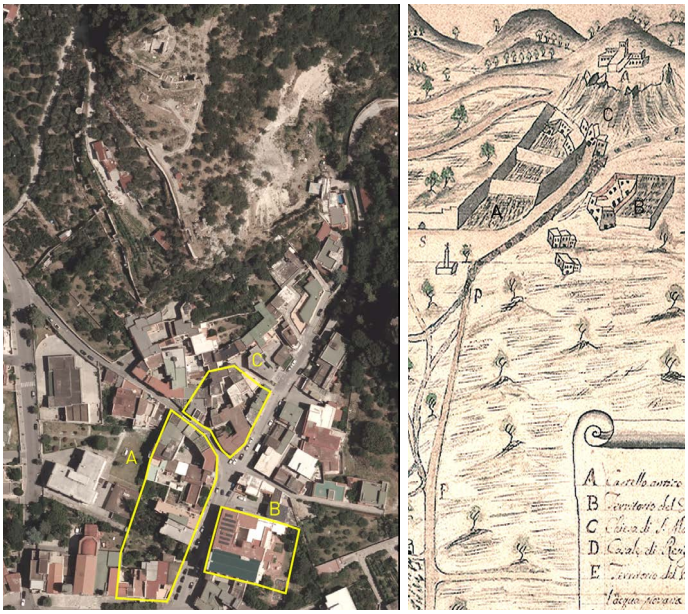

Fig. 12 Reading and comparison of historical documentation with the state of the places: A. Palazzo De Rinaldi; B. Conventual Minor Fathers; C. Medieval village.

bit around their central axis, enabling movements both vertically and horizontally (Figure 15).

This methodology presents itself as an expedient and cost-effective approach, proving effective in rekindling general interest in numerous cultural sites considered 'minor.' These sites, often overlooked or entirely unknown, benefit from the ability of these images to make their exploration in a virtual environment accessible and engaging, thus contributing to the valorization of lesser-known yet significant locations.

From this perspective, Roccarainola Castle stands as an example of relevance, both as a fortified structure of more modest dimensions and as a historical testament scarcely known among its own citizens. Specifically, it's a modest defensive structure situated in the Agro-Nolano, whose remains still today bear tangible connections to the surrounding urban development since its early construction phases (Rocchi, 1908; Manzi, 1999; Capolongo, 2001) (Figure 11). This small fortress, with traces of a glorious past, represents a focal point in local history, highlighting an intrinsic link with the evolution of the nearby settlement over the centuries.

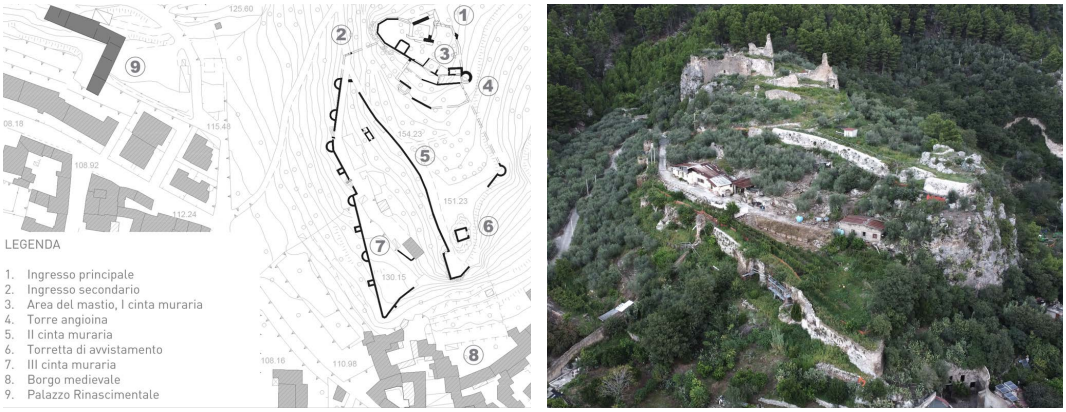

Fig. 13 . Roccarainola Castle, general plan with identification of the constituent elements still visible. Cartography of the Municipality of Roccarainola; aerial photo of the southern side of the castle (elaboration and photo by R. Miele).

Considering its defensive function and, consequently, the need to oversee the entire Agro Nolano valley, the castle perches on a hill of Monte Majo, emerging as a tangible testament to the region's history since the 12th century. During the Swabian era, it harmoniously integrated into the dense network of castles and fortified structures in Terra di Lavoro.

Dominating the landscape from this elevated position, the castle constituted an essential link in the chain of defenses and architectural testimonies characterizing the area, particularly the defensive line stretching from the so-called Matinale Castle of San Felice a Cancello to reaching the castle of Avella at the opposite end. Its presence not only symbolized the power and strategic importance of fortified settlements in that historical period but still today reveals details and stories of ancient Terra di Lavoro, providing a significant window into an era of considerable importance in the history of Campania Pars Orientalis (Cordella, 2007).

The image of the castle, mirroring its history, has undergone transformations over the centuries due to interventions necessary to adapt to evolving defensive techniques. These interventions, occurring over time, have contributed to altering the original structure of the fortress.

The lack of documents and images makes it difficult to analyze the construction phases and reconstruct the castle's appearance at its abandonment.

Fig. 14 The castle in the urban dimension (Drone photography by R. Miele).

The absence of a robust documentary and iconographic apparatus represents a significant obstacle in fully understanding the architectural history of the castle.

This gap makes it difficult to delineate the various stages of its structural evolution and, above all, to reconstruct the exact appearance it had when, already in a state of disuse, it suffered definitive destruction during the German bombings of 1943 (Capolongo, 2001).

Nevertheless, what local scholars have supported regarding the origins and developments of the small fortress still serves as a valid starting point useful for formulating, albeit approximate, hypotheses that allow visualizing how the original structure of the castle might have appeared. Even today, for instance, it is possible to trace among the dense vegetation the path outlined by the three defensive walls which, connecting with each other, wind along the irregular ridges of the rocky terrain. The first of these walls delineates the area of the keep, within which remains of robust walls are still visible, suggesting the presence, according to observations by Manzi, of an imposing palatium (Figures 12, 13). Therefore, by observing the traces left by these defensive walls, it's possible to hypothesize about the layout and function of the different sections of the castle. The evident presence of the remains of considerable height within the first defensive enclosure suggests the hypothesis of an important fortified residence, whose architectural impact is still perceptible from the visible traces.

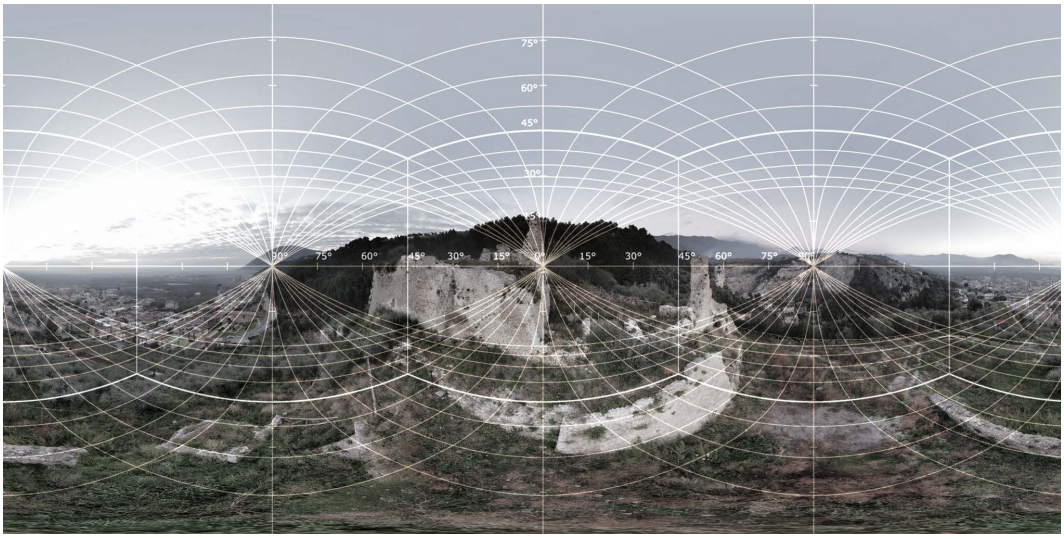

Fig. 15 Geometric construction of the equirectangular images obtained for the castle.

From the southeast corner of this area, the point of intersection between the first and second defensive enclosures, emerges the circular Angevin tower, a structure clearly subsequent to the fortified enclosures. Extending south from this tower is the second curtain wall, strategically positioned to adapt to the complex terrain's configuration.

It's noticeable that this wall exhibited a robust wall structure on the southwest side, while on the east side, it featured smaller dimensions, presumably considering the steep rock face inherently impenetrable.

The third enclosure connects to the second through a small quadrangular-shaped observation turret and further extends along the southwest slope, bordering the rocky outcrop on which the keep and fortified palace stand. The expansion of this third curtain wall contributed extensively and strategically to defending the southern part of the castle complex, embracing and protecting the main structures of the castle in a commanding position (Manzi, 1999; Cordella, 2007).

Therefore, Roccarainola Castle emerges as a focal point for the town's visual and cultural identity, deeply rooted in its history, culture, and traditions. However, despite efforts to revive the surrounding area, the castle, having remained

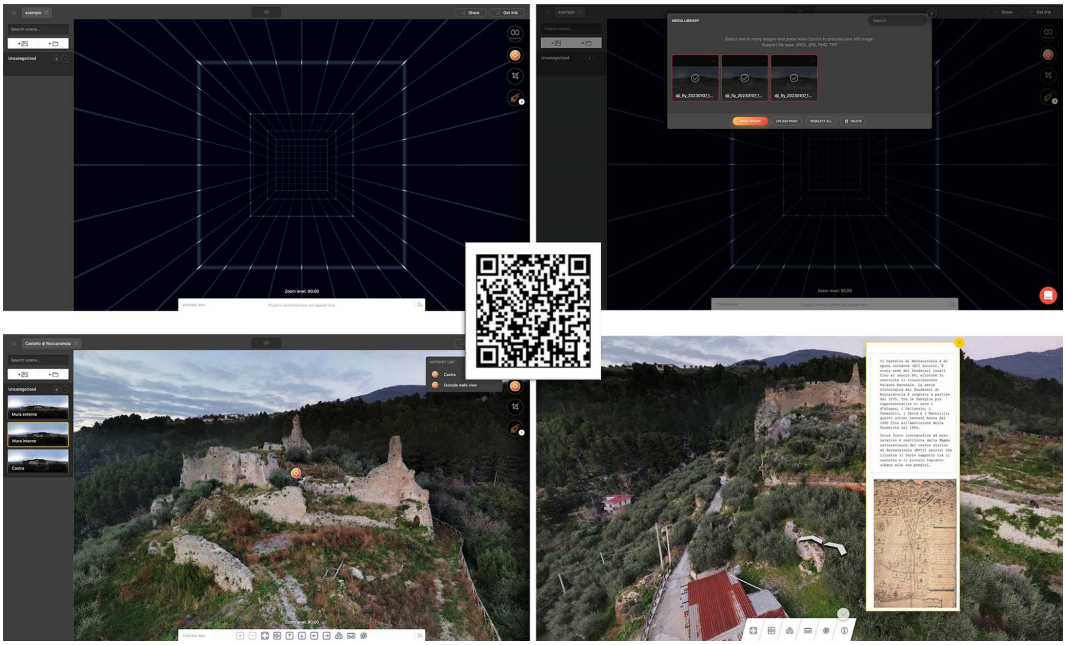

Fig. 7 Configuration phases of the virtual path using the Lapentor open access software. (Graphic processing by R. Miele).

abandoned for an extended period and subjected to evident unauthorized occupation, is currently under renovation and, therefore, not accessible to the public. This situation prompts reflection and a targeted intervention to address the current issues of accessibility and utilization of Cultural Heritage, following the principles of the discipline of Design. Consequently, the urgent need to preserve the castle's historical memory found a practical response in employing Digital Culture tools, particularly through the adoption of the Virtual Tour methodology. These tools have opened up new scenarios in enhancing and experiencing cultural heritage, enabling the public to explore the castle and its history virtually and interactively, even during periods when physical access is limited or impossible.

Given the constraints of inaccessibility, it was necessary to employ a drone, specifically the DJI Mavic Mini 2 model, which, using the panoramic shooting mode, captured the frames required for creating the indispensable equirectangular images to initiate the virtualization project (Figures 14, 15).

The use of *Lapentor* software, a free and open-access VR platform, facilitated the construction of the virtual tour. Through a simple and intuitive interface, the operator could upload various scenes (the equirectangular images) and link them together using specific transition hotspots. In the case of Roccarainola Castle, the project envisages exploring three distinct environments that allow observing the castle from different perspectives: from outside the walls, inside the walls, and in the keep area. The path was customized based on the project's specific objectives and target audience.

The use of multimedia hotspots allowed configuring a journey enriched with content useful for understanding the fortified structure. The description of the layout was facilitated through elaborate graphics and textual information, accompanied by vocal tracks generated using the open-access text-to-speech platform, *FREETTS*.

The Virtual Tour is accessible on all devices via a link or by scanning a QR code, without the need to install third-party apps. The interface, simple and intuitive, offers complete control of the virtual tour through a single control bar, enabling audio management, *VR* experience settings, gyroscopic function, georeferencing information, and project details (Figures 16, 17).

In this context, the use of Digital Culture tools emerges not only as a valid but also as a precious approach. Apart from promoting targeted actions to enhance and preserve historical memory, these tools prove effective in overcoming current limitations hindering direct access to heritage sites.

The application of Digital Culture not only initiates processes for recovering and valorizing the past but also represents a fundamental opportunity to sustain interest in cultural heritage even in temporary situations when physical access is limited. This perspective opens new avenues to make historical and cultural heritage more accessible and engaging for a broader audience, offering an immersive exploration and learning experience that transcends both temporal and geographical boundaries.

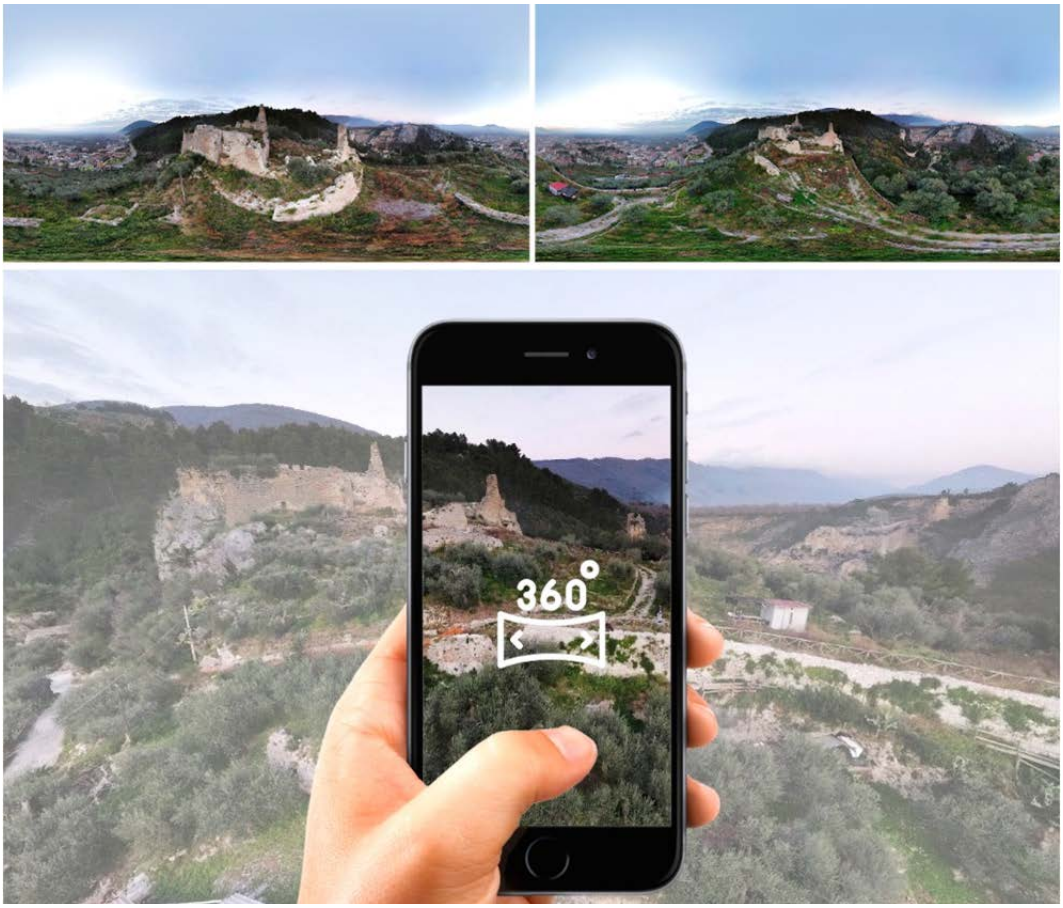

Fig. 8 Spherical (or equirectangular) images of the Roccarainola castle with simulation of the virtual experience using spherical visualization software (elaboration by R. Miele).

CONCLUSIONS

The research analysis conducted, far from being just a reflection, emphasizes primarily the crucial and multidimensional role of Design in the creation of images intended for the virtual consumption of knowledge. This implication not only leads to a deep and thorough reflection on current issues related to the recovery, communication, and valorization of cultural heritage, especially in smaller urban areas but also assumes an increasingly prominent role when the image itself 'expands,' becoming a driving force for initiatives within the sphere of Digital Culture. In this context, the image be-

comes a tool to achieve the goal of making shared cultural heritage more accessible and inclusive, broadening the horizon of users and consumers.

The imperative need to preserve the historical memory of Roccarainola Castle highlights the pressing demand for intervention capable of rekindling a sense of rediscovery among citizens, especially for a place often overlooked due to its familiarity and daily proximity.

A dynamic and expeditious approach takes shape in the development of a virtual tour designed not only to overcome physical and cultural barriers but also to create an immersive and inclusive environment. This approach aims to evoke vivid interest and curiosity in visitors, placing them at the very center of an engaging, interactive, and participatory learning experience that encourages active exploration and deeper understanding of the content. Looking towards the future, the project reveals extensive opportunities for expansion and improvement, offering possibilities for continuous content and scenario integrations. This flexibility allows the project to extend to new historical sites, within a virtual network of cultural routes in constant expansion. Furthermore, with the hope of a probable recovery of the examined area, the virtual tour could not only catalyze the revitalization of local tourism but also act as valuable support for on-site visits, providing an engaging and comprehensive multisensory experience for visitors.

In conclusion, these ongoing advancements not only confirm the cardinal role of Design and digital images as essential elements for the consumption and valorization of Cultural Heritage but also underscore their potential in fostering an innovative and future-oriented approach within the expanding Digital Culture sphere. This evolving landscape shapes itself as fertile ground for creating more complex, personalized, and participative cognitive and cultural experiences, aimed at a diverse and ever-growing audience of cultural consumers, thus contributing to a more inclusive, immersive, and deeply enriching cultural experience for all.

NOTES

1. This contribution is the result of collaborative work. The *Introduction* and *Conclusion* paragraphs are attributed to Ornella Zerlenga; *'Immersive' images for the representation of Cultural Heritage: between analogue and digital* is attributed to Margherita Cicala, and *Virtual itineraries for the digital enjoyment of Roccarainola Castle* is attributed to Riccardo Miele.

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