

SCHOLAR ARCHITECT 2021

English edition

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TRANSLATED BY Florina TUFESCU

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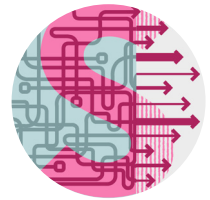
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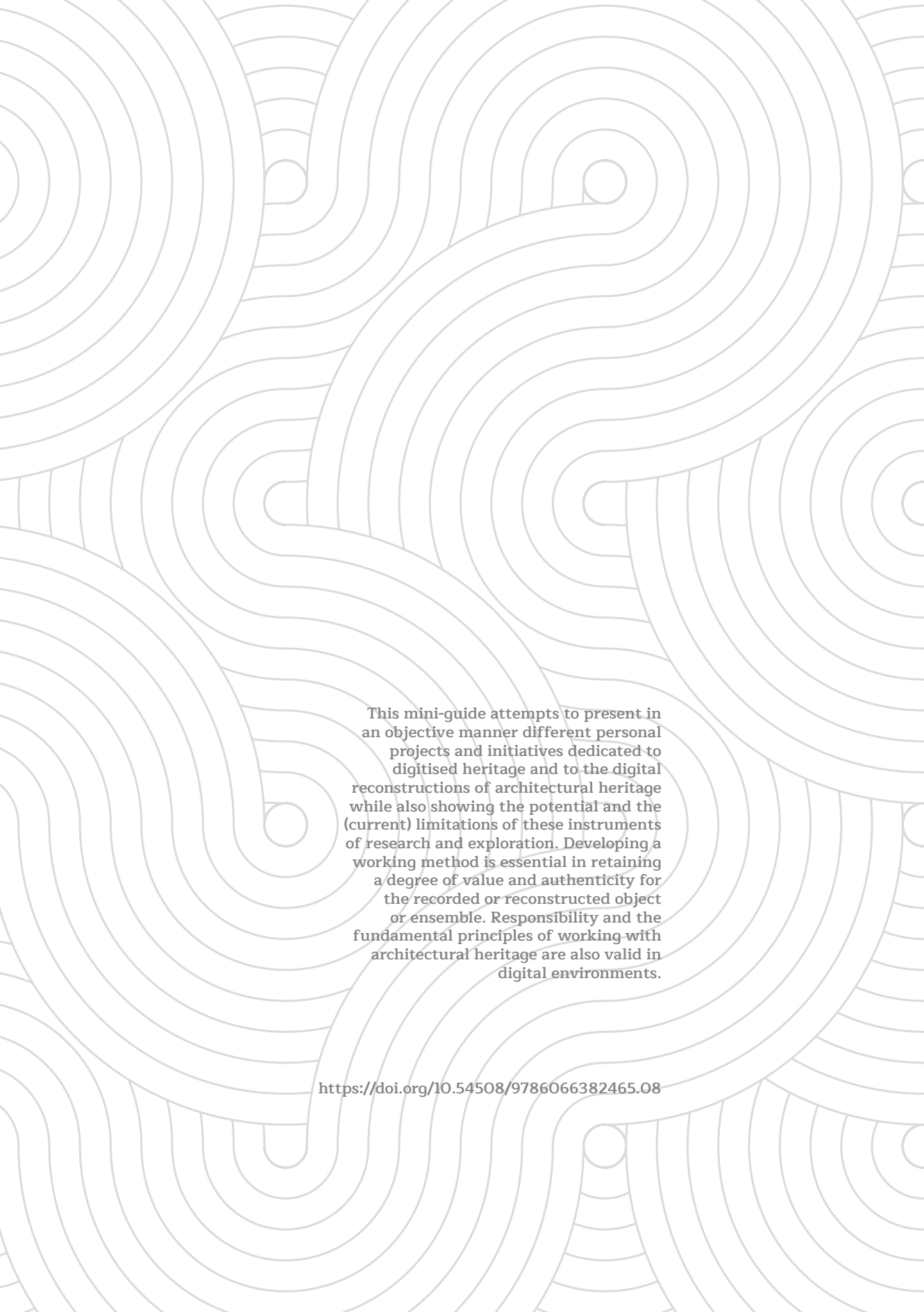
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This mini-guide attempts to present in an objective manner different personal projects and initiatives dedicated to digitised heritage and to the digital reconstructions of architectural heritage while also showing the potential and the (current) limitations of these instruments of research and exploration. Developing a working method is essential in retaining a degree of value and authenticity for the recorded or reconstructed object or ensemble. Responsibility and the fundamental principles of working with architectural heritage are also valid in digital environments.

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Digitised and born-digital heritage

Univ. Assist. Ioana Elena ZACHARIAS VULTUR PhD Arch.

Introduction

The original version of this chapter was aimed at the students of the “Ion Mincu” University of Architecture and Urban Planning and of all the Romanian universities with this profile, from all years of study (I-VI), at doctoral students, trainee architects and young professionals in architecture and related fields who deal with design, specialisation or research themes that concern heritage. The language has thus been simplified for greater clarity and accessibility.

This paper is a continuation of the short exploration, intended as a guide to “**The Historical approach**”, which was published in “**Research methods and techniques specific to architecture**” within the framework of the *Scholar Architect 2020* project. It presents possible versions of the **relationship between heritage and contemporary design in the context of the technological (r)evolution**. More precisely, we will refer to the **manner in which the latest digital technologies can be used for the benefit of architectural heritage**, both in the sphere of teaching and research and of actual interventions (restoration, conservation and design).

To complement the theoretical part, we will demonstrate how we explored **the relationship between architectural heritage and its digital or digitised versions (virtual reconstructions)** by organising and coordinating two activities within the framework of the project *Scholar Architect 2021 – Improving the quality of research and teaching in architectural education* project – CNFIS-FDI-2021-0069. This refers to the **Digital Heritage_webinar** (online seminar) and the **Digital Heritage_lab** (workshop), which took place in September 2021 and which will be described in detail in the subsequent sections.

The **keywords** of this mini-guide are:

digital heritage, digitised heritage

virtual anastylosis

VR and AR immersive experiences

open access to cultural heritage content

Why do we talk about digitised and digital heritage in our national architectural education and professional practice?

Although UNESCO defined **digital heritage** already in 2003 in the **Charter on the Preservation of Digital Heritage**, the rapid evolution of technologies and the transient pandemic context have increased reliance on the latest technologies and the need to research, to disseminate information, to explore and to intervene with their help. Digital technologies have enabled the following: the development of digitised databases, digital archives, specialised photogrammetry collections, 3D scanning of monuments as a precision instrument in interventions on architectural objects, the development of collaborative (international) platforms for distance work, museums and heritage sites made accessible through VR and AR, the capacity to diagnose and to establish the pathology of a monument or to uncover in a non-invasive way elements of the interior structure that cannot be observed otherwise.

The **interventions on monuments** as well as **context-related architectural design** can benefit from the use of these instruments.

We will briefly explore the forms of technology that can **serve heritage** by increasing data accuracy, and that can improve the quality of analysis and intervention as well as disseminate the value of heritage both to a specialist and a broad audience.

While **the history of the architectural profession and the evolution of architecture** in Romania are marked by moments of synchronisation and desynchronisation (Zahariade, Brătuleanu, 2008) with Western Europe, interrupted by various influences or characterised by introversion and isolation (1947-1989) or by prolonged transition, at present we are increasingly well-connected to the international landscape. With regard to architectural education on the topic of **heritage** – covering legislation, discourse, specialists and even good practice examples for restoration and conservation – we approach an increasingly high level, but we only have a limited number of good practice models in this area.

We can synchronise with the contemporary practices that have already attained a level of maturity in the international academic and professional environment. The international recognition of the Romanian architect diploma creates an opening and at the same time a need to align ourselves with ever higher standards. Familiarisation with digital

technologies – as a student and as a chartered architect preoccupied by **heritage** – constitutes an advantage on the (international) market of architectural services.

A coherent didactic vision is needed, with methods of work and research shared by the design studio as well as by the specialist (restoration and conservation) studios. The academic and professional level must also be made visible through **models of good practice** in the interventions on the national **architectural heritage** on a large scale: in the urban and rural space. These models need to be promoted; a clear balance must be established between doctrines, restrictions and permissions, with **good communication** and a good rapport with the general public and with the investors and the political sphere. Architecture and especially the architectural heritage of a state represent elements of identity, power and of economic and aesthetic appeal, which must be **valorised and optimally used**¹.

Furthermore, already from the time of our university studies and later as architects we have the task of acting as culture advocates, intellectuals and competent practitioners who cultivate the taste of the general public and who help improve the quality of life. Thus, if we wish to create a national space with **high-quality** interventions on **architectural heritage** (as well as on **urban, archaeological or landscape heritage**) we need to **communicate very well**. Architecture itself is a language through which we communicate, as stated in the description of one of the courses I coordinate at UAUIM, namely Architectural Language II: “We understand architecture as a language of signifying forms by means of which human beings remodel the existing and not as a simple act of communication or as a purely aesthetic act” (Criticos, 2021).

So it is about **responsibility**, but also about an intelligent and well-balanced **dialogue** with the past, about **creativity** and even about **innovation**.

The perception of the general public and also within the national group of professionals should be of heritage as an **asset** and not as a **liability**, as I argued in a lecture and article presented in New York in 2018 (Zacharias Vultur, 2018, p. 18). Towns, villages and landscapes grow organically through intermingling with various forms of **built heritage**, which in the long term encourages creativity and innovation, both artistic and scientific (technical).

From time immemorial, **architecture** has been influenced more strongly or discreetly by technical and technological (r)evolutions, sometimes starting from the imaginary level, pictured in anticipation literature

¹ Lecture on “valorised” and “optimally used” heritage by the members of the ARCHE team, presented within the framework of the “Schönberg Live Studio 2021” Summer School that took place in Dealu Frumos, the county of Sibiu, between 16 and 29 August 2021 at Casa Verde and at the Center for Vernacular Architecture Studies. Arranged by Ioana Zacharias Vultur, PhD, Scientific coordinator, together with the organising team. Project sponsored by the Architectural Stamp Duty, the Sibiu-Vâlcea branch of OAR (The Romanian Order of Architects).

and in the visual arts and subsequently transposed into specialised vocabulary and construction. I explored this theme in my doctoral thesis “The metaphor of the machine in modern architectural discourse. Le Corbusier and Norman Bel Geddes” (2012). With regard to **architectural heritage**, already from the Enlightenment, the great “Age of Reason” of the XVIIth and XVIIIth centuries:

“Modern interests in heritage and its conservation have always been closely connected with sciences and a scientific approach. [...] sciences should be used as a ‘tool’ according to the requirements of the different tasks coming up in conservation. [...] The role of science is to assist in analysing the genuine, historical material of such work” (Jokilehto, 2018, pp. 291-292).

The American philosopher Thomas Kuhn² discusses the position of **science** in relation to **history** in his book *Structure of Scientific Revolutions*, first published in 1962. The author notes a non-linear pattern in the rejection of science by communities whenever it made significant advances because it “introduced a radically new way of looking at nature and the behaviour of materials” (Jokilehto, 2018, p. 292). In addition, Kuhn defines the “scientific revolution” in **research** as a moment when science enters a crisis caused by methods that no longer provide satisfactory answers to newly emerged phenomena. Thus, the scientific revolution is the replacement of an old paradigm by a new one, with **new research methods and a new set of rules**. Of course, Kuhn mainly refers to research in physics or chemistry, but these revolutions and discoveries also influence architecture and the conservation and restoration techniques of the modern era.

By analogy, the development of the science of digital technologies gradually affects all forms of working with cultural heritage and it even generates a new category: **digital heritage**. As in the case of any new human creation with its accompanying “power”, it is essential that we only exploit its advantages and eliminate all the potentially negative aspects. This is why specialists take a responsible approach in defining research methods, the set of rules and principles and also the values on the basis of which the new digital technologies are to be used in working with **heritage**.

Definitions

It is essential to start from the definition of the term **digital heritage** and its composition as it appears in the vision of UNESCO.

According to the **Charter on the Preservation of the Digital Heritage** of 17 October 2003, republished in a 2009 UNESCO document:

² Thomas Kuhn (1922-1996) is one of the most influential philosophers of science of the XXth century and his book, *The Structure of Scientific Revolutions* (1962), is one of the most frequently cited of all times. Apart from his doctrines, Kuhn is credited with having inaugurated a new style in the philosophy of science.

“THE DIGITAL HERITAGE AS A COMMON HERITAGE

Article 1

Scope

The digital heritage consists of unique resources of human knowledge and expression. It embraces cultural, educational, scientific and administrative resources, as well as technical, legal, medical and other kinds of information created digitally, or *converted into digital form from existing analogue resources*. Where resources are “born digital”, there is no other format but the digital object. Digital materials include texts, databases, still and moving images, audio, graphics, software and web pages, among a wide and growing range of formats. They are frequently ephemeral, and require purposeful production, maintenance and management to be retained. Many of these resources have lasting value and significance, and therefore constitute a heritage that should be protected and preserved for current and future generations. This ever-growing heritage may exist in any language, in any part of the world, and in any area of human knowledge or expression.”

(Charter on the Preservation of the Digital Heritage, 2009, p. 2)

So this is about **“born-digital”** resources as well as those **“converted from existing analogue resources”**. There are forms of **digital heritage** originating from **digitised heritage** such as **digital reconstructions** from the level of artefacts up to the level of archaeological, architectural and urban ensembles, on the basis of analogue documents: drawings, plans, maps, printed texts, works of art, various documents from traditional archives etc.

According to the above-quoted UNESCO definition, the forms of **digital heritage** encompass both **“born-digital”** resources as well as those **“converted from existing analogue resources”**. **In this mini-guide** we will refer to the **digital heritage created by virtual architectural reconstruction of monuments**.

Digital heritage is “made up of computer-based **materials of enduring value** that should be kept for future generations. Digital heritage emanates from different communities, industries, sectors and regions. **Not all digital materials are of enduring value ...**”, as stated in the “Concept of Digital Heritage” article on the UNESCO website: <https://en.unesco.org/themes/information-preservation/digital-heritage/concept-digital-heritage>.

To sum up, it is about two types of relationship between heritage and the latest digital technologies, each of which can provide support for its preservation (archiving, scanning, recording and digital measurement etc.) and conservation for future generations (through investigative technologies but also through transmission in digitised form, including via reconstructions etc.). These have been discussed in my lecture titled **“VR in the service of Architectural Heritage”**, at the Tech4Culture conference at the French Institute in Bucharest on 3 March 2020.

The connection to the teaching objectives of UAUIM

The increasing preoccupation with **architectural heritage** reflected already in the first-year curriculum of the design studio activities of the “Ion Mincu” University of Architecture and Urban Planning facilitates knowledge transfer from the Department of History & Theory of Architecture and Heritage Conservation.

Continuous learning on the issue of **heritage**, with a gradual increase in understanding and critical thinking, can be achieved with the help of seminars, lectures and specialised subjects.

The themes of the restoration and conservation studio and the design, diploma project and doctoral research themes which make an intervention on a monument or additions to protected sites are already structured into work stages, based on **digitised** documents (scans of surveys, urban plans, drawings, old photographs, archival documents – texts, maps, etc.); thus, they use a few standard design programmes for vectorisation, for the marking of the pathology of the degradations, their values and degrees, and for the intervention proposal covering architecture, structure, restoration and conservation. So these are rather representations of data obtained from analogue sources and the value of the drawn pieces is illustrative rather than scientific.

Nevertheless, a few techniques and technologies are available to increase data accuracy and the quality of details by introducing scientific data and, frequently, details that would remain hidden with non-invasive methods: 3D photogrammetry, 3D scanning, LiDAR (which has revolutionised archaeological research), GIS technologies for data collection and mapping, instruments that measure the humidity or temperature of buildings and works of art (e.g. frescoes), etc.

How can the latest technologies support contemporary architectural education and practice?

They can function as an additional resource alongside the standard computer programs already used in architectural education, in restoration and conservation studios as well as in specialised practice since we can already describe these technologies as having attained “maturity” in the work with material heritage in all its forms, from the artefact scale to large urban ensembles and archaeological sites. They must of course be used **responsibly**, with a constant emphasis on the criteria of heritage **value** and **authenticity** at every stage of the analysis and, where appropriate, of the digital reconstruction.

It is about adding precision but also, frequently, adding new details, to the understanding of a monument, as shown by the following examples. These instruments do not replace on-site knowledge of the situation or the principles of restoration and conservation charters; they are not absolute truths, but only a technically more advanced stage.

Essential criteria and working methods for digitised and digital heritage (virtual reconstructions of architectural monuments)

Authenticity

It is worth recalling two principles of restoration that refer to the authenticity criterion, which I previously introduced in “**Research methods and techniques specific to architecture**”, in the chapter on “**The Historical approach**”:

“Restoration, Art. 9. The process of restoration is a highly specialised operation. Its aim is to preserve and reveal the aesthetic and historic value of the monument and is based on respect for original material and authentic documents.”

(The Venice Charter, 1964)

With regard to **digitised heritage**, this **principle of authenticity** is by and large or even fully observed since the digitisation process does not (intentionally) distort information and if there are discrepancies, these derive from the primary sources themselves. An example of discrepancies would be those between the initial project of an architectural monument (for planning permission), the classical survey based on standard measurement methods and its 3D scan. These can arise from modifications of the built monument versus the drawn project (for various reasons – economic, technical problems discovered during the construction process, compromises on style or construction materials, etc.) or from errors of the classical survey versus 3D or 4D scanning. These pieces are thus authentic and each of them can be seen as a “verification” of the architecture and of the state of a monument from several perspectives, even including the textual descriptions, the photographs or the artworks that describe it. The final project of restoration, conservation and intervention on an architectural object that is carried out on the basis of these pieces must thus constitute sophisticated research on all these layers of information in order to achieve the greatest possible precision and level of authenticity and thus preserve the value of the monument.

“Restoration should aim to re-establish the potential oneness of the work of art, as long as this is possible without committing artistic or historical forgery, and without erasing every trace of the passage through time of the work of art.”

(Brandi, 2005, p. 50)

This brief quotation from Cesare Brandi’s famous *Theory of Restoration* raises three issues on the **digital heritage** resulting from the combination of **the digitised** with “**born-digital**” components, namely the concept of “**virtual anastylosis**”, the potential **interpretative limitations**

and the necessity of defining a working method. These aspects were discussed in a very recent article published by researchers from two internationally recognised institutions – The Institute for Technologies Applied to Cultural Heritage, CNR, Rome, Italy and the Department of Archaeology and Ancient History & the Humanities Lab of Lund University, Sweden. Titled “Reconstructing the original splendour of the House of Caecilius Iucundus. A complete methodology for virtual archaeology aimed at digital exhibition” and thus referring to an ancient and well-known site of Pompeii, the article “starts with a discussion on the philological correctness of a reconstruction based on different kinds of sources, such as paintings, drawings, technical and literary texts, comparisons etc., and proceeds to explore the use of integrated 3D models (both reality-based and source-based)” (Demetrescu et al., 2016, p. 51).

The first project goal was “to survey, record and analyse an entire Pompeian city block, Insula VI” and the second was “to investigate how the use of such documentation may influence the archaeological effort to define the original appearance of the buildings that composed the insula” (Demetrescu et al., 2016, p. 52). If “anastylosis” stands for the reconstruction of a partially destroyed object through the greatest possible use of the original architectural elements (technique also employed in the restoration of ceramics or other small objects), “**virtual anastylosis**” is the reconstruction partly based on **in situ** elements and measurements and partly based on **non-in situ** elements such as watercolour representations of the ensemble, the interpretation of old photographs, plaster models, XIXth century technical drawings, etc. To come up with a working method, the project authors use a table that attempts to summarise the types of sources consulted for the virtual reconstruction of the Pompeian ensemble: objective sources (**in situ** ruins, the 3D model scanned with the TOF laser scanner, frescoes and abstracted architectural elements whose original position is known as well as photographic images and interpreted sources (scientific studies such as archaeology databases, published books, etc., or material evidence – old photographs of vanished frescoes showing their state of conservation during the first half of the XXth century, XIXth century watercolour paintings, technical drawings of the XIXth and of the XXth century and theoretical analogies and parallels to the in situ paintings, with decorative schemes specific to Pompeii, etc.). Thus, the topic of **authenticity** is viewed here from the perspective of potential **interpretative limitations** determined by two types of sources – **in situ** and **non-in situ** ones –, i.e. by the correct correlation of their positions in space (more precise or relative, depending on the source), the possible distortions or artistic representation of sources (photography, watercolour), but also by the accuracy of the textual descriptions.

This is why the authors of the research project and of the article have developed a **working method**, a workflow, to explain the exact steps to be followed, the modalities for verification and the ways in which the **virtual reconstruction** of this World Heritage archaeological site can become as free of imprecisions as possible, bringing a great deal of information and even indicating new elements, inaccessible with classical

instruments of measurement. The article provides a wealth of examples and explains the work process from a realistic perspective by indicating the various high-performing technologies that have been employed, the possible relationship between analogue, digitised and born-digital sources and the (current) limitations and benefits.

The use of equipment and of types of investigations using the latest software – 4D scanning, software such as Blender, Cloudcompare or Meshlab for the visualisation of morphology or Metashape for photogrammetry, 3DHOP as an online platform for work and dissemination – has enabled the discovery of internal details from the different phases of evolution that are otherwise hidden from sight and impossible to observe with non-invasive methods.

To conclude, an example such as this gives an **up-to-date** picture of the **state of knowledge** and of the possibilities of combining conventional methods with **digitised and born-digital heritage** sources to address **the criterion of authenticity in the virtual reconstruction of a historical monument**, in this case one belonging to **archaeological heritage**.

Value

While this criterion and its observation in the interventions on heritage sites and on historical monuments has been briefly discussed in the chapter on “The Historical approach” of the SCHOLAR ARCHITECT 2020 project, it will now be placed in relation to the forms of **digitised and digital heritage**, i.e. those **converted from analogue sources** and the **born-digital** ones.

As apparent from the above-quoted definitions in the Charter on the Preservation of Digital Heritage, “**Many of these resources have lasting value and significance**, and therefore constitute a heritage that should be protected and preserved for current and future generations.” (The Charter on the Preservation of Digital Heritage, 2009, p. 2). This means that not all resources have lasting value and significance. So what is digitally created **for the purpose of heritage preservation** and its transmission over time should not damage the **value** or image of the monument and should constitute a type of **valuable resource by itself**, through the quality of the final product, through the **added value** it brings in relation to knowledge and even to image (possibly unknown before, for example in the case of a reconstructed ensemble), etc.

It is thus important to assume **responsibility** for the use or creation of digital resources where heritage is concerned and not to distort the constructed reality but to be objective and precise.

This is the manner of working through which digital technologies can support heritage, augmenting its memorial, emotional, historical and aesthetic value. In addition, digital technologies can even help **safeguard** a monument or architectural or archaeological ensemble that faces a natural or man-made threat; they should therefore be used in a measured and balanced fashion.

Case study

An example of a study and project that adds **value** while also retaining the **authenticity** of a heritage site is given in the article “World Heritage, vernacular dwellings and digitalisation: the case of the Fortified Churches in Transylvania, Romania”, published in the 2020 edition of the UAUIM annual CSAV Journal, which I coordinate. The authors, widely recognised personalities in the protection of **architectural vernacular heritage** and UNESCO experts based at Escola Superior Gal-laecia, Portugal and at Universitat Politecnica de Valencia, Spain, introduce the project **3D Past**, which “was designed aiming at enlightening the European vernacular World Heritage” and subsequently developed by the two institutions between 2016 and 2020 in the project “Living and virtual visiting European World Heritage”, in the framework of the Creative Europe programme of the European Commission.

The stated aims of this research and reconstruction project were “studying and valuing the Outstanding Universal **Value** of these vernacular settlements”, understanding “how their **authenticity** is preserved” and “turning vernacular World Heritage Sites virtually accessible” (Correia et al., 2020, p. 15).

It focused on eight vernacular heritage sites, among which we find “Villages with Fortified Churches in Transylvania, Romania” listed in the fifth position. “The selection [...] is intended so the developed approach could be replicated, in the future, in other sites of Europe, and across the world.” (Correia et al., 2020, p. 16).

Given the complexity of the project, we will only focus on a brief review of the types of sources used and on the methods and results, i.e. the data that can illustrate a manner of working with **digitised and digital heritage**.

The method

Following research on the sites, on the elements of vernacular architectural heritage and on the geography of these areas, a digital platform – <https://www.esg.pt/3dpast/platform/> – and a virtual reality (VR) and augmented reality application (AR) were created. The case of the Transylvanian Saxon villages is presented on this platform page <https://www.esg.pt/3dpast/platform/transylvania.html>; it contains 3D models of houses and house ensembles, plans of fortified ensembles, house plans, technical drawings that explain the typical spatial configuration, technical details of the construction joints and of structure as well as photographs from the site and of the research and restoration teams at work and images that capture the local colour and atmosphere (Fig. 1).

The AR and VR elements can be accessed on mobile devices and via online platforms and one of the interactive experiences consists in “the real-time overlap between historical images and real observation [...] allowing the visitor to have a sensorial perception of the site’s evolution” (Correia et al., 2020, p. 32).

To conclude, this project, accessible by virtue of its digital character, is a model of implementation, of the combination of **analogue sources** and **born-digital sources**. The aim is to further enhance the global **heritage** sites, making them accessible to a broader public who can perceive them as **collective heritage**.

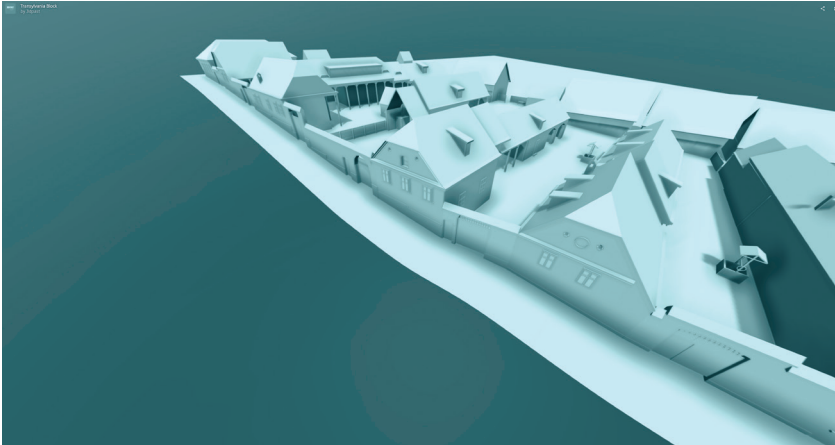


Fig. 1. 2D image of one of the 3D models from the digital platform of the 3D Past project.

The virtual reconstruction represents a special configuration, typical of the Transylvanian Saxon villages, in which the functional organisation and the construction links between houses can also be observed.

Image source: <https://www.esg.pt/3dpast/platform/transylvania.html>

Digital architectural heritage

Argument

The American professor Edgar Dale proposed in 1946 a model that would become well-known in the history of pedagogical methods – **the Cone of Experience** (or **the Pyramid of Learning**) (Fig. 2). This diagram shows how a student's (or any individual's) understanding and capacity of remembering information **increases** in direct proportion to the practical nature of the activity, the degree of authenticity of the experience and **the number of senses involved**. Transposing this to architectural education, the studio, the internships, the visits, the study trips, the workshops and the summer schools all support precisely this essential direction. They are supplemented by immersive experiences mediated by **VR** and **AR** technologies which allow one, for example, to explore an architectural monument or to learn the history of art and architecture. These virtual environments enable remote visiting as well as the observation of details otherwise inaccessible in the course of the on-site survey of building, such as elements of the painting on a high ceiling, the detail of a fresco, etc.

The most recent VR applications for **heritage architecture** appeal to **kinaesthesia**, the “simulation of real experience” category, and are thus very likely to facilitate the memorisation and understanding of a space, especially an interior one, according to Dale's principle.

Case study

The most relevant example to this effect is the way in which **VR** and **AR** technologies have been used to showcase the Palace of Versailles, an ensemble that has been on the UNESCO list since 1979 and is thus part of **World Heritage**.

In 2019, the Palace of Versailles, in partnership with Google Arts & Culture, launched the “**VersaillesVR: the Palace is Yours**”, a virtual reality application using 3D photogrammetry (thousands of photographs) which enables the free visit of the entire palace and appeals to different senses. It is supported by the commentaries of the scientific team on over 150 works of art and it allows access to otherwise inaccessible places and details.

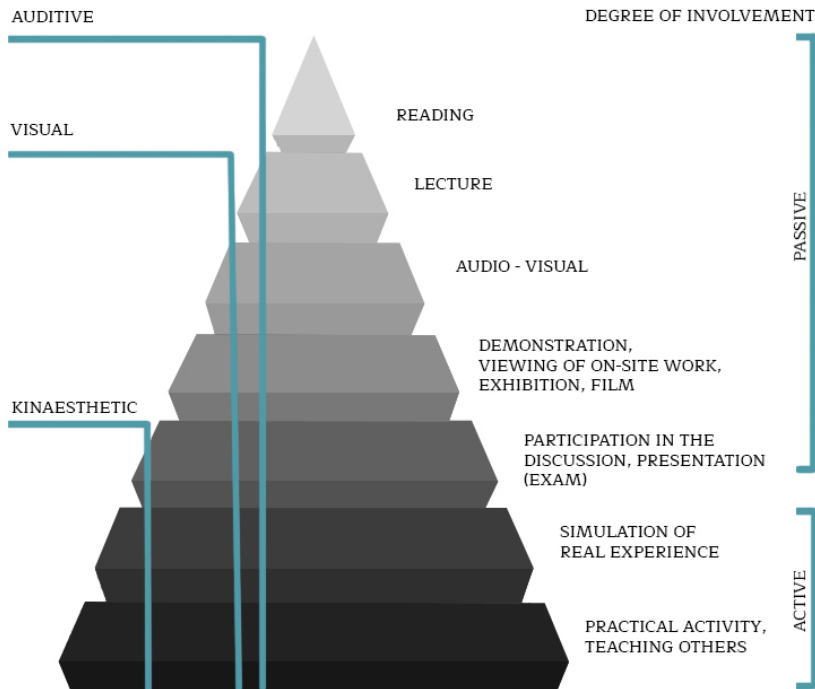


Fig. 2. Diagram based on Edgar Dale's Cone of Experience or Pyramid of Learning, 1946. Image source: personal archive, adapted from Dale (1969).

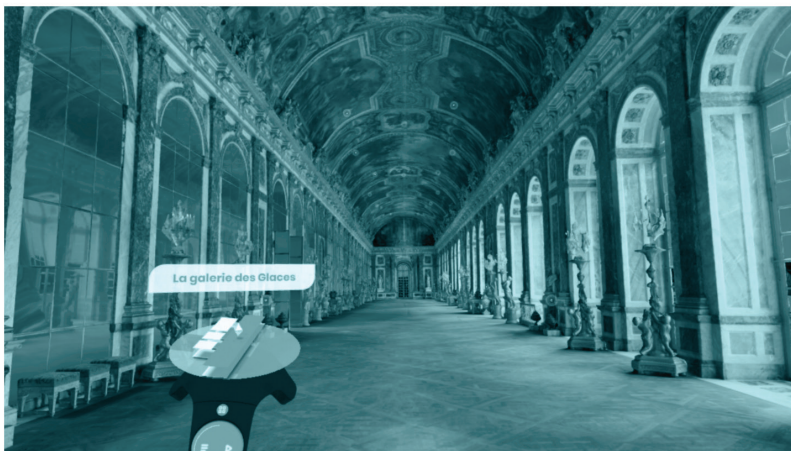
This is why one of the international speakers invited to the **Digital Heritage webinar** (15 September 2021) was Paul Chaine, head of the Digital Department of the Palace of Versailles and lecturer at Sciences Po Paris and at the ESCP Business School. His lecture introduced the Palace of Versailles projects that use VR and AR with an educational purpose, for increased accessibility and democratisation of knowledge. Nowadays,

museums must adapt to new phenomena and be accessible in new ways in order to maintain their relevance and appeal to an increasingly diverse public. Yet these re-invention processes require a lot of responsibility and creativity when working with **cultural heritage** content.

Turning to the concrete example of the “**VersaillesVR: the Palace is Yours**” application (Fig. 3), it can be downloaded from the Steam platform and experienced via the VR headsets HTC Vive, Oculus Rift or Valve Index: <https://en.chateauversailles.fr/news/life-estate/versaillesvr-palace-yours#a-unique-visit>.

In comparing my actual visits to the Palace of Versailles with the VR visit, I can state that the feeling of a real experience is very similar (natural lighting, the sound of footsteps, the realism and the precision of the photogrammetry-based images at the level of colours and textures), but that the virtual experience feels far more intimate (the user is alone in the space of the Palace, there are no other visitors or guides); the information and commentary on the works of art can be very easily accessed; otherwise inaccessible details can be seen in close-up or from different angles, as only a restorer working on a fresco or some other ornament (e.g. on the high ceilings) would be able to observe them.

Put on your headset and be transported to the Hall of Mirrors during the night-time.



Hall of Mirrors in *VersaillesVR: the Palace is Yours*.
© Château de Versailles, 2019.

Fig. 3. Still from the VR tour of the Hall of Mirrors, from the project “VersaillesVR: the Palace is Yours”.

Volume and the true-to-life aspect are conveyed by means of 3D photogrammetry technique, supplemented by various elements of interactivity and appeal to the senses: the sound of footsteps, the possibility of touching surfaces, of coming closer, of hearing or reading information, of seeing remarkable details or details not accessible on an actual visit (e.g. the painted ceilings).

Image source: <https://en.chateauversailles.fr/news/life-estate/versaillesvr-palace-yours#a-unique-visit> (c) Château de Versailles

The Palace of Versailles has been developing over many years learning tools for different levels of education, with special programmes that assist teachers in the preparation of visits and, more recently, on its webpage of Pedagogical resources – <http://ressources.chateauversailles.fr/> – with special materials on art history, or with pedagogical, cultural and scientific resources for teachers on the *Edutheque* webpage – <https://www.edutheque.fr/utiliser/arts-et-lettres/partenaire/chateau-de-versailles.html>.

Such a virtual visit can be an excellent environment for a few art history lessons, for seminars on Rococo architecture and furniture, for a workshop on the complex work of restoration and conservation carried out over the years at the Palace of Versailles following destruction or various events, etc. These are of course the topics of interest that would be compatible with the UAUIM curriculum, but the offer is also relevant to other cultural fields: literature, Baroque music, playwriting and theatre, fashion history, political history, etc.

Activities linked to the SCHOLAR ARCHITECT 2021 project objectives

Within the framework of the **SCHOLAR ARCHITECT 2021 project**, I organised and coordinated two activities that would familiarise the UAUIM academic community with the manner in which traditional education and the latest technologies for the investigation, intervention upon and dissemination of material heritage can be **judiciously combined** for an **addition** of accuracy and technical abilities to the training of a contemporary architect, a synchronisation to the international specialist environment. This is of course about testing the internal academic environment by introducing working methods that have already reached maturity in the international architectural environment.

The Digital Heritage webinar took place on 15 September 2021 on the Zoom platform (due to the pandemic). The speakers I invited to this English-language event were Nicolo Dell’Unto, Paul Chaine, Andra Bria and Ioana Mischie; each of us prepared a presentation on the theme of **architectural heritage** in relation to its **digitised** and **digital** forms, and thus on the different methods through which it can be investigated and analysed by architects, student architects and restoration professionals and through which it can be disseminated and explored by a more informed or a broader public with the help of virtual reality or augmented reality technologies.

Nicolo Dell’Unto is Associate Professor at the Department of Archaeology and Ancient History of Lund University, Sweden, Director of DARK Lab, the digital archaeology lab of his home institution and Visiting Associate Professor at the Department of Collection Management of Oslo University, Norway. His presentation, titled “Virtual Space and Knowledge Production”, explained the methods of digital research and virtual reconstruction of sites pertaining to **world archaeological heritage** – such as Pompeii – or to national heritage – such as the sites

and **artefacts** on the territory of Sweden, which he uses in DARK Lab. In addition to the high-performance equipment for measurements and in situ recordings, the digital instruments for investigation, used for diagnosis and pathology, and the platform for **digital collections of artefacts** – with object cards and detailed information – these resources proved essential during the pandemic, when they were also used as a **teaching environment** for study and examinations. In addition, the use of VR technology in the DARK Lab of Lund University aims to assist students and researchers in exploring reconstructions of heritage architectural ensembles of which only some archaeological traces have survived, for the better understanding of spatiality, of the way of living, of the composing elements or of details such as the way in which natural light penetrated, the positioning of a specific iconography, functional relationships, etc. Starting from the idea of **exemplaria graeca**, which is at the basis of the preoccupation with heritage in antiquity, and thus from the **importance of the model**, the purpose of the in-depth study of these sites, including via the digital environment, is to support knowledge, preservation and use (re-interpretation) of successful models, the understanding of certain spatial typologies adapted to a particular era and context. The images from his presentation have been discussed in the previous section, “Essential criteria and working methods for digitised and digital heritage (virtual reconstructions of architectural monuments). Authenticity”.

The digital collections of artefacts introduced by Prof. Dell’Unto are a set of small-sized pieces of archaeological heritage – tools, vessels, weapons, etc. – pertaining to a particular site and organised on specific criteria. They are essentially 3D scans or 3D photogrammetric images of the real objects, which can be studied on the online platform under the form of 3D volumes; each object is accompanied by a card with precise data on measurements, epoch, state, material and numerous other details. The role of these collections is to organise, along the same lines as physical museum collections, a series of pieces originating from the same site or linked by a common scientific criterion in order to also have a digital archive for their preservation (Fig. 4).

Paul Chaine’s presentation at the **Digital Heritage_webinar** focused on the way in which the Palace of Versailles, a globally recognised architectural monument, opens up to virtual visitors, to a diversified and broader public with the help of the new digital technologies. It was titled “VR/AR in Versailles, a tool to address all audiences”. The virtual reality application developed in 2019 in partnership with Google Arts & Culture named **“VersaillesVR: the Palace is Yours”**, which was presented in the previous section, is a first step towards a broader institutional project, with additional types of digital products that will support exploration and education with the help of VR and AR technologies. These products, partly based on analogue sources converted to digital format and partly based on born-digital sources, have been conceived for the dissemination and democratisation of knowledge, made accessible to a broad public, but also as a teaching tool, relevant from primary to tertiary level of education.



Fig. 4. Image of the Dynamic Collection of artefacts of the DARK Lab of Lund University.

The volumes are obtained through 3D photogrammetry, aggregated by means of software programs and uploaded to this interactive platform, which has even been used for student examinations during the pandemic.

Image source: https://models.darklab.lu.se/dynmcoll/Dynamic_Collections/

I invited these two experts to give presentations on the latest international experiences in the field of **digitised and digital heritage** to the UAUIM community of students, doctoral candidates and teaching staff and to share information on the current state of specific types of cultural and educational initiatives, but also with a view to creating new collaborative opportunities in the future.

To complement the French and Swedish perspectives, the two Romanian guest speakers, Andra Bria, the founder of Craft Product School, and Ioana Mischie contributed with presentations of their experience in using VR for cultural heritage in general, including the project of a digital university in virtual reality: OmniversityVR - <https://omniversity.app/>. Their experience of international transdisciplinary projects, ranging from cinema to topics in architecture, sociology and politics, provided a fresh perspective and demonstrated how we can adapt to the society of the future.

The webinar aimed to function as an exchange of ideas, a lively debate and as an opportunity to form professional relationships between all the participants, a bridge to future international projects.

Digital Heritage_lab was a hybrid, online and on-site, workshop that complemented the **Digital Heritage_webinar**. The guests were the two webinar speakers Nicolò Dell'Unto and Paul Chaine, together with the widely recognised specialist Prof. Habil. Hanna Derer, PhD., Arch., from the Department of History & Theory of Architecture and Heritage Con-

servation and architect Loredana Stasisin, the creator of Stasisin Services, initiator of the “Houses That Cry” project and at present an active professional in the field of digitised heritage, creator of tours and virtual exhibitions. The workshop participants were students at the Faculty of Architecture, The Faculty of Interior Architecture and The Faculty of Urban Planning as well as doctoral candidates and trainee architects. Prof. Derer raised the issue of **responsibility** in working with the forms of **digitised and digital heritage**. Loredana Stasisin presented her professional experiences in connection to different projects of architectural heritage digitisation and possible directions in the development of museums in the digital era.

The workshop that took place at the **“MAC POPESCU” Experimental Studio (High-Tech Learning Centre)** of UAUIM between 20 and 24 September was the practical application of the elements of theory and methodology introduced in the **Digital Heritage_webinar**.

Theme

The activity proposes the exploration of one of the recording techniques for heritage artefacts, namely photogrammetry, the opportunity of working with the latest software and of launching a small specialised database: a digital collection.

More specifically, the theme is titled **“Collection of historical locks”** and requires each participant to select an individual case study. These are the selection criteria: the lock must pertain to a representative historical style but not necessarily to an architectural monument of Bucharest (or of the locality where the online participant is based); it must be on the outside, i.e. an entrance door, accessible for detailed photographs, and it must represent an “emotional anchor”. Why choose such an object as the theme? The idea is to have an object of reasonable size for the duration of the workshop, placed at a suitable height and accessible for photograph-taking from all angles and also an object that is representative of the building to which it belongs. In addition, patina and the detail features of this type of object speak of its history, of symbols and style, of the importance of the building over time and of the way in which it has been used by those who entered it, of the care or neglect with which it has been treated.

Objective

It is essential for students, doctoral candidates and trainee architects to become familiar with and to be taught a method of work and collaboration in which both the autonomy of decisions and cooperation with a team are practised. Theoretical knowledge of architectural history and heritage protection is drawn upon for the reasoned individual selection of the case study and subsequently in the final, contextualised presentation. Technical abilities are demonstrated through participating in the practical instruction and in the demonstrations provided by the technical coordinator, the architect and Associate Professor Andreea Iosif, PhD from the Experimental Studio “MAC POPESCU”. The practical component consists of the field trip, the collecting of the required photographs

(200-500 images from all angles), the aggregation of the 3D model and finally the writing of the object card, its insertion in the 3D online collection and the creation of a poster.

The ability of achieving a concrete result at the end of the workshop, on the basis of practical instruction, is complemented by the capacity of understanding and showcasing a heritage artefact, of signalling the case of an endangered monument, of promoting a representative, yet forgotten, building, of bringing new information on a project and of presenting it via the resulting 3D and via an AI poster. To an architect, both the content component and the component of graphic and aesthetic representation are important – in harmony with the architectural style to which the object belongs and with the purpose of the poster – as is the communication and presentation component.

Coordinators

I provided the technical coordination together with the architect and Associate Professor Andreea Iosif, PhD, who was also the coordinator of the “MAC POPESCU” Experimental Studio, and with Andra Bria and Ioana Mischie.

The jury of the student projects were Andra Bria, Ioana Mischie, Nicolò dell’Unto and Paul Chaine.

Method

The workshop was designed to help students improve their skills of working independently and as a team, in the collaborative preparation of a collection of digital artefacts.

The participants had a well-defined, gradual programme for the five days of the workshop, from the explanation of the theme to individual exploration in the field, technical instruction and constant guidance in the Experimental Studio; they learned the technique of 3D photogrammetry, benefited from demonstrations using software such as RealityCapture and the SketchFab platform and they created together a first digital collection of objects with object cards and finally a poster.

Participation prerequisites were familiarisation with the theme of **digital heritage** through attendance of the **Digital Heritage webinar**, possession of a smartphone, necessary for collecting hundreds of photographs at the site, and technical abilities in working with new software programs.

The best three projects, all consisting of 3D photogrammetry, the artefact card and the poster, were granted prizes from the bookshop chain Cărturești and all the attendees received participation diplomas, signed by the members of the jury and by the Rector of UAUIM.

The project evaluation criteria for all three components were: technical quality; the ability to contextualise the chosen case, to observe the characteristics of the historical architectural style to which it belongs (specific to Bucharest) – from Classicism to Modernism – and to showcase these heritage objects also at the level of composition, content and aes-

thetics of the poster; lastly, the ability to communicate the observations and results of this small-scale research project in the final presentation (Fig. 5, 6, 7, 8).

The workshop has a dedicated Facebook page <https://fb.me/e/16XvI1tX1> while the objects obtained through 3D photogrammetry have been uploaded on the SketchFab platform.

The participants demonstrated technical abilities as well as their knowledge of architectural history in its concrete application in a case study in addition to sensitivity and a sense of mission and responsibility as professionals in the field of architecture or urban planning in relation to interventions on heritage.

Results

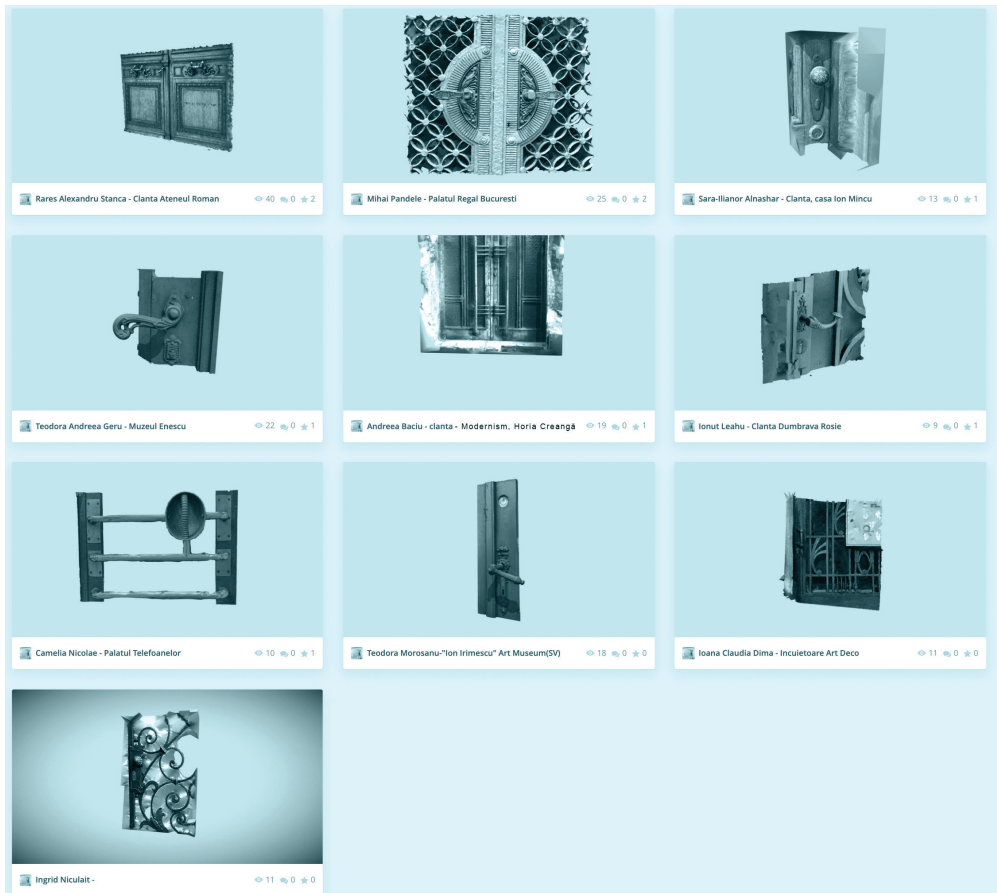


Fig. 5. The "Collection of historical locks" on the digital platform Sketchfab.
Image source: <https://sketchfab.com/virtualia.uauim>



Rares Alexandru Stanca - Clanta Ateneul Roman

AtelierExperimental 46 2
+ Add To Embed Share Report
Triangles: 300k Vertices: 150.4k [More model information](#)



Teodora Andreea Geru - Muzeul Enescu

AtelierExperimental 22 1
+ Add To Embed Share Report
Triangles: 729.9k Vertices: 366.4k [More model information](#)

Fig. 6. Details of two case studies: the main entrance of the Romanian Athenaeum and that of the Enescu Museum, Bucharest, Digital Heritage_lab. The high quality of the 3D photogrammetric images, completed over a very short time, is noticeable. Image source: <https://sketchfab.com/virtualia.uaaim>



Fig. 7. Poster for the lock of the main gate of the Palace of Telephones, Bucharest, Digital Heritage_lab.
 Author: Camelia Nicolae, UAUIM.



Fig. 8. Poster for the lock to the back door of the Ion Mincu House, Bucharest, Digital Heritage_lab.
 Author: Sara-Ilianor Alnashar.

Conclusion

The present guide offers both a theoretical exposition and a reflection via concrete creations and practical activities of a few contemporary manifestations of the relationship between architectural heritage and digital technologies, which can be useful in the specialist academic environment and in professional practice.

Digital platforms created for the UAUIM academic community can be useful in doctoral research, for studio restoration projects, for teamwork and for remote international collaboration.

In light of this fact, I initiated in 2017 the CSAV Lab – a lab dedicated to heritage – under the aegis of the Center for Vernacular Architecture Studies which I coordinate, where I organised a training session on GIS software, sponsored by the Environmental Systems Research Institute (ESRI), Romania. The invited instructors trained representatives from each UAUIM department who were given study certificates and personal licences. The objectives were to use this type of software for the mapping of (vernacular) heritage in the national territory, to disseminate this high-potential technology to all departments and to create a digital platform that enables remote collaboration on joint research projects.

This final objective was only accomplished in 2021 when, following the two above-mentioned activities, namely the **Digital Heritage webinar** and the **Digital Heritage lab**, I launched the **CSAV Heritage Lab** on the CSAV website; this platform will use the software programs presented in the above-mentioned case studies: www.csav.ro.

This mini-guide attempts an objective presentation of the different projects and initiatives by showing the potential as well as the (current) limitations of these instruments of research and exploration. In addition, the development of a research and work method is important for maintaining an as high as possible degree of **value** and **authenticity** both for digitised objects and for digital reconstructions of objects or ensembles of architectural heritage.

From the perspective of the architect and also from that of the coordinator of restoration and conservation projects, continuous learning and the development of new abilities in working with heritage are essential in order to remain competitive and professionally relevant.

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