FRANCISCO JAVIER MELERO RUS
MARIA LUISA BELLIDO GANT

UNIVERSITY HERITAGE AND TECHNOLOGIES

CURRENT EXPERIENCES IN ANDALUCIA

#10

AUTHORS

FRANCISCO JAVIER MELERO RUS
Dpto. Lenguajes y Sistemas Informáticos, Universidad de Granada
fjmelero@ugr.es

MARIA LUISA BELLIDO GANT
Dpto. Historia del Arte, Universidad de Granada
mbellido@ugr.es

ABSTRACT

In this text we intend to approach the diverse heritage of the Andalusian universities to understand/analyze the most interesting experiences carried out in the work of diffusion and its relation to information and communication technologies (ICTs). We will analyze the usage of 3D scanning for cataloguing and disseminating movable and immovable artworks, the use of an app and QR codes to access the content, or the immersive experiences of 360° videos to allow connecting heritage with distant people and territories.

KEYWORDS

Heritage; University; New Technologies; Dissemination; 3D Scanning; App; Immersive Videos; Web

INTRODUCTION

University heritage is, in general, largely unknown, both to the users of these assets and to the public. The importance of this living and active heritage lies in the fact that it is intimately linked to the history of the depositary universities[1] and alternates historical, artistic, and scientific values with teaching[2], learning, research and management this occurs fundamentally with the scientific collections of the universities.

Many of these collections are dispersed within the buildings that make up the different university campuses, although there are also cases where they are integrated into university museums. One of the first international examples of this type of museum is the Ashmolean Museum which opened in 1683 and is linked to the University of Oxford. In Spain, we should highlight the Museo de la Universidad de Alicante (MUA), the Museo de la Universidad de Navarra (UNAV) and the Museo de la Universidad de Valladolid (MUVA), to name but a few. In terms of collections, the Complutense University of Madrid has 30 collections distributed in Health Sciences, Humanities, Heritage and Science; or the University of Salamanca, which recounts its eight centuries of history through its heritage.[3]

The interest aroused by university heritage explains the creation of the European Academic Heritage Network (Universeum) in 2000 and the foundation of the International Committee of UMAC (International Committee for University Museums and Collections) in 2001 with the aim of conserving, preserving, and communicating university collections and museums. This Committee has carried out different research projects such as the one entitled "*The Professionalisation of Museum Work in Higher Education: A Global Approach*" in collaboration with ICTOP (ICOM's International Committee for the Training of Personnel), the AAMG (Association of Academic Museums and Galleries, USA) and Universeum, the European Academic Heritage Network.

Relying on the use of ICTs, the typological complexity together with the need for dissemination has led many universities to implement projects to make this heritage visible and conserve it[4] as part of their commitment to the institution, the university community and the general public.[5]

In this context, it is worth noting that Andalusian universities, aware of their rich and diverse heritage, have been carrying out inventory and cataloguing work as a vehicle for the conservation and dissemination of these assets. In recent years, these tasks have increased with the use of ICTs and today, many of these universities present their heritage on specific websites that serve to make them visible and disseminate them.[6]

In this context, it seems interesting to present an experience of collaborative work for the conservation, dissemination, and enhancement of university heritage coordinated by the University of Granada.

WEBSITE AND APP

The Vice-Rectorate for University Extension and Heritage of the University of Granada coordinates the "*Andalusian Universities' Virtual Heritage Portal Project*", which is part of the Atalaya Project.[7] In the framework of this project, which has been developed since 2010 in its web version[8], a mobile application called Atalaya3D has been available since 2016[9] to access the catalogue of the most significant works and buildings of the artistic heritage of the ten Andalusian public universities.

This mobile application makes it intuitive and easy to consult the technical data of the works, and to access their multimedia content. Among those are photographs, audio descriptions, videos, and even three-dimensional models of buildings, rooms, and sculptures obtained from high-precision 3D scans.

An exclusive feature of the mobile application, not available on the project's website, is the recognition of QR codes found on the posters of the works of art exhibited in the different Andalusian universities, so that the textual and multimedia information can be accessed by simply photographing the QR code. Furthermore, these codes are prepared so that any user with any code reader can access the information on the heritage asset, redirecting them to the project's website even if they do not have the Atalaya3D application installed. The Atalaya3D app, available for iOS and Android platforms, can be downloaded from both the Apple AppStore and Google Play, by searching for "Atalaya3D" or following the links available on the website.

The Atalaya3D collections have also recently been included in a more general-purpose tourism application, "Aumentur"[10]. In this application, visitor guides have also been created for museums, such as the Health Museum of the University of Granada (MUSAL), or routes through the heritage of the universities with the geolocation of their points of interest.

3D DOCUMENTATION OF MOVABLE AND IMMOVABLE ASSETS OF THE UNIVERSITY HERITAGE

Within this project, it seems fundamental to us to list a line of developments by which we have obtained 3D models with high precision, which also serve as very valuable documentation of the asset that can be used by the restoration-conservation teams of the different universities.[11]

By obtaining highly accurate and detailed geometric models, it is possible to obtain valuable documentation of the surface of the artwork, enabling remote studies, semantic annotations on damaged areas, or propositions for interventions[12]. They even allow for the simulation of physical forces to detect cracking points[13] or to rebuild missing parts.[14] A 3D digital documentation of a sculpture

offers much more information than a simple photograph, and makes it possible to generate unique elements to make the work more accessible to people with visual impairments by 3D printing, or even to simulate spatial locations more realistically.

To this end, the project is supported by the most advanced acquisition devices on the market and a team of highly experienced researchers and professionals in charge of the technical tasks (specifically, professors from the TARVIS Research Group, Advanced Virtual Reality, Interaction and Simulation Technologies, TIC-236). The movable assets are digitised with a resolution of 0.3 mm (10 points per sq. mm) and an average error of 0.03 mm, using a structured white light scanner that is calibrated before each scan to obtain the highest fidelity to the original piece.[15] Heritage rooms and buildings are digitised with a laser scanner offering resolutions down to 1 mm, capturing both the colour and geometry of the property. More recently 3D modelling has been carried out using photogrammetry.

The Virtual Portal is a continuously evolving and expanding project. There are more than 1000 files in the database, 15% of which have three-dimensional information in the form of a 3D model that can be examined by the visitor without the need to install any additional software, using a simple browser only. This 3D visualisation on the web makes the project a pioneer on a national level, as since 2010 it has allowed the visitor to observe the works from any angle and distance interactively,[16] when X3D standard was adopted.[17]
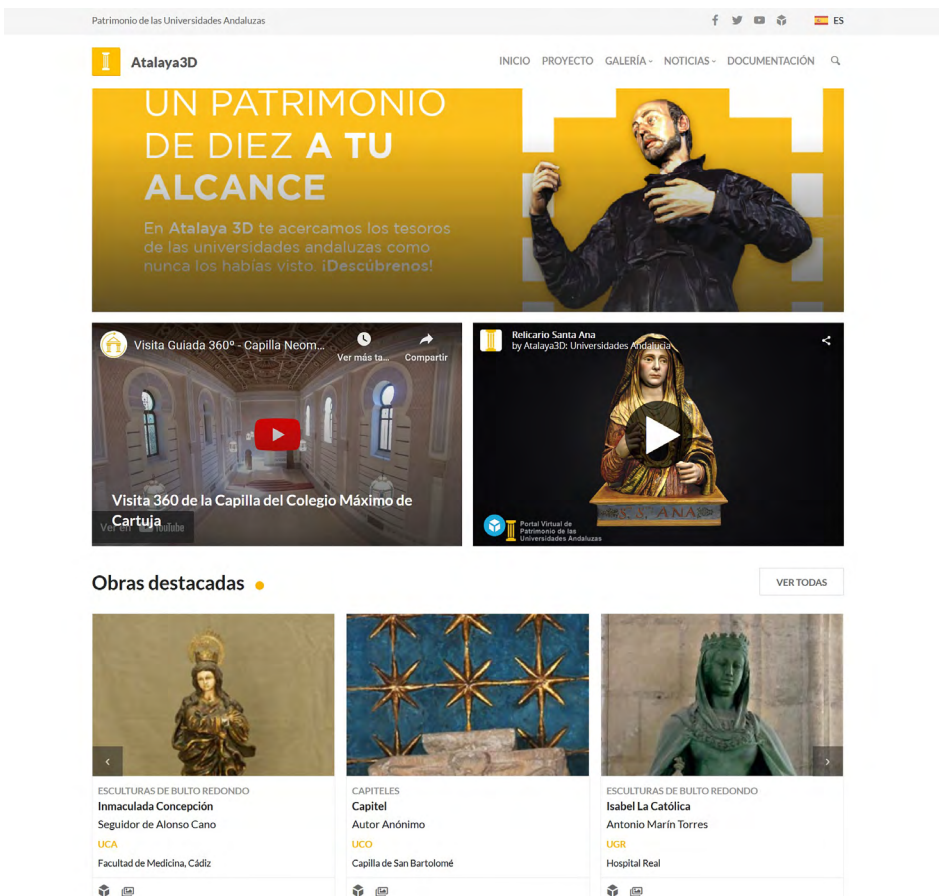

FIG. 1. Atalaya 3D Website
© Portal Virtual de Patrimonio de las Universidades Andaluzas.

On #MuseumWeek 2016[18], the catalogue of 3D models was included in the Sketchfab® platform in its own account[19]. This platform is currently the main repository of disseminating 3D models on the web, easily integrated into social networks such as Facebook and Twitter. The platform's Virtual Portal is at the same level as other museum such as the British Museum or the National Archaeological Museum of Spain. It is the institution that has published the highest percentage of works with absolute geometric accuracy, as no photogrammetry has been used in any of them.

In addition, the availability of 3D models facilitates the creation of animated infographics which, thanks to social networks, allow easy dissemination of the university heritage. So far, 36 videos have been created, many of which are already on YouTube and accessible to any user by visiting the web portal, while the rest are in the process of being edited.

It is a project in which all Andalusian public universities participate, which aims to bring the university heritage closer to an interested public as a first step towards its dissemination.

Among a total of 28 heritage buildings digitised in 3D, the Oratorio de la Madraza[20] of the University of Granada stands out for its complexity. For this monumental space, data collection was carried out using a high-precision laser scanner for medium-distance data. Seven spherical shots were taken, each providing 20 million colour points, with a precision of less than 1mm, and a resolution (separation between points) of approximately 2mm on average. After several months of
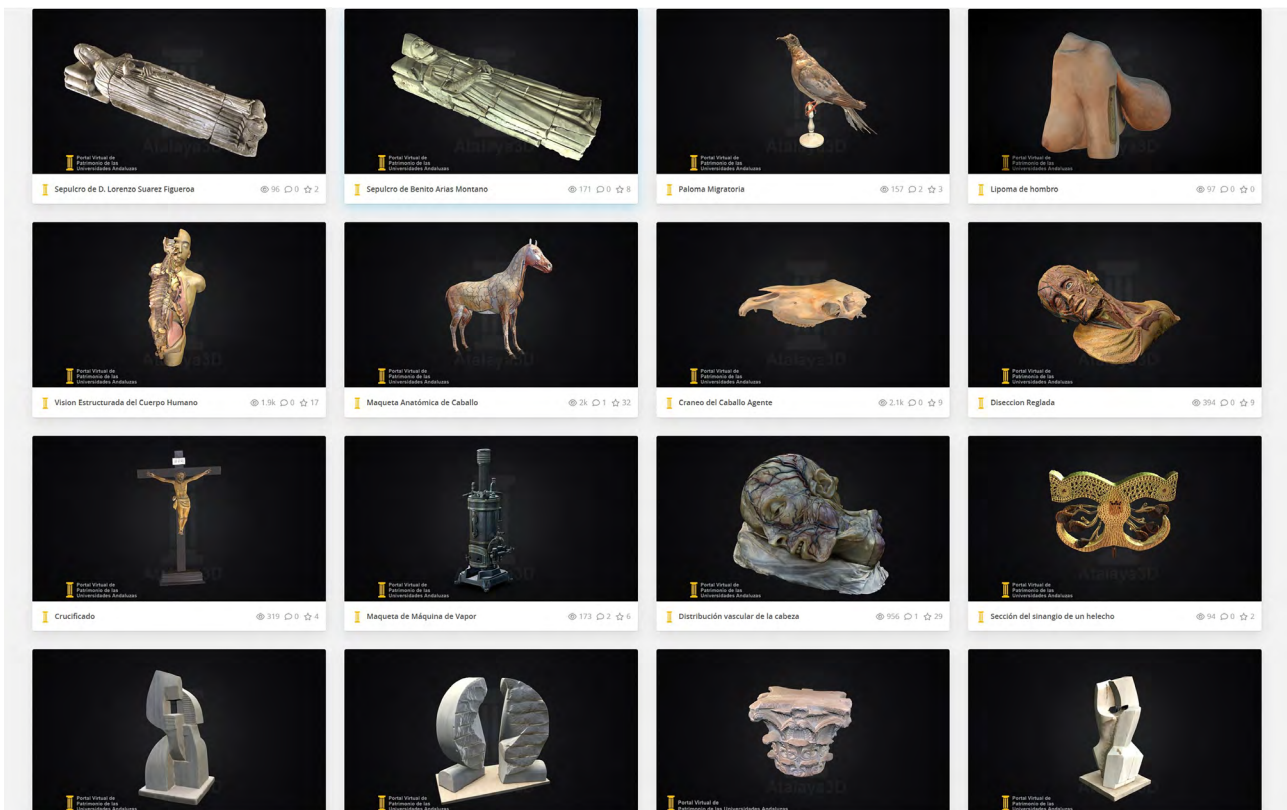

FIG. 2. Some examples of the catalogue of 3D models in the Sketchfab® platform.
© Portal Virtual de Patrimonio de las Universidades Andaluzas.

processing, a polygonal model of 50 million triangles has been generated which reproduces the muqarnas and coffered ceilings of the chapel, as well as the archaeological remains under the glass floor with maximum reliability.

Although high precision and high-quality documentation of the vault and walls is available, for the web visualisation of the oratory, it has been necessary to simplify the model to around 900,000 triangles, which is a not insignificant quantity. Even though it can be visualised on today's mobile phones, a few years ago it was difficult to use on desktop computers. In addition to this modelling, the project also includes other buildings belonging to the Universities of Seville, Jaén, Málaga, Córdoba, and the International University of Andalusia. The project also includes the scanning and generation of 3D models of 71 movable assets belonging to the Universities of Almeria, Cadiz, Cordoba, Granada, International University of Andalusia, Jaen, Malaga, and Seville.

360º VIRTUAL VIDEO TOURS

In 2019, it was decided to incorporate 360º video guided visits as a new informative resource into the project, which, due to the emergence of the COVID-19 pandemic turned out to be a pioneering idea worldwide. In these resources, the virtual visitor takes a video tour of the historical space in question, being able to direct their view at any time to the point of interest that most catches their attention. During the pandemic, under the hashtag #quedateEnCasa (#stayAtHome), the public was encouraged to use these resources to continue making cultural visits.

#QúedateEnCasa
y date **una vuelta**

Visita virtual por inmuebles históricos de nuestras universidades

FIG. 3. Banner of virtual tours of historic buildings of Andalusian universities launched during the pandemic.
© Portal Virtual de Patrimonio de las Universidades Andaluzas.

In contrast to the so-called 360º virtual tours made with spherical photographs, the material in this case is a video with a voice-over (or a guide in person) which tells the viewer the history and details of the monument as if it were a face-to-face visit. In addition, multimedia resources such as 3D models or infographics are integrated into the image which support the visit and enhance the experience.

So far, six 360º virtual tours have been carried out, some of which, such as the Royal Hospital of the University of Granada[21], have been viewed more than 4000 times. In other cases, such as the Pantheon of Illustrious Sevillians of the University of Seville, the resource has allowed the general public to get to know a space that is normally not very accessible. Currently, there are 360º video tour resources at the Universities of Cordoba, Granada, and Seville, and work is underway to create new resources for the Pablo de Olavide University and the International University of Andalusia, among others.

CONCLUSIONS

We are convinced that this project not only serves to make university heritage visible and publicise it, but also enriches collaborative networks and allows us to jointly tackle cross-cutting heritage conservation projects.

The generated 3D models are available for research purposes, so this project has increased the quality of the documentation of the main artworks of our universities. We were pioneers in uploading and disseminating sculptures in 3D websites in 2010, and our aim is to continue introducing new 3D assets for scientific research and public knowledge, as well as CT scans of the smaller pieces.

This is a project that, after twelve years, continues incorporating the latest technological innovations for the dissemination of heritage, and to make culture accessible to everyone, creating connections between the territories, and highlighting both the history and the latest advances of the university community.

FIG. 4. 360º Panoramic view of the virtual video tour to the Sala Neomudéjar of the Colegio Máximo at the University of Granada.
© Portal Virtual de Patrimonio de las Universidades Andaluzas.

ENDNOTES

1 See the Salamanca Declaration on the historical-cultural heritage of universities. Salamanca, 11 January 2008, signed by the rectors of the universities of Salamanca, Alcalá, Barcelona, Granada, Oviedo, Basque Country, Santiago de Compostela, Seville, Valencia and Valladolid. http://umac.icom.museum/wp-content/uploads/2017/05/declaracion_SALAMANCApatrimonio_2008.pdf

2 Alfageme & Martin 2006; Hernández 2008.

3 Vozmediano 2016.

4 e.g. González & Prado 2017.

5 Díaz 2012; Bellido 2013.

6 Vozmediano 2017.

7 Bellido & Melero 2016.

8 https://atalaya3d.ugr.es

9 "App Atalaya3D: el patrimonio artístico de las universidades andaluzas en el bolsillo", TV report in Historias de Luz (http://www.historiasdeluz.es/historia-del-dia/cultura/noticias-andalucia-atalaya3d-app)

10 https://www.aumentur.app

11 Melero & Jiménez 2012, "Patrimonio Virtual", TV Programme "Tesis" about Portal Virtual de Patrimonio de las Universidades Andaluzas, Atalaya3D: https://www.youtube.com/watch?v=S4Kc97A_aM4

12 Soler et al. 2017.

13 Callieri et al. 2004.

14 Melero et al. 2010.

15 Revelles & Melero 2014.

16 Jiménez et al, 2012.

17 Magnor et al. 2015.

18 See https://secretariageneral.ugr.es/informacion/noticias/el-portal-virtual-de-patrimonio-de-las-universidades-andaluzas-se-une-a-la-museumweek (accessed: 31/07/2024)

19 https://www. sketchfab.com/atalaya3d

20 https://atalaya3d.ugr.es/obra/palacio-de-la-madraza (accessed: 31/07/2024)

21 https://www.youtube.com/watch?v=HT_51uRaeg4

BIBLIOGRAPHY

- Alfageme & Martin 2006: B. Alfageme, T. Martín: Uso formativo de los Museos Universitarios en España, in: Revista de Teoría y Didáctica de las Ciencias Sociales, Mérida-Venezuela, 2006, no. 11, pp. 263–286.

- Bellido & Melero 2016: M. L. Bellido Gant, F. J. Melero: Atalaya3D: El Portal Virtual de Patrimonio de las Universidades Andaluzas, en Revista PH, Instituto Andaluz del Patrimonio Histórico, Consejería de Cultura, no. 89, 2016, pp. 15–16.

- Bellido 2013: M. L. Bellido Gant: Arte y museos del siglo XXI. Entre los nuevos ámbitos y las inserciones tecnológicas. Barcelona, Universidad abierta de Cataluña, 2013.

- Callieri et al. 2004: M. Callieri, P. Cignoni, F. Ganovelli, G. Impoco, C. Montani, P. Pingi, R. Scopigno: Visualization and 3D data processing in the David restoration, in: IEEE computer graphics and applications, Nr. 24 (2), pp. 16–21.

- Diaz 2012: J. Diaz: Patrimonio universitario, patrimonio virtual, in: Educación y Futuro, Nr. 27, 2012, pp. 121–137.

- González & Prado 2017: Beatriz Prado Campos, María-José González López: La realidad aumentada aplicada a la conservación. Proyecto IVAPTA. Estudio y conocimiento de alteraciones en pintura sobre tela.

La ciencia y el arte VI. Ciencias experimentales y conservación del patrimonio, 2017.

- Hernández 2008: F. Hernández: Los nuevos retos de los museos universitarios, in: Revista de museología, Nr. 43, 2008, pp. 8–22.

- Jiménez et al. 2012: J. G. Jiménez, M. García, J. Revelles, F. J. Melero: Digitalización 3D y Difusión en Web del Patrimonio de las Universidades Andaluzas mediante X3D Y WebGL, in: Virtual Archaeology Review, no. 3, 2012, pp. 55–59.

- Magnor et al. 2015: M. Magnor, O. Grau, O. Sorkine-Hornung et al. (ed.).: Digital Representations of the Real World: How to Capture, Model, and Render Visual Reality. A K Peters/CRC Press, 2015.

- Melero et al. 2010: F. J. Melero, A. León, & J. C. Torres: Digitalización y reconstrucción de elementos cerámicos arqueológicos de torno. Virtual Archaeology Review, Nr. 1 (2), pp. 137–141.

- Melero & Jiménez 2012: F. J. Melero, J. G. Jiménez: Digitalización y Virtualización 3D en la Web de obras de arte, in: El Patrimonio Cultural y Natural como Motor de Desarrollo, Investigación e Innovación. Sevilla, Universidad Internacional de Andalucía, 2012.

- Revelles & Melero 2014: J. Revelles, F. J. Melero: El Portal Virtual de Patrimonio de las Universidades Andaluzas, in: XXIV Congreso Español de Informática Gráfica (CEIG 2014), Zaragoza 2014.

- Ruiz Torres 2017: D. Ruiz Torres: El uso de tecnologías digitales en la conservación, análisis y difusión del Patrimonio Cultura, in: Anuario AC/E 2017 de Cultura Digital. Acción Cultural Española. Madrid 2017, pp. 130–214.

- Soler et al. 2017: F. Soler, F. J. Melero, M. V. Luzón: A complete 3D information system for cultural heritage documentation, in: Journal of Cultural Heritage, 23, 2017, pp. 49–57.

- Vozmediano, 2016: E. Vozmediano: "Museos universitarios de arte en el mundo", https://www.elespanol.com/el-cultural/blogs/y_tu_que_lo_veas/20160111/museos-universitarios-arte-mundo/93860619_12.html (visited 17/02/2022)