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Edited by Koraljka Kuzman Šlogar,
Ivana Štokov and Anamarija Žugić Borić

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Iva Niemčić
Agiatis Benardou

Editors

Koraljka Kuzman Šlogar, Ivana Štokov, Anamarija Žugić Borić

Proofreading

Marta Brkljačić

Layout

Vesna Bader

Cover design

Anja Tkalec

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Digital Humanities & Heritage

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PREFACE

These proceedings of the 3rd and 4th DARIAH-HR conferences provide an excellent window onto contemporary issues in digital humanities. The articles in this volume span the range of activities in which digital humanists are currently involved: from research to teaching and infrastructure development. The articles are also theoretically and methodologically diverse, from thoughtful, philosophical reflections to quantitatively based investigations. Many of the articles reflect a praxis-based approach in which the authors combine theory and practice to explore some of the most pressing issues of our times. Some of the articles offer the reader roadmaps to follow in developing national or institutional infrastructures, others offer practical lessons in collaboration, particularly with the cultural heritage sector. Taken together, the ten articles in this collection offer much food for thought in navigating the technologies, as well as institutional opportunities and limitations, in our current moment of digital scholarship and education. Read collectively, each of the chapters in this volume offers a piece of a puzzle, moving from reflective inquiries to practical implementation. The introductory essay, Neven Jovanović's "A Philologist Looks Back – How the 'Digital' Changed Our Workflows and Our Questions", is a thoughtful reflection on the ways in which technology has impacted our work over the past 30 years as (digital) humanities researchers, ending, as many endings do today, with generative AI (GenAI). Jovanović's questions and speculations about what our research environment, technically, intellectually, and ethically, may be in the coming years, are ones that many of us ponder. How will it change our own research practices, and what will it mean for those entering our disciplines today? Jovanović's article made me reflect on this preface that I promised to write. More than once it crossed my mind that it would be easier for me to simply copy and paste the articles into a GenAI, ask for summaries, and then ask it to create an overall assessment of the volume. And even though this proceedings volume will be published open access, I felt

more than a pang of conscience in uploading this volume, this data, to a large language model (LLM) before its publication date. I also felt that if the editors had wanted GenAI to write the introduction, they would have bypassed me, the human, and simply asked the AI themselves. And thirdly, I would feel guilty passing off writing that was not mine and putting my name on it, which may reflect an increasingly old-fashioned approach to this new technology.

Jovanović's modestly written essay, which perhaps underplays his contribution to philology, and to Latin writing in Croatia, connects us with larger issues. Not only the role of technology and infrastructure in the humanities, but how we as researchers interact with and develop it, as well as the (still lacking) reward structures for building infrastructure. But the questions he poses in the latter parts of the article are ones that occupy many of us, as educators, as researchers, and as humans, in what is fast looking like a brave new world.

The first article in the volume, Radovan Vrana's "Researchers from the Humanities in Croatia and Research Data: An Empirical Case Study" explores the barriers and opportunities for researchers, particularly in the humanities, to share their (FAIR) research data, and why data in the humanities has not developed into an ecosystem or a "knowledge commons". Barriers to contributing to these commons include ethical and legal, financial (including a lack of infrastructure and long-term support), and cultural challenges, despite the opportunities. These include data creation being elevated to the same level as publications, as well as credit for creating the dataset when it is reused.

Vrana's 2023 survey of 90 Croatian researchers in the humanities on their practices related to the sharing, use, and storage of research data makes for interesting reading. His results demonstrate that there are still significant barriers in both sharing and reusing data, but also that there is a growing awareness and willingness to participate in open science practices. His conclusions are no doubt broadly applicable across Europe: that focused interventions are essential to bridge the gap between willingness and capability, including data education (for example, data management), institutional support (in the development of secure environments for depositing and managing research data), and stronger incentives for elevating the creation and sharing of data to the level of published scholarship.

Mehak Sejwal's "Ancient Scripts, Modern Methods: Analysing the Asokan Edicts" shifts the volume from meta concerns to the application of digital humanities methods to a specific case study: that of Emperor Asoka's 3rd-century BCE inscriptions, written in Prakrit using Brahmi and Kharosthi scripts. This shift is also geographical as Sejwal's research is carried out in India at an Indian institution, using non-Western scripts, with far less infrastructure, institutional support, and adoption of digital methods than is typical in Western countries. Nevertheless, Sejwal argues that there are great advantages in adopting digital approaches to elevate the rich legacy of Indian cultural heritage for a global audience.

Although the corpus of Asokan inscriptions is not large, it poses significant linguistic challenges as they are written in three different languages (Prakrit, Greek, and Aramaic) and four different scripts (Brahmi, Kharosthi, Greek, and Aramaic). Content-wise, it is rich and varied, from edicts encouraging moral and ethical conduct ("Dhamma") to instructions on governance, welfare, and non-violence. Voyant Tools, a freely accessible web-based environment for text analysis, was used. After transliteration and translation, the corpus was explored through its analytical modules to identify linguistic patterns, recurring themes, and structural variations across the inscriptions. The results of this research demonstrate the international reach of digital humanities: ancient stone inscriptions were analysed using software developed in Canada to bring new insights into the thoughts and teachings of a 3rd-century BCE emperor of the Indian subcontinent into the 21st century, which Sejwal argues, still holds lessons for us today.

Josipa Maras Kraljević's "Photographs From the Croatian War of Independence: From Analogue Archives to Digital Access" returns the volume to Europe. As with the previous article, it centres on a single data type, in this case images, from a Croatian portal, with a focus on the Centre's large photographic holdings from the Croatian War of Independence, numbering almost 100,000 photographs. Maras Kraljević explores the multilayered and multifaceted background of photographs and their digital surrogates. These include the circumstances under which the photograph was taken and later digitised, where it might have been published, and any accompanying (textual) information. All of this plays a part in interpretation. The article raises

issues of authenticity, reproduction, restoration, and preservation, as well as the duty of care that archivists must take in making difficult and sensitive heritage publicly available. Despite the costs and intellectual property concerns, the value of making these important artefacts publicly available online and allowing them to be seen and used alongside other similar materials, is invaluable.

Lucia Binotti and Jhosep Delgado's "The DEMAP Syllabus: A Generative Approach to Teaching Digital Humanities for Romance Languages, Culture, and Heritage" provides the opportunity for another key aspect that digital humanists are involved in, namely teaching, to be highlighted. The course, designed and delivered at the University of North Carolina at Chapel Hill, integrates digital methods with design thinking, maker culture, and project-based learning, a combination of methods that is ideal for a digital humanities classroom. First developed in 2021, it has gone through several iterations until 2024, when prompt engineering was incorporated into the curriculum, with the shorthand for the learning goals distilled to "DEsign-MAke-Prompt" (DEMAP). After describing the shape of the course and its pedagogic underpinnings, Binotti and Delgado describe several student projects as case studies illustrative of the outcomes of the methods employed. Ultimately, authors argue for a pedagogic remapping of the methods and tools traditionally used in digital humanities teaching, one that challenges traditional methodological assumptions and embraces "alternative" methodological perspectives and practices.

In keeping with digital humanities pedagogy, Laura Šejić, Katarina Matkerić, Kristina Komšo, Ana-Marija Petrović, and Artur Pocem Mihaljević explore new methods for digital humanities workshops developed for secondary school students in their article "Preserving the Past, Shaping the Future: Heritage-Based STEM Workshops in Ivanić-Grad, Croatia". The workshops have been developed by the Friends of Heritage Association, a non-governmental organisation and museum dedicated to making more visible the cultural heritage of Ivanić-Grad. One of their outreach activities utilises STEM methods to explore heritage through hands-on, project-based learning. Skills taught range from 3D modelling to documenting, inventorying, and digitising cultural heritage objects. The article not only describes how four workshops were planned and executed, it also explores their underlying theoretic-

cal and pedagogic goals, including developing and cementing relationships with local stakeholders as well as reaching students before they make their career choices. With an overarching goal of highlighting the relevance of STEM in everyday life and its historical context, the developers of the workshops bridged the gap between the past and the present through engaging activities addressing real-world problems.

Roberto Lazzaroni's "Museums as Relational Ecosystems: Technology, Volunteer Participation, and the Digital Transformation of Heritage. Negotiating Memory and Innovation at the Ethnographic Museum of Alta Brianza" pivots the volume to another domain space in which digital methods are increasingly used. Lazzaroni's article brings together new theories and approaches to museum design, focusing on not just who museum exhibitions are created for, but equally, who they are created with. Working from ICOM's 2022 revised definition of museums which should "operate and communicate ethically, professionally and with the participation of communities, offering varied experiences for education, enjoyment, reflection and knowledge sharing" (International Council of Museums 2022), Lazzaroni approached the digital transformation of the Museo Etnografico dell'Alta Brianza (MEAB) through a participatory lens in which the museum is not a fixed space of objects and their explanations, but a space of cultural negotiation. Working with a group of volunteers, and responding to a host of real-world limitations (from funding to technology), this article charts various ethnographic approaches that were employed to follow a multigenerational group of volunteers who were given the freedom to create a temporary exhibition on a topic of their choice. The concluding sections document the successes and limitations of the approach, both institutional and for the individuals involved. It reflects on issues such as technical obsolescence, financial limitations, innovation, peer learning, collective ownership, and experimentation. Ultimately, it focuses on how digital technologies can be integrated into standard museum workflows and how they can open new horizons for both the museum and its visitors.

Goran Zlodi, Tomislav Ivanjko, and Eva Vitković's article "Collaboration Between Cultural Heritage Institutions, Citizens, Researchers, and Students in Citizen Science: The 'DigiSport' Project as an Exploratory Case Study" stays with the theme of cultural heritage and participatory practices. The research was carried out by the

Faculty of Humanities and Social Sciences at the University of Zagreb in collaboration with the Croatian Sports Museum. The goal of the project was to enrich metadata for over 16,900 digitised sports photographs, which was carried out by retired and active sports journalists. The goal of the project was not only the enrichment of the objects, but to understand 1) the motivational drivers and trajectories of retired and active sports journalist volunteers, 2) the reliability and scale-up potential of a citizen science workflow for photographic metadata, and 3) the influence of multi-stakeholder collaboration on project outcomes and sustainability. Moreover, the article explores the relationship between the relevant communities in undertaking the project, from the volunteers to museum professionals and researchers. The article documents the project's research questions, methodologies, and workflow, making it a valuable use case for others interested in conducting similar research.

Emiliano Degl'Innocenti, Francesco Pinna, Alessia Spadi, and Federica Spinelli's "Bridging Tangible and Intangible Cultural Heritage: DARIAH-IT's Contribution to the H2IOSC Project" takes a different approach to interdisciplinary collaboration. This article documents the approach undertaken in H2IOSC, a federated cluster that facilitates collaboration between the Italian nodes of four prominent social sciences and humanities (SSH) research infrastructures, CLARIN, DARIAH, E-RIHS, and OPERAS, to address issues of interoperability and data integration with the dual goal of preservation and increasing understanding of cultural heritage in the digital age. H2IOSC's primary objective is to conduct data-driven research activities by supporting several scientific workflows through high-performance computing. A no less important objective is to enhance the adaptation, implementation, and efficiency of existing facilities through a variety of activities, such as onboarding and training, as well as the creation of FAIR data. DARIAH-IT's principal project was to create a digital philology workflow which has resulted in two pilots: the Digital Philology Hub (DPH) and the Digital Heritage and Memory Hub (DHMH). These hubs, developed across the research infrastructures, speak to the power of and need for collaboration in building virtual research environments: their architecture, workflows, and features, as well as the tools and methods underpinning it. This article makes visible the benefits of interdisciplinary collaboration in developing digital infrastructure for research purposes.

Mihaela Blagaić Kišiček's "OA Scholarly Publishing: Moving Beyond the Institutional Website" concludes the volume with arguably the last stage in the research process, that of publication. It focuses on the impact of open-access (OA) book publishing at three levels: the European (specifically, the European Research Area, ERA), the national (in this case Croatian), and the institutional (comparing the publication practices of 14 public Croatian institutions). The article charts OA initiatives in the ERA going back to 2008, subsequent consortia and coalitions, as well as conditions and requirements for OA publishing, particularly beyond journal articles, including embargo periods and licensing. The history Blagaić Kišiček traces covers decades, highlighting only incremental advances in OA book publication policies, initiatives, and models, ending in one of the most recent initiatives, the PALOMERA project (2023–2024) which surveyed OA book publishing in 39 European countries. The results of the survey demonstrated a continued fragmented landscape, with the conclusion that "an internationally uniform approach to setting and formulating OA book policies is not viable". However, it did propose a set of overarching, adaptable, actionable recommendations, which the article examines within the context and history of Croatian book publishing more broadly, and specifically within the Institute of Ethnology and Folklore Research. The article explores this initiative in terms of the specific requirements of making OA books available and provides a practical roadmap for other institutions undertaking a similar initiative. The concluding sections take a hard look at OA publication of books within Croatia and Europe, arguing for an institutional, national, and Europe-wide focus on not only making these texts available, but also ensuring the technical infrastructure and policies for their discovery and reuse.

The shape of this volume mirrors the range of opportunities and challenges that new technologies offer (digital) humanists – beginning with individual research practices, to teaching with new technologies, to collaborations beyond the humanities, to developing digital infrastructure and new publication modalities. There is much here to use as a roadmap for implementation, to model, and to reflect on.

Susan Schreibman
DARIAH Director

A PHILOLOGIST LOOKS BACK – HOW THE “DIGITAL” CHANGED OUR WORKFLOWS AND OUR QUESTIONS

NEVEN JOVANOVIĆ

University of Zagreb, Faculty of Humanities and Social Sciences
Zagreb, Croatia

neven.jovanovic@ffzg.unizg.hr

ORCID iD: 0000-0002-9119-399X

The essay is a personal reflection on how the “digital” changed philologists’ way of working. It takes a critical stance towards the use of certain metaphors that are currently popular in the digital humanities. This essay also criticises the ambivalent attitudes of Croatian academic and science policies towards digital work in assessments of academic contributions, as well as my own work as a contribution to digital infrastructure. In the end, looking towards the future, this essay will demonstrate some amazing and unsettling possibilities of large language models (LLMs) used for basic philological tasks, such as translating and interpreting.

Keywords: digital humanities, infrastructure, scholarly workflows, large language models (LLMs), literary translation and interpretation

The location of our conference is full of beauty and paradoxes: the city of Split is a spicy mixture of old and new, of temperament and tourism, of Diocletian and the Game of Thrones. Meanwhile, the Faculty of Humanities and Social Sciences in Split, the heir to the tradition of Marko Marulić, occupies the building that used to house a retail company called Brodomerkur. This interesting combination allows me, and obliges me, to look both a bit backwards and a bit ahead. I will comment on how I got here (by “here” I mean “digital humanities”), how the “digital” changed

what I do as a scholar – the way I work, the questions I ask. Furthermore, I will share my hopeful fears and fearful hopes regarding the future. The essay will reflect on the past and the future through the metaphors of infrastructure and workflows. For a good number of years, both metaphors, especially the first one, have been used to shape, justify, and describe the aspects of our work that the policymakers seem most willing to support and finance. However, Andrew Prescott from the University of Glasgow argued as early as 2010, in a lecture subsequently published in 2016, that “infrastructure”, as a metaphor borrowed from Cold War military planning (when it was used for the system of airfields and communications), is not relevant to what we do in the humanities:

An orchestra is not a piece of musical infrastructure; it is integral to the music. A dancer is not human infrastructure. Above all, libraries, archives, and museums are not infrastructure. The manuscripts, books, and objects in these institutions are the heart of the humanities, the object of its study, not a supporting service for the humanities (Prescott 2016).

The voice of Andrew Prescott notwithstanding, we have been using these metaphors for a decade and a half. They have served us well, and in the process, they have formed our opinions and beliefs regarding ourselves and our activities. How, exactly, did that happen?

I was born in 1968, the year of the assassination of Martin Luther King, the Prague Spring, Apollo 8 and its “Earthrise” photograph. In 1993, 25 years later, I typed my graduate thesis on a mechanical typewriter. The words I had typed were influenced by a visit to Vienna on a grant, when I did research in the library of the Institute of Classical Philology, University of Vienna. The institute had all the books I knew I needed for the thesis, including some I did not know I needed. The fact that they had most of the books in open access (a concept unknown in Zagreb at the time) not only made my work easier, but was inspiring in itself. That visit, the chance to use the books which I only would have read about at home in Zagreb, contributed greatly to what I am today. What welcomed me in Vienna in 1993 was an example of a well-developed infrastructure.

The title of my essay claims that I am a philologist. But what does that mean, exactly? In English, the word is unusual, somewhat out-

dated. For example, in 2013, the American Philological Association, founded in 1869, chose to relinquish the term and to change its name to the Society for Classical Studies. Outside the Anglophone culture, however, there are scholarly traditions and systems – in German, French, Italian – in which the word does not sound so strange. There, a philologist is a specialist who researches texts (mainly old texts) from the perspectives of the history of their language, their literary system, and their fortunes and misfortunes as physical objects (manuscripts or printed books). Philologists differ from linguists and literary scholars; philologists are more interested in the particular – in an individual text, or even a specific copy of that text – while linguists and scholars of literature think more about the text's general aspect. As for myself, what my philology colleagues do with texts in Mandarin, German, Arabic, or Croatian, I do with texts in Latin.

I have already mentioned that in 1993, my graduate thesis was typed on a typewriter, with copies produced by carbon paper. Five years later, in 1998, my *Magisterarbeit* (another sign of a different scholarly culture: it is a scholarly work between a graduate thesis and a PhD) was typed on a computer with a text processor. At the time, I used the computer primarily as an advanced typewriter, and for the research itself, I relied mainly on photocopies from microfilms. With the help of these microfilms, I compared two Renaissance Latin manuscripts from the Vatican Library (incidentally, today both of them are digitised and visible in the Digital Vatican Library (DigiVatLib) collection). Those were humanities, even advanced humanities – something new and something true was discovered and reported – but those were definitely not digital humanities. I was merely using a new tool in an old way.

The situation changed in 2000. Somewhere around that time, the internet became available in Croatia, and I discovered concordance software: the Oxford Concordance Program, in the form of micro-OCP (the Oxford Concordance Program for microcomputers, as the PCs were called at the time). To use the programme, without much thought about why I was doing this, I built a small set of digital Latin texts. The set comprised Latin poems of Marko Marulić, a Croatian Renaissance poet from Split (among the poems was his vast epic *Davidiad*, which put me to sleep several times while I was correcting the OCR'd text). I

do not remember exactly how I got the micro-OCP diskette; I think a colleague linguist shared it with me. If you asked me whether meeting a colleague and sharing knowledge and tools is infrastructure, I would reply that it is definitely not a planned instance of it.

At the same time, the organisation in which I work, the Department of Classical Philology of the University of Zagreb, Faculty of Humanities and Social Sciences, thanks to its librarian, bought two CD-ROMs that became immensely important for my research. The first one was *Poesis*, a corpus of classical Latin poetry prepared by Carlo Mastandrea and Luigi Tessarolo of Ca' Foscari University of Venice. The second was *Perseus 2.0*, a collection of materials – not only texts, but images as well – from Greek and Roman antiquity, prepared by Gregory Crane from Tufts University. The collections enabled us to access and search most of what ancient Greeks and Romans have written, and a colleague of mine, now deceased, was moved to tears when he first used the third such CD-ROM, the *Thesaurus Linguae Graecae* (TLG). He had cried: “Now I can do in a minute what took me years and years to achieve!”

Access and search. To be able to access any text quickly and read it, to quickly search for any string in a single text, or in hundreds of texts. These possibilities changed the way we, Greek and Latin philologists, work. Access and search introduced us to approaches that were previously reserved for colleagues with the best memory and the most experience, or those with access to the best library and ample time for research. The search turned out to be even better than we expected, as it also retrieved unforeseen results. Moreover, regular expressions (pattern-based search queries) turned search into a kind of strategic game. Not only did this game bring results, but, little by little, it also introduced some of us to programming.

I did not realise it at the time, but by collecting, scanning, and applying optical character recognition (OCR) to all Latin poems of Marko Marulić to search them with the concordance software, I have at the same time created a small digital collection of Neo-Latin texts.¹ The corpus of ancient Latin, of Latin written by Romans, is already large.

¹ Neo-Latin is Latin used after it has stopped being a living language, that is, a language used naturally.

However, the corpus of later Latin – Latin of the Middle Ages, of the Catholic Church, of Renaissance humanism and the Republic of Letters, of public administration and charters, of old scholarly literature – is immense. Before computers, nobody ever even thought about gathering it (or a part of it) all in one place, in one collection. The computers made it possible for us to think and dream about such endeavours.

When I was defending my PhD in 2007, the world had already completely changed on its digital side. The internet brought me to Google Books – an ocean of opportunity for discovery if you work with Latin or with old texts – and to the Text Encoding Initiative (TEI), a standard based on Extensible Markup Language (XML), the amazing, heroic collective effort to systematically translate philological categories (very broadly speaking) into computationally manipulable forms. At the time, I was not preparing texts for publication in books anymore. I was discovering images of relevant books by Croatian Latin authors in Google Books or elsewhere, correcting the OCR in the texts of these books, marking them in TEI (including the metadata, information about the texts), and storing such editions in a folder on my computer. None of these steps existed for me before the year 2000.

When I had collected a significant number of texts, a visit to the “Project for American and French Research on the Treasury of the French Language” (ARTFL) at the University of Chicago helped me to install their freely available software PhiloLogic on a server of the Faculty of Humanities and Social Sciences in Zagreb. It was not the easiest thing to do (the underlying programming languages turned out to be subtly different in their American and European variants). It took the joint efforts of the faculty system administrators and the ARTFL programmers, but they bore fruit, and in 2009, I was able to publish what I had collected. It was published on the internet, thus completely bypassing printed books and their publishers. Not that I have anything against books and their publishers, but the quantity of Latin texts (some five million words) would have simply not been acceptable for print publication, and full-text search would not have been possible in such a publication anyway.

This publication, a collection of Latin texts by authors such as Marko Marulić, was named *Croatiae Auctores Latini* (CroALa). It has an

international standard book number (ISBN) and an international editorial board. Both moves were strategically borrowed from the publishing world to ensure scholarly credibility and to make the publication acceptable, as well as – to an extent – understandable to Croatian committees and authorities assessing and funding scholarly activities. Building CroAla was presented to the national Ministry of Science (as it was then called) as “Digitisation of Croatian Latin Writers” and funded as a research project. At the time, “digitisation” was an acceptable and understandable term, even though, as it turned out, different people understood it in different ways (later on, the Croatian Science Foundation explicitly refused to fund digitisation, which they presumably interpreted as book-scanning), and despite the fact that – as I now understand – what was funded was not something building the infrastructure, but the scholarly results achieved using the already existing infrastructure.

Sixteen years on, CroAla still lives. It currently exists on the internet, at croala.ffzg.unizg.hr, in two forms – as PhiloLogic, with an older version of the text collection itself, and as a newer, simpler interface made recently with BaseX, a database designed primarily for XML documents.² The interface is limited to a set of functions that my colleagues need and use most often. Unfortunately, the whole system is unreliable because I am the system administrator. If I am absent and BaseX stops, the users have to wait until I log in and restart everything. This aspect seeks improvement.

CroAla also exists in another corner of the internet. Its XML texts are published and preserved in a repository on Zenodo, the open repository operated by the European Organization for Nuclear Research (CERN) and developed under the European OpenAIRE programme. Zenodo is a planned, well-thought-out, critical piece of infrastructure (as well as another welcoming, open, and free publication channel). But the case of Zenodo indicates that, in the eyes of authorities, infrastructure is not something “built by one person” (even when that person is supported by a scholarly organisation). To draw another parallel with airfields and

² The interface was written during my sabbatical leave; the tradition of a free seventh year, with its allusion to the Old Testament, can be regarded as another aspect of scholarly infrastructure.

military communications systems mentioned earlier, funding bodies and decision-makers understand infrastructure as something developed at (at least) the nation-state level.

Let us consider this for a moment. By using PhiloLogic and TEI XML to publish CroALa, so as to make Croatian Latin accessible and searchable for anyone on the internet, I was building infrastructure for international research of Croatian Latin. Sure, the system was (and still is) in large part a manufacture, closer to an unprofessional, do-it-yourself kind of undertaking. I remain an amateur programmer who uses other people's software, who feels thrilled when a script actually runs as intended (and feels puzzled and frustrated when something unexpected happens). However, CroALa worked, and it still works most of the time. And yet, while building this infrastructure, I was not being a scholar. I was not making discoveries, I was not creating new knowledge. In the best case, I was preparing the ground for eventual discoveries. Therefore, when the time came for a promotion, my work on CroALa was only reluctantly evaluated as scholarly (additional explanations were requested from my promotion committee). Had I published a tiny fraction of CroALa texts as a critical edition in a book, it would have been positively evaluated as a scholarly monograph. It would have fit expectations perfectly, although a book is, to be honest, also a piece of infrastructure for discoveries. However, it is a traditional piece of infrastructure. The reluctance of Croatian scholarly authorities to recognise digital contributions has weakened over time, and yet, digital activities (such as "building databases") are still valued less – in practice, they bring fewer points than traditional scholarly publications.

A more important point of my reminiscing is that the infrastructure that I have built (being only half-aware of what I am actually doing), and that I afterwards used for my own research and further projects, changed not only my research subject, but also myself as a researcher. It changed the way I approach philology and the way I think about it.

My workflow now begins with casual internet searches in CroALa, Google Books, Internet Archive, or elsewhere. My reports include URLs of searches and retrieved objects, because they make my claims verifiable, and anybody with access to the internet could repeat them and get the same results (at least for a couple of years).

However, there is more. Before online (re)searching, before consulting databases and concordances, I used to do as I was trained. I used to start by reading a single text thoroughly and closely, in its details and its entirety, then I thought hard about the text, and finally, I reached out to other texts and knowledge somehow connected with the initial text. Search and concordance, however, opened my thinking and my research process to chance, to serendipity. “If I type a phrase from the text in a search box, what will happen?” Chance and serendipity widened my textual horizons and, at the same time, made them shallower: when a phrase produces a hundred and fifty hits in a hundred and fifty different texts, I skim, I do not read all these texts thoroughly and closely. I read not only serially, but also in parallel.

Such parallel reading has always existed in philology. This is how concordances were read, how word studies and dictionaries were made (and dictionaries are also a kind of infrastructure). But in scholarship, it took second place; the archetypal scholar was a hero who had read all and remembered all, without the need for reference works. For this hero-scholar, however, it was sufficient to present a couple of passages and call them “representative” without much discussion of what representativeness exactly means; we were not always warned that the same number of representative examples stands for a set of a hundred occurrences and a set of a hundred thousand occurrences. The new possibility to obtain all search results and count them made me ponder what is frequent and what is rare. From there, I logically turned to statistics, another approach unusual for philologists.

Parallel reading, counting, and statistics. I am still the close reader I was in the year 1993, but at the same time, I am something else. Just like the city of Split is both the city of Diocletian’s palace and the Brodomerkur building.

And now it is time to step into uncharted territory, from the past towards the future. Here, I will touch on something I only know a little about. It may turn out to be a fad (like virtual reality of yesterday), but it may also turn out to have shaped the future not only of the humanities, but also of work, services, and society. Databases and search changed the way I do philology – will large language models (LLMs) change it as well?

Let me offer a small example. This is a Latin sentence written by Marko Marulić (1450–1524), and is one of his earliest preserved sentences. This sentence has never been translated into English. Here it is in the original:

Ignotus ad te litteras scribo, quem, etsi nunquam viderim, amavi tamen antequam viderim (Marulić 2024: 440–441).

If you don't understand it, in our day and age, you can submit it to the Google Translate service:

I am writing a letter to you unknown to you, whom, though I have never seen, yet I loved before I saw you.

As a Latin philologist, I can tell you that the translation is correct, but the word order “you, whom, though I have never seen” does not make the sentence completely clear. To me, it does not sound quite right in English.

Here is the same sentence translated by the version of the ChatGPT LLM available online at the time of writing:

I, unknown, write letters to you, whom, although I have never seen, I loved nonetheless before I saw.

We are able to get the sense of the sentence now, but it still does not sound quite right. So, I asked ChatGPT – something that I cannot do with Google Translate – to make the sentence easier to understand. Here is what it produced:

I, who remain unknown to you, am writing this letter. Even though I have never seen you, I loved you before I ever laid eyes on you.

To my ears, the word order “am writing this letter” still leaves something to be desired, but this version is way better than the two previous ones. The truly fascinating thing, however, is that the model reacted to my suggestion. It rewrote the sentence the way I asked it to. This is both fascinating and scary, or more precisely, uncanny.

Let's take it further: in the same way the model translated a Latin text, I can ask it to summarise a Latin text, or to interpret it, and if I am not satisfied with the interpretation, I can give further instructions, push the model further... What will happen then? Will the LLM become

our next infrastructure, similar to the internet? Will it serve as a prosthesis for my research and my thinking, much like the internet, or a concordance, or a dictionary, or a book currently serves as a prosthesis for my memory and knowledge?

There are two unknowns to this exciting future.

The lesser unknown is that, at the moment, nobody understands the exact way the LLM arrives at its solution. It is not that I, as a lay person, do not understand it, in the same way that I do not understand how exactly a smartphone or a computer works, although I use a smartphone and a computer all the time. The problem is that nobody, not even specialists, not even people who created the LLM themselves, understands how it arrives at solutions, and how and why it activates and connects certain neural nodes. At the moment, teams are hard at work trying to reverse engineer such connections of neural nodes, in a way strikingly similar to neuroscientists trying to identify parts of our brains which get activated when we think about something. We have created something we do not fully understand.

To you, this may sound exhilarating; it is almost the work of an artist, not a scholar. To me, this causes unease and apprehension. You may say: “A solution becomes itself a new problem? This is nothing new; this is not unknown to the human condition.”

We come to the other unknown now.

I have judged the Latin translation of ChatGPT acceptable, even brilliant. I have been able to do so because I know Latin. I can require that the LLM change the interpretation of a text because I already know the text and already have a certain opinion about it, because I already have an interpretation, so what is really new in this circular interaction? But what happens if I decide to take a shortcut, if I ask the LLM to summarise something I have not read? Let us suppose that I trust the model to be correct, that, after checking a hundred Latin translations done by the model, I have a good appreciation of its capabilities (the models will certainly reach that stage soon). What happens then? And what happens, from a humanities point of view? Does the LLM become an assistant? Does that assistant replace not only me (at this stage), but also a gifted student on my team? And, the social issue aside,

do I become a lazy scholar, one who outsources one's thinking? Does outsourcing to LLMs thus become the norm? Do we, by embracing LLMs as infrastructure, contribute to the extinction of all humanities? Because, in the final analysis, if we can outsource thinking about books, what is the point of us reading books and thinking about them?

I do not know. What I do know is that we have some hard thinking to do. At the moment, it may be easy and efficient to accept what is on offer, just as it is easy to think through existing metaphors of artificial intelligence, infrastructure, workflows, and data (yes, most of the time, these are all metaphors). But this can be too easy to satisfy a genuinely critical attitude. Therefore, whatever the outcome, let us not use the metaphors without thinking, just as we would not want to use tools without thinking. Both tools and metaphors change us and shape us, as they have done to me as a philologist. However, let us not allow tools and metaphors to change and shape us without us trying to understand what they do and what we are doing in the process. Things are too interesting to happen unexamined.

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RESEARCHERS FROM THE HUMANITIES IN CROATIA AND RESEARCH DATA: AN EMPIRICAL CASE STUDY

RADOVAN VRANA

Faculty of Humanities and Social Sciences, University of Zagreb
Zagreb, Croatia

rvrana@ffzg.unizg.hr

ORCID iD: 0000-0002-8867-8275

Traditionally, published works were the primary output of scholarly research. However, the 21st century significantly elevated the importance of research data. While STEM fields rapidly adapted to new data infrastructures, the humanities initially lagged. Since then, the humanities have made considerable strides in developing the number and quality of digital tools for managing digital research output. This study investigated the research data practices and perspectives of a group of humanities researchers in Croatia. Findings reveal a strong engagement with research data created by other researchers, primarily for comparative secondary analysis. However, specific applications like quality checking and templating new research questions were less common. A significant finding was the near absence of research replication attempts, largely attributed to a lack of formal education in research data management. While most researchers in this study provide some level of open access to their own data, practical barriers hinder more extensive sharing. These include inadequate infrastructure, fears of misuse (such as idea and authorship theft), and significant time commitment. The study concludes that despite valuing and sharing data, effective data reuse for critical tasks like quality control and replication remains limited. This is primarily due to training deficits, infrastructure issues, and security concerns. This study also highlights the need for improved education, institutional support, and incentives to fully realise the potential of reusing research data in the humanities.

Keywords: humanities researchers, infrastructure barriers, personal barriers, research data management, research data practices

INTRODUCTION

As modern science becomes increasingly digital and data-driven (Swan 2012: 16; Tenopir et al. 2020: 2), a profound shift has occurred in the paradigmatic understanding of what constitutes research output. For centuries, published scientific works, such as journal articles, books, and, later on, conference papers, were the primary outputs of scientific endeavour. However, as a result of technological advancements, the 21st century has broadened this notion, placing increased focus on research data as a valuable research output and elevating its significance as a potential source of new scientific information. Research data refers to the factual records (numerical, textual, visual, audio, or multimedia) used as primary sources for scientific research, which are commonly retained for analysis or to validate findings (Organisation for Economic Co-operation and Development 2007: 13).

In this era of collaborative and data-intensive networked science, research data analysis (or processing), sharing, and reuse have become important assets for scientific collaboration (Swan 2012: 65). To prevent the loss of valuable research data and to enhance the efficiency of scientific activities and funding allocation (Lee and Stvilia 2017: 1), key stakeholders in science, including individual researchers, scientific communities, governments, and funding agencies have begun to actively provide systematic care for research data. This systematic care is known as research data management and requires proper research infrastructure.

Although research infrastructure is evolving to better support the research activities, including long-term support for research data, many researchers still struggle with and lack knowledge about effective research data management practices for the information their work generates. Consequently, the processes for handling research data often lack the necessary efficiency, making it difficult for researchers to collect large, complex datasets and prepare them adequately for long-term preservation and reuse. For individual researchers, managing research data is a time-consuming, costly, and tedious task that demands resources often unavailable to them (Rehnert and Takors 2023: 2).

This paper examines research data management challenges in a group of researchers in the humanities in Croatia, who participated in the study. Rather than providing a comprehensive overview of research data management challenges in general, it highlights real-world obstacles researchers face when managing their data.

RESEARCH DATA IN THE HUMANITIES AND RESEARCH DATA MANAGEMENT

During the recent decades, the humanities have become more digitally intensive, similarly to other fields of science, but even more intensively since the emergence of digital humanities. There are several understandings of what digital humanities are, and there are two main views in defining digital humanities (Bell and Kennan 2021: 160–161). The first view treats technology as a tool and the digital as mere material. It aligns with early notions of “humanities computing” and focuses on the computational use of digital tools. However, this view faces criticism for lacking self-reflection and failing to produce impactful or relevant humanities scholarship. The second view sees technology and digital media not just as tools, but as subjects of study too. It emphasises the importance of questioning how digital technology shapes knowledge production in the humanities (leading to the development of digital humanities).

Digital humanities date back to the twentieth century, when the focus was on data standards such as TEI and the digitisation of cultural heritage. Related activities included text mining and cultural analytics used to examine digitised and encoded texts, images, audio, video, and other objects. These activities were enabled by computational tools that revealed details in source materials, uncovered patterns and anomalies, quantified attributes, and generated visualisations to support knowledge creation (Rath 2016: 268). A new phase of development and wider acceptance of the term itself dates to the early 2000s (Kirschenbaum 2010: 57). Later on, visualisation techniques were added to enhance data analysis, and digitisation has since improved access to research materials, including research data.

The handling and perception of research data vary significantly across scientific fields. To distinguish between them, two research paradigms are discussed: positivism and interpretivism. Each offers a distinct perspective on the reality that researchers observe and analyse.

Positivism emphasises observable, measurable facts and aims to produce credible, objective data by maintaining researchers' neutrality and distance from participants. It seeks to develop universal, generalisable laws, unlike interpretivism, which values contextual richness in data (Alharahsheh and Pius 2020: 41; Junjie and Yingxin 2022: 10–11).

Interpretivism holds that truth and knowledge are shaped by people's interpretations within their historical and cultural contexts. It relies on narrative data and emphasises understanding subjective meanings in social and cultural systems. Its ontology is subjective, which can lead to contradictions when explaining social phenomena (Junjie and Yingxin 2022: 12). It focuses on in-depth, context-specific variables, recognising that humans differ from physical phenomena due to the complexity and richness of their meanings. It argues that social science research should be distinct from natural sciences, as it considers cultural, temporal, and situational differences that shape diverse social realities. Unlike positivism, interpretivism seeks deep insights rather than universal, generalisable laws (Alharahsheh and Pius 2020: 41–42).

Researchers in the humanities may incline more to interpretivism than positivism, which is more common in some other fields of science. Humanists frequently view research data through a different lens than other researchers and may lack the institutional and technical support structures available in other scientific fields (Higgins et al. 2024: 3). In the humanities, for example, much data remains in analogue form, with only a fraction digitised with issues of data ownership, participation in data sharing and curation practices that are typically limited to small communities (Gualandi et al. 2023: 54). Furthermore, even among digital humanists, there is no clear consensus on what data sharing means and how to implement it, or how to define its success (Ruediger and MacDougall 2023: 4). Data sharing between researchers in the humanities faces cultural barriers; prioritising publication over data; and framing research as based on sources rather than data, which can make the entire concept of “data sharing” seem alien. Differences between

researchers themselves also play a role in data sharing. Some researchers in the humanities practice methods which are viewed with ambiguity and even hostility from some more traditionally oriented researchers in the humanities (Ruediger and MacDougall 2023: 3–4). Pablo Dorta-González, Sara M. González-Betancor, and Maria Isabel Dorta-González (2021: 13) investigated the motivation of researchers for data sharing and found that researchers' data-sharing is significantly motivated by formal recognition and credit, particularly data citations, which younger researchers value highly. For most researchers, data sharing is undervalued. However, previous experience with open data reuse strongly correlates with increased data sharing frequency and is more prevalent in later career stages, despite citations being less valued by older researchers.

In conclusion, data sharing has become mainstream in the technical and natural sciences. It has also become so in the social sciences, and it is expected that the humanities adopt (or may already have adopted) the same practice.

SIMILARITIES AND DIFFERENCES IN UNDERSTANDING RESEARCH DATA-RELATED ACTIVITIES

Researchers in different fields of science researched differences in understanding research data-related activities. Nushrat Khan, Mike Thelwall, and Kayvan Kousha (2023) surveyed various disciplines to understand the differences and commonalities in research data production, sharing, and reuse. Their study identified three key areas needing improvement to boost data sharing and reuse. First, data-related issues include the need for more data sharing with accompanying code, ensuring data availability and accessibility with DOIs, better data management practices, formalising data citation, guaranteeing data quality, and encouraging the publication of data papers. Second, technological solutions are vital. This means developing enhanced search systems with improved tagging, creating user-friendly interfaces, building recommendation systems for datasets, providing more tools for data extraction and analysis, and setting up alert systems for new datasets. Finally, cultural and policy changes are essential. This involves increasing

awareness and acceptance of secondary data analysis, promoting data and data repositories, offering incentives for data creators (like data badges or co-authorship), boosting funding for secondary data analysis, encouraging collaborations, and streamlining guidelines for handling sensitive data (like qualitative or medical data), legal/copyright information, and data access procedures.

Ixchel M. Faniel and Elizabeth Yakel (2017) investigated data sharing and reuse in social science, archaeology, and zoology. They found that while infrastructure and traditions varied across these fields, five key trust markers for data reuse were consistent: the data producer's identity, documentation quality, original peer-reviewed publications, evidence of prior reuse, and the repository's reputation.

Benedikt Fecher, Sascha Friesike, and Marcel Hebing (2015) explored why academic researchers are reluctant to share their research data, despite strong encouragement from policymakers, funders, and journals. They concluded that research data isn't currently functioning as a "knowledge commons". To improve research quality and scientific progress, they recommend policies that better incentivise data sharing, increase education on data curation, sharing culture, documentation, and security, and significant investment in efficient, user-friendly data repositories and management software.

Ana Sofia Figueiredo (2017) explored the challenges and opportunities in data sharing, identifying hurdles across four key domains. Ethical and legal challenges stem from the risks of de-identifying and re-identifying data, necessitating controlled access and strong technical safeguards. Financial costs associated with robust data storage, management, and analysis systems can deter laboratories. Cultural barriers include researchers' fear of competitors misusing, misinterpreting, or gaining an advantage from their shared data, which highlights the need for more education and engagement within the scientific community. Despite these challenges, Figueiredo (2017) highlighted significant opportunities in data sharing. Data can be recognised as a primary research output by being published as peer-reviewed, citable papers, which also boosts reproducibility. Depositing data in public repositories and publishing in data journals can increase the reach of published data and enhance the scientific reputation of data creators, with stud-

ies showing that open data often leads to higher citation rates. Finally, data sharing provides a return on societal investment in science by reducing experimental duplication and enabling data re-analysis.

RESEARCH DATA MANAGEMENT

Regardless of differences in understanding what research data are and how to approach processing and sharing of these data, modern science universally necessitates the systematic management of research data: “handling of research data (collection, organization, storage, and documentation) during and after a research activity” (Science Europe n.d.). It involves overseeing data throughout its lifecycle to guarantee its long-term availability and reusability, supporting discovery, retrieval, quality control/comparison to other research studies, and reuse (Bradshaw et al. 2021; Gläser et al. 2017; Iranifard and Latifnejad Roudsari 2022; Krause 2016; Yilmaz 2013). Core management activities encompass discovering, selecting, verifying, analysing, managing, archiving, publishing, sharing, citing data, creating data management plans, and ensuring that any research conducted is both ethical and reproducible. These processes depend on essential research infrastructure, diverse tools, and comprehensive metadata for describing, managing, and packaging the data (Kanza and Knight 2022; Lee and Stvilia 2017: 27).

Research data management in the humanities differs in some aspects when compared to other fields of science. Research data in the humanities requires different management strategies than natural sciences due to data types, standards, and research processes (RDM for the Humanities and Social Sciences n.d.). Furthermore, researchers in the humanities face unique challenges compared to sciences, such as the conceptual ambiguity of data, smaller-scale but complex datasets, and less institutional support, contrasting with more established research data management infrastructures in scientific fields (Haugh and Musgrave 2019; Higgins et al. 2024: 9–10).

Research data have become a new outcome of scientific endeavour and are important for possible reuse later on. Reuse of research data is possible if researchers follow the FAIR data principles. FAIR stands for findable, accessible, interoperable, and reusable. Universities around

the world and their funding bodies promote FAIR data principles to facilitate the development of open science and ensure: early and open sharing of research; pre-registration, registered reports, data deposition in shared repositories, pre-prints, open collaboration within science and with other knowledge producers/users; immediate and unrestricted open access to scientific publications, research data, models, algorithms, software, protocols, notebooks, workflows, and all other research outputs; verifiability and reproducibility of research outputs; practising responsible research output management (publications, data, and other outputs) in line with the FAIR principles and to promote public engagement in research and innovation, bolstering citizen science and enhancing public trust in science (European Commission n.d.). In Croatia, several scientific institutions and associations provide support for the understanding of FAIR data principles and encourage such practices. For instance, Ruđer Bošković (scientific) Institute and its Centre for scientific information (ex the Institute library) offer introduction into open data and FAIR data principles (Končić 2021; Centar za znanstvene informacije n.d.). The Ministry of Science, Education and Youth of Croatia suggests that all data should be openly available (Ministry of Science, Education and Youth n.d.).

Research data management, research data sharing, and data reuse are part of the open science movement. Open science is

a movement for transparency in research and access to the dissemination of research findings and underlying data. Open Science includes the concept of open access publishing, or the concept of publishing scientific findings without a paywall, but goes beyond this to include making code, data and methods available to allow for increased awareness and reproducibility of research activities. Foster's six pillars of Open Science are: open methodology, open source, open data, open access, open peer review, and open educational resources (Network of the National Library of Medicine n.d.).

More generally, "open science is about making sure that all elements of scientific discovery are freely available for everyone to view, share, and utilize; it is to encourage collaboration in the pursuit of new knowledge" (UNESCO n.d.).

More specifically,

open science aims at making scientific knowledge openly available, accessible and reusable. The key elements of open science include: open access to scientific knowledge (including open access to scientific publications, data, educational resources, software and hardware); open infrastructures; open engagement with society and dialogue with indigenous and traditional knowledge systems, among others (UNESCO n.d.).

Research data management has become crucial in science (regardless of the scientific field) as it (Maurya and Subaveerapandian 2022: 259–260):

- saves resources, keeps data secure and decreases search time in the long run;
- helps in increasing the efficiency of research and facilitates future discoveries;
- alleviates data control to reduce the loss of research data;
- increases research integrity and permits collaboration;
- promotes knowledge transfer by maximising data visibility and increasing research impact;
- improves accessibility and the life cycle of data;
- ensures compliance with funding agencies;
- decreases duplication and reduces manipulation of original data.

All these benefits are also applicable to the humanities and should be used by humanities researchers to achieve long-term availability of the research data. To achieve this, researchers in the humanities should be offered additional education in research data management.

While the quantity of research data is increasing exponentially (Steiner 2023), the humanities lack the established infrastructure of other scientific fields but are developing it through projects and institutional support, such as digital repositories. Still, humanities-focused data repositories are underdeveloped, and individual scholars' data is often hard to find or outdated. Lisa Goddard (2023: 6) wrote about different approaches to preservation of humanities research output, like dark archiving, preserving objects and metadata in a repository, web harvesting, emulation, preservation of dynamic/social sites, and archiving static versions. There are many challenges researchers and librarians are facing, as described by Goddard. Digital repositories, as

one of the best solutions for archiving research output, face challenges like the ongoing funding challenge to support file hosting and technical development, as well as the diversity of required file formats, metadata schemas, research structures, and user interfaces (Strange et al. 2023: 349). However, for many humanities researchers, the concept of long-term sustainability in digital humanities presents a significant challenge, because it is not a fixed state but rather a continuous process involving technical updates, financial commitments, environmental considerations, and human investment in training and career development (Tucker 2022). As a result, valuable datasets and tools are inaccessible due to problems like resource limitations, legal, technical, and institutional barriers that restrict who can use or share datasets and tools, and the lack of institutional and technical support available in the sciences, resulting in research data unusable or inaccessible due to technical, financial, and infrastructural barriers (Arthur and Hearn 2021; Higgins et al. 2024: 9–10; Rath 2016).

According to Roxanne Shirazi (2022), there are several problems in discovering digital humanities resources:

1. difficulty in locating digital humanities projects: It is challenging for students and researchers to find scholarly digital humanities projects, even when actively searching for them;
2. reliance on personal networks: Discovery of digital humanities work heavily depends on “a network of relationships” and knowing “who works with whom”, leading to exclusivity and closed circles of knowledge;
3. conflation of discoverability: “Discoverability” is often confused with interoperability, re-use, metadata standards, automated harvesting, aggregation, outreach, and promotion, shifting the responsibility solely to the creator.

Nonetheless, the future looks bright for the humanities and the research data they generate, with the emergence of new digital tools and technologies that assist humanities researchers in managing their research data (Bernasconi and Ferilli 2024; Idrazova et al. 2023; Joo et al. 2022; Pan et al. 2023).

RESEARCH

This research aimed to explore practices related to the sharing, use, and storage of research data among Croatian researchers within the humanities. The main hypothesis of the research was: researchers in the humanities interact with and manage research data in ways that significantly differ from those in the natural sciences and other scientific disciplines. These differences originate from the interpretive, qualitative, and often contextual nature of humanities research, where data may include historical texts, artworks, oral histories, or cultural artefacts, and where the boundaries between “data” and “interpretation” are more fluid. As a result, humanities scholars may adopt different strategies for data collection, curation, documentation, preservation, and sharing, often shaped by disciplinary norms, ethical considerations, and institutional constraints (different policies and guidelines). Still, this research study aimed at collecting data about facts related to research data management in the humanities in Croatia, connecting them to similar activities in other fields of science to create more comparable results. Research questions aimed at finding out answers to the following problems:

RQ 1 – Did the researchers in the humanities in this research study use the research data of other researchers (regardless of purpose)?

RQ 2 – Did the researchers in the humanities in this research study facilitate the use of their research data by other researchers?

RQ 3 – What barriers did the researchers in the humanities in this research study encounter while sharing their research data with other researchers?

An online questionnaire, comprising 25 closed-ended and 3 open-ended questions (28 items in total), served as the primary research instrument. Open-ended questions were thematically analysed to identify recurring ideas and patterns. No ethical approval was necessary from the authors’ academic institution, so it was not requested. The participants were fully informed in advance about the details of the research study in the email invitation sent to them and, additionally, on the initial webpage of the research study (Google Forms). The participation in the research study was completely voluntary, and no iden-

tifiable data about the participants were collected. To maximise participant recruitment, a combination of convenience and snowball sampling strategies was utilised. Invitations to participate were distributed through a mailing list called “znanstvenici.hr” of Croatian researchers owned by and hosted on the Ruđer Bošković Institute’s mail server in Zagreb, Croatia. The study was conducted between 28 June 2023 and 31 August 2023, utilising this mailing list, which, while accessible during the research period, is no longer active. Ultimately, responses were obtained from 90 researchers in the humanities. The owner of the mailing list has never provided the total number of participants subscribed to the mailing list. As a result, there is no factual data about the response rate in this research study other than the number of respondents. Bojan Macan, Lea Škorić, and Jelka Petrak (2024: 47) who used the same mailing list for their research study in early 2023 (the same year and the same mailing list as in this research study), state that

15,000 researchers, postgraduate students, research associates, librarians, and other professionals from the science and higher education system of the Republic of Croatia who, at some point, through participation in various conferences and workshops, by giving consent in the Croatian Scientific Bibliography (CROSBİ), or through a subscription form, have expressed their wish to subscribe to the mailing list and receive the content distributed through it.

The results of this empirical research study can provide insight into (but not a complete picture of) facts, attitudes, and opinions of the participants about the topic of research data management in the humanities (because the participants declared their association with the humanities).

RESULTS

Regarding demographics, seventy-two (80%) respondents answered the gender question. Among those who answered ($N = 72$), twenty-one (29.17%) identified as female, forty-nine (68.05%) identified as male, and two (2.78%) chose not to declare their gender. The mean length of researchers’ work experience in this study was twenty-six years (median = 26 years) (Table 1). The respondents were not further divided by

sub-discipline within the humanities, as some sub-disciplines might be represented by very few respondents.

Table 1. Years of work experience of the respondents by gender (author: Radovan Vrana).

	N	Years of work experience (median)	Years of experience (average)
Male	49	25	23.44
Female	21	19	18.73
Do not want to declare gender	2	18.5	18.5

In a subsequent part of the questionnaire, participants were asked whether they used research data created by other researchers. Of the ninety participants, seventy-nine (87.78%) reported using other researchers' data, while eleven (12.22%) stated they did not. Six respondents provided reasons for not using other researchers' data, generally citing no need for such data in their specific research. One respondent elaborated: "The collections of data I need are mostly produced by cultural institutions and are available to me through GitHub."

The high reported rate of data reuse suggests a strong interest among the respondents in the work of their peers and indicates the perceived value or necessity of accessing data generated by other researchers.

Next, the study participants were asked to rate the general importance of research data to them (on a scale from 1 – not important at all to 5 – most important). Figure 1 presents the results related to the perceived importance of research data. Quality of research seems to be the most important to the respondents, followed by preparation of research and implementation of research. The quality of research (correct methodology of research, real and not falsified data/results) usually means that other researchers can replicate the research or do secondary analyses based on one's original research data (Baker 2016; Camerer et al. 2018; Feilden 2017; Serra-Garcia and Gneezy 2021; Stanley et al. 2018). The main problem with this idea is that far too many research studies are difficult to replicate, which has created a new type of crisis in science and raised many questions about the integrity and

accuracy of published research worldwide. Nevertheless, the availability of research data remains a very useful and desirable result of the development of modern data-intensive science.

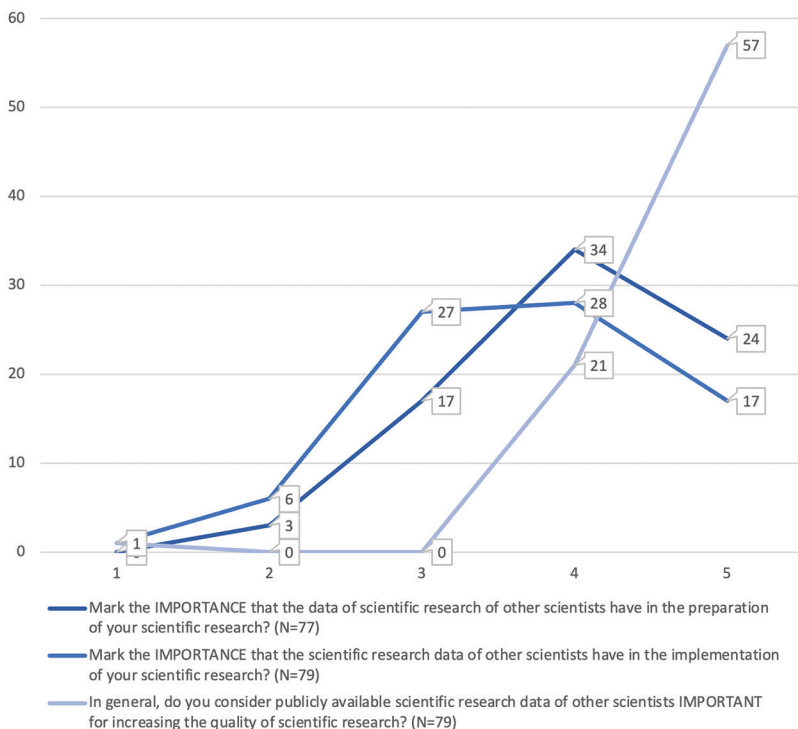


Figure 1. Importance of research data to researchers (author: Radovan Vrana).

In addition to rating the importance of research data, the study participants were asked how frequently they use other researchers' data (RQ 1) to check the quality of their own research (for instance, to compare research methodology and data processing and interpretation). Seventy-seven (N = 90, 85.55%) responded to this question (Figure 2).

The most frequent response was "Sometimes" (N = 33, 42.86%), indicating that researchers occasionally rely on other researchers' data for their research quality checks. Only a small number reported using other researchers' data, "Most often" (N = 10, 12.99%) or "Constantly" (N = 5, 6.49%), suggesting that frequent reliance on external data for qual-

ity assessment is uncommon among this group. Furthermore, a notable portion of respondents reported “Never” ($N = 13$, 16.88%) using other researchers’ data for this purpose, while sixteen ($N = 16$, 20.78%) indicated they do so “Rarely”.

These results (Figure 2) suggest that, while participants may generally value research data (as indicated in the first question and Figure 1 results), using data created by other researchers specifically for assessing the quality of their own work is not a frequent practice. The relatively low numbers in the “Constantly” and “Most often” categories may indicate barriers such as data availability, trust issues, or methodological preferences. Conversely, the peak in the “Sometimes” category suggests that researchers selectively use external data for quality checks when they deem it necessary or beneficial.

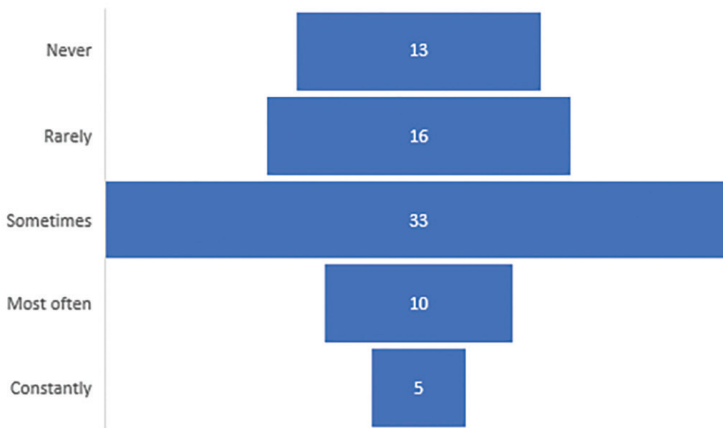


Figure 2. The frequency of research data use created by other researchers to control the quality of their scientific research ($N = 77$) (author: Radovan Vrana).

Another key research activity is the use of external data for secondary analysis, specifically comparing one’s own results with those of other researchers (but not replicating their research, which is in focus in one of the following questions). This aligns with the goals of open research data/open science paradigm. When asked how often they engage in this comparison, the majority of respondents reported doing so frequently

(Figure 3). The most common response (N = 79, 87.77%) was “Often” (N = 30, 37.97%), followed by “Usually” (N = 18, 22.78%) and “Constantly” (N = 13, 16.45%). This highlights data comparison as a common practice among researchers. A significant minority (N = 16, 20.25%) selected “Sometimes”, indicating a more selective approach. Very few avoid the practice entirely; only one respondent chose “Never” (1.26%) and one chose “Rarely” (1.26%). These results suggest that most researchers recognise the value of comparing their findings with other researchers’ data as part of secondary analysis (RQ 1). The distribution confirms that data comparison is a prevalent and generally valued aspect of the research process, undertaken with varying degrees of regularity.

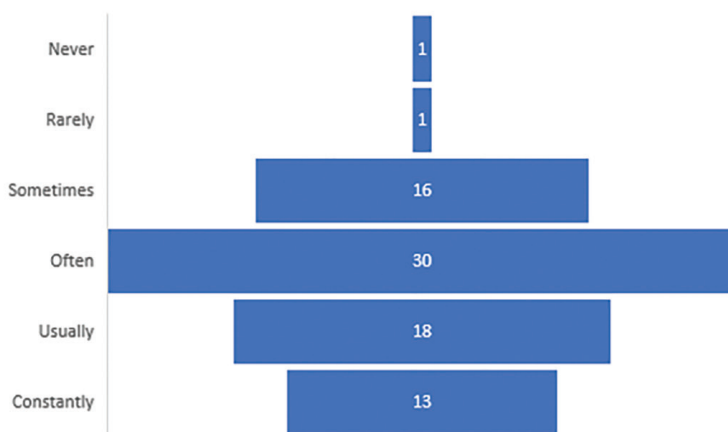


Figure 3. Comparison of results based on research data of other researchers in secondary analysis (N = 79) (author: Radovan Vrana).

Other researchers’ data can also be used as a template for new research questions. Seventy-nine respondents (87.77%) answered this question. Forty-six respondents in this study indicated they “Sometimes” use external data for this purpose (58.23%). In contrast, few rely on this approach frequently, with only ten selecting “Most often” (12.66%) and two choosing “Constantly” (2.53%). A significant number of participants reported using other researchers’ data “Rarely” (N = 26, 32.91%) for generating new questions, while “Never” was not selected by any respondent (0.00%). Generally, these findings suggest most researchers

in the study utilise other researchers' data (RQ 1) as a template at least occasionally, with "Sometimes" being the most common frequency. However, frequent reliance on previous research data for this purpose ("Most often" or "Constantly") appears relatively uncommon.

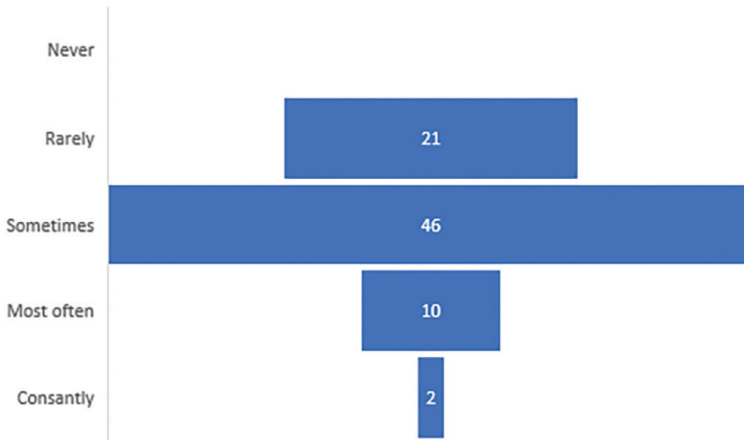


Figure 4. Frequency of use of scientific research by other researchers as a template for formulating research questions in your scientific research? (N = 79) (author: Radovan Vrana).

Another challenge involves replicating other researchers' studies using available data. Among the seventy-nine respondents (87.77%), the vast majority (N = 67, 84.81%) reported never attempting replication. Nine (11.39%) had tried but failed to achieve identical results, while only three (3.79%) had successfully replicated the findings.

To effectively work with research data, researchers must be educated in research data management. Among the seventy-nine respondents (87.77%), the majority (N = 59, 74.68%) had received no education in this area. Of the remaining respondents, eight (10.12%) had watched a webinar on the topic, seven (8.86%) had attended a lecture, three (3.79%) had participated in a workshop, one (1.26%) had taken a specialised course, and one (1.26%) had attended a university course. Lack of education in research data management may hinder replication efforts. Addressing this gap through formal training and promoting research replication as a standard practice could improve research reliability and scientific integrity.

Researchers in this study faced several challenges when working with research data (multiple answers were possible) and possibly shared research data with other researchers (RQ 2) and barriers to data sharing (RQ 3). The most significant was the lack of an adequate data sharing infrastructure, reported by twenty respondents. This suggests struggles with tools, platforms, or institutional support, i.e. lack of adequate infrastructure. The second most common challenge was fear of data misuse, specifically idea theft (seventeen respondents), indicating hesitation due to intellectual property concerns. These challenges could be categorised as personal. Additionally, excessive time consumption (fourteen respondents) suggests data sharing is seen as burdensome. Concerns about authorship theft (thirteen respondents) and lack of knowledge on sharing methods (twelve respondents) highlight educational and security gaps. Technical problems (ten respondents) point to potential compatibility or software issues. Other reported challenges included fear of commercial misuse (six respondents) and costs (five respondents). Though less common, these remain obstacles. Crucially, only three respondents reported no problems, indicating the majority face at least one barrier. These findings suggest that while researchers value data sharing, substantial obstacles remain, particularly regarding infrastructure, security, and perceived effort. Addressing these could foster a more open, collaborative environment.

The final question aimed to assess the extent to which researchers provide access to their research data (N = 72, 80%). The responses indicate varying levels of openness, with a significant portion of researchers offering some form of data access. Thirty researchers (41.67%) provide full open access to all their research data, reflecting a strong commitment to transparency and open science (as stated in the first part of this paper). Nineteen researchers (26.39%) provide partial open access, indicating a willingness to share but with potential limitations due to privacy concerns, ethical considerations, or proprietary restrictions. Four researchers (5.56%) provide partial access with additional limitations, while only two researchers (2.78%) offer full access with restrictions (e.g., password protection, IP limitations). Two researchers (2.78%) do not provide access to their research data at all, highlighting possible concerns related to confidentiality, competition, or a lack of infrastructure for sharing. Fifteen researchers (20.83%) provide access

through alternative means not listed in the predefined categories, suggesting additional diverse approaches to data sharing (“I offer some form of access to the data from my scientific research that is not listed here”).

The high percentage (73.61%) of researchers offering some level of open access suggests a positive trend towards open science. Meanwhile, the 20.83% using unlisted methods highlights the need for better standardisation and infrastructure to facilitate consistent data-sharing practices. The low number of researchers restricting or withholding data entirely (5.56%) suggests that most researchers recognise the value of data transparency but may require more structured systems to ensure secure and ethical sharing. Overall, the results indicate that open data access is becoming the norm, with most researchers (whether partially or fully) willing to share their data.

However, some still impose restrictions or use alternative methods, underscoring the need for clearer guidelines, improved infrastructure, and greater institutional support for open data initiatives.

DISCUSSION

This study explored research data practices and perspectives of a group of researchers in the humanities in Croatia. Their work experience is extensive (mean work experience: 26 years), with a notable majority identifying as male (68.05% of those responding). The findings indicate a strong baseline engagement with research data; a high proportion (87.78%) reported using data created by other researchers (RQ 1), suggesting significant value placed on accessing and utilising peer research within this community. This aligns with the generally high importance researchers assigned to research data overall (indicated by Figure 1 results).

Despite this general use and perceived value, the specific applications of other researchers' data reveal important variations. While researchers frequently compare their results with other researchers' data as part of secondary analysis (sixty-one respondents doing so “Often”, “Usually”, or “Constantly”), indicating a common practice for contextualising findings, the use of other researchers' data specifically

for quality checking (comparison of methodology, results, etc.) one's own work is considerably less common. The peak response for quality checking was "Sometimes" (thirty-three respondents), with significant numbers reporting doing so "Rarely" (sixteen respondents) or "Never" (thirteen respondents). Similarly, using other researchers' data as a template for new research questions, while practised by most at least occasionally, was dominated by the "Sometimes" response (forty-six respondents), with frequent reliance ("Most often" or "Constantly") being rare. This suggests that while data reuse is prevalent, intensive application for quality control or frequent templating is less typical, perhaps reflecting methodological preferences, disciplinary norms, or barriers to accessing suitable data for these specific purposes.

A different finding emerges concerning research replication. An overwhelming majority ($N = 67$, 84.81% respondents) had never attempted to replicate another study using available data, and of the few who tried, only three were successful. This near absence of replication practice points towards significant barriers, as stated by Baker (2016), Camerer et al. (2018), Feilden (2017), Serra-Garcia and Gneezy (2021), and Stanley et al. (2018). A likely major contributor is the profound lack of formal education in research data management, reported by a majority ($N = 59$, 74.68%) of respondents. Without foundational research data management skills, tasks like assessing data quality, understanding metadata, and managing complex datasets for replication become formidable challenges.

Opening one's research data for use by other researchers faced numerous practical barriers identified by the respondents, ranging from infrastructural problems (as stated by Rehnert and Takors 2023) to personal fears (RQ 2 and RQ 3). The lack of adequate data sharing infrastructure and pervasive fears about data misuse – including idea theft and authorship theft – represent significant barriers. Furthermore, the time commitment required and insufficient knowledge on how to share data add to the burden. Technical difficulties and concerns about costs or commercial misuse also contribute, but were less frequently represented. Only a small number of respondents reported encountering no problems, which is concerning. These barriers collectively hinder not only replication efforts but likely also reduce enthusiasm and capabil-

ity for effective data sharing and reuse, despite respondents' apparent willingness.

Nevertheless, when examining respondents' own data sharing practices, a positive trend towards openness is evident. A substantial majority (73.61%, $N = 53$ cumulatively) provide some level of open access to their data, with full open access being the most frequent approach (in accordance with the open science paradigm explained in the first part of the paper). This suggests a growing commitment to open science principles by the participants. However, the landscape is complex; partial access is also common, as well as the use of alternative methods not covered by standard categories (like direct requests), highlighting a need for more standardised practices and flexible infrastructure. While outright refusal to share data is uncommon, the existence of restrictions and varied sharing methods indicates persistent concerns related to ethics, confidentiality, or simply the practicalities of making data accessible.

In conclusion, the study reveals a dichotomy among these experienced humanities researchers: they value and utilise external research data, particularly for comparison, and are increasingly willing to share their own data. However, this exists alongside significant, interconnected challenges, including a major deficit in research data management training, practical barriers related to infrastructure and security fears, and consequently, extremely low rates of research replication. While open science principles appear to be gaining traction regarding data provision, effective data reuse for crucial tasks like quality checking and replication remains limited. Addressing the identified gaps through targeted training, improved infrastructure, clearer guidelines, and fostering a research data curation culture that values replication appears essential to fully realise the potential of data-driven research in the humanities.

LIMITATIONS

A primary limitation of this research is the lack of a clearly defined population from which the sample of participants for this study was drawn. The study relied on self-identification by individuals as researchers in

the humanities in Croatia. This means there was no external verification or specific criteria used to select participants beyond their own confirmation.

Consequently, the findings and conclusions of this study regarding the current state of research data use and management are limited to the experiences of the self-selected individuals who participated. While all three research questions were addressed and results presented, these findings cannot be broadly generalised to the entire population of humanities researchers in Croatia.

CONCLUSION

While published scientific works were traditionally viewed as the primary output of scientific endeavour, the 21st century has brought a shift, elevating the significance of research data. Advances in IT technologies, particularly the internet, facilitated the development of infrastructure crucial for long-term research data management. Fields such as STEM rapidly adopted this infrastructure, whereas adoption lagged in others, including the social sciences and especially the humanities. However, the emergence of digital humanities has begun to transform research data management practices within the humanities.

While there is clear recognition of the value of other researchers' data, reflected in high usage rates and a strong inclination towards data sharing, the intensity and consistency of application remain limited. Data are often used for different types of comparisons, but less so for tasks such as quality assurance or developing new research questions. Most strikingly, replication of other researchers' work is virtually absent, underscoring persistent challenges within the field.

A key obstacle is the widespread lack of formal training in research data management, which leaves researchers ill-equipped to handle complex data tasks. This is compounded by practical and psychological obstacles, including inadequate infrastructure, fears of data misuse, and uncertainties around sharing protocols. Despite these obstacles, the majority of respondents do engage in some form of data sharing, with many embracing fully open access, an encouraging sign of alignment with open science ideals.

To bridge the gap between willingness and capability, focused interventions are essential. Improved research data education, institutional support (especially hardware and specialised software), education in research data management, secure research data sharing mechanisms, and stronger incentives for research replication could foster a more sustainable, transparent, and impactful research culture in the humanities. Without such steps, the full potential of research data reuse in the humanities will remain unrealised.

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ANCIENT SCRIPTS, MODERN METHODS: ANALYSING THE ASOKAN EDICTS

MEHAK SEJWAL

Indian Institute of Heritage, Noida, Uttar Pradesh, India
Indian Institute of Technology, Jodhpur, India
sejwalmehak@gmail.com

Digital humanities have significantly advanced in recent years, particularly within Western academic contexts. However, in Eastern countries (like India), this field is still emerging and lacks institutional infrastructure and broad scholarly adoption. This paper explores the potential of digital humanities in India through a case study of Emperor Asoka's 3rd-century BCE inscriptions, written in Prakrit using the Brahmi and Kharosthi scripts. Traditional methods of reading inscriptions, including attention to detail, transliteration and translation, have been applied first to create a corpus of proclamations, instructions, governance, welfare schemes, etc. Computational tools were then used to conduct word frequency and collocation analysis as well as create visualisations, such as clouds and trend graphs. The results demonstrate that computational methods can facilitate the analysis and presentation of ancient texts, revealing patterns, themes, and structures not immediately apparent through traditional reading. Thus, this study highlights the potential of digital humanities to support the preservation and study of ancient languages and scripts in India, providing methodological insights and promoting the development of digital humanities scholarship in the East.

Keywords: digital humanities, Asokan edicts, language preservation, textual analysis, computational epigraphy

INTRODUCTION

Digital humanities combine humanities scholarship and computational methods, enabling new approaches to the study, preservation, and interpretation of cultural heritage across temporal and spatial

contexts. They bring together diverse perspectives and expertise from across the globe, fostering a collective effort to explore, preserve, and reinterpret our shared heritage by making it more accessible and interactive. While Western research infrastructures have driven significant advancements in digital humanities, scholars such as Domenico Fiormonte, Sukanta Chaudhuri, and Paola Ricaurte (2022) have pointed to the ongoing geographic imbalance in the field, particularly the marginalisation of non-Western textual corpora and research perspectives. They highlight how the field remains predominantly centred on the West. In the East, digital humanities are still emerging and often lack institutional infrastructure and widespread scholarly adoption. This imbalance underscores the need for methodological frameworks that address infrastructural and linguistic challenges specific to the East (Fiormonte et al. 2022).

In India, for example, a developmental stage can be noticed where institutions like Jadavpur University, Kolkata, offered a Post-graduate Certificate Course in Digital Humanities and Cultural Informatics for the first time in 2013. The Indian Institute of Technology Jodhpur later introduced a master's degree in digital humanities, while other institutions have incorporated digital humanities as a component within broader programmes. The field in India is, thus, still in its nascent stage and requires more exploration, innovation, and trust to gather public interest.

This limited public engagement also applies to historical studies, where only in the past few decades has there been a shift towards more pluralistic interpretations of India's past, fostering dialogue between diverse historiographical perspectives. Romila Thapar (1968) has argued that it was only in the 1960s that a systematic history of changing interpretations of ancient India could be written, allowing the past to be examined more firmly within an Indian historiographical framework. This is especially important given that after decades of independence, the country is still believed to be the country of snake charmers (Business Standard 2019), despite its rich cultural heritage, legacy, and historical complexity. These challenges are compounded in the study of ancient languages such as Prakrit and scripts like Brahmi and Kharosthi, where digital resources and infrastructure remain especially limited.

In light of these challenges, the paper takes the case study of Emperor Asoka's 3rd-century BCE inscriptions and explores the potential of digital humanities in India,¹ where the field is still developing institutionally, with a focus on Prakrit inscriptions written in the ancient scripts, Brahmi and Kharosthi, used in the Asokan Edicts. Through this case study, the paper underscores the need to expand digital humanities research within the East, particularly in the study and preservation of ancient languages and scripts. This approach highlights both the challenges and the transformative potential of computational methods in historical research.

SIGNIFICANCE AND BACKGROUND

India has the largest population in the world, and historically, it is home to one of the largest and oldest civilisations: the Harappan Civilisation, dated as old as 3,500 BCE. Since then, the land has been continually inhabited by indigenous people and has drawn foreign travellers like Megasthenes, Xuanzang, Al-Biruni, Jean-Baptiste Tavernier, and Thomas Roe through the centuries. These travellers, along with indigenous sources, have left detailed accounts documenting the region's cultural and historical development across centuries. However, despite their significance, these historical records of the natives and the foreigners remain largely overlooked. It is, therefore, necessary to engage with such records by using traditional and modern approaches.

The ancient texts of India were initially transmitted orally in Sanskrit (Tull 2015). Subsequently, Prakrit gained prominence as a widely used vernacular language. Prakrit is a language that Dr. Urmishree Bedamatta defines as the Sanskrit spoken by the mouths of the masses. It is a language that, in the process of becoming colloquial, got simplified and removed certain sounds from the parent language, for example, "Dharma" became "Dhamma" and the word "akṣara" became "akkhara".

¹ The variation between "Ashoka" and "Asoka" arises from differences in transliteration conventions. "Asoka" reflects the more traditional scholarly transliteration from Sanskrit and Prakrit sources, whereas "Ashoka" is the spelling used by the masses, which does not follow the transliteration rules. In this paper, I have retained "Asoka" in the main text for consistency with the source language, while keeping "Ashoka" in the reference list to match the spelling used in the cited works.

The vastness of the Indian subcontinent resulted in the diversification of Prakrit into various regional dialects like the Maharashtri, Sauraseni, Magadhi, Ardhamagadhi, etc. (Woolner 1986). Some of the oldest variants of the language are of Asokan Prakrit, written in stone in the inscriptions of the Mauryan king Asoka, one of the most influential rulers of ancient India. His name, meaning “without sorrow”, symbolically aligns with his historical role in unifying much of the Indian subcontinent under one government for forty years by creating one of the world’s oldest welfare states, promoting non-violence and advocating conquest by moral force (Allen 2012). He was able to leave a lasting impact on the history and culture of India. Asoka’s ideals of peace and unity have shaped India’s identity and art of his times, like the Sarnath Lion Capital and the Asoka Chakra have become integral to Indian state symbols, currency, and the national flag (Olivelle 2024).



Figure 1. Map of Asokan Edicts (left); Kalsi Rock Edict (centre); Vaishali Pillar Edict (right). Source: Wikimedia Commons (2007a; 2016; 2007b).

He also commissioned a set of rock and pillar inscriptions across the subcontinent (Figure 1) in Brahmi, Kharosthi, Greek, and Aramaic scripts (Figure 2). These inscriptions provide insights into his times, reign, policies, administration, ethical principles, cultural interactions, political conditions, and religious tolerance. They also shed light on the neighbouring regions and the words that the emperor wanted his subjects to hear regularly and abide by. These texts also depict a ruler who, in the 3rd century BCE, publicly acknowledged his errors, notably after the Kalinga war, and redefined kingship through a model of moral

governance. The paper first examines the content of Asoka's inscriptions and then seeks to demonstrate how digital humanities methodologies like text analysis can be applied to the study of non-European epigraphic corpora.



Figure 2. Comparative Scripts of Asokan Inscriptions: Brahmi, Kharosthi, Greek, and Aramaic. Source: Wikimedia Commons (2018a).

METHODOLOGY

In the first phase, the Brahmi and Kharosthi inscriptions were examined through traditional epigraphic methods, including close reading with a focus on linguistic and contextual features. A meticulous analysis followed, leading to transliteration into Devanagari and the International Alphabet of Sanskrit Transliteration (IAST), which were then translated into English. These were compiled into a structured digital corpus combining source-script text,² transliterations, and translations (Figure 3).

² The corpus is a part of a larger doctoral research project and cannot be made public at this stage. However, the complete transliterated corpus will be made available through an open-access repository upon publication to enable reproducibility and facilitate further research.

integrated visualisation modules that are particularly suited to exploratory corpus analysis without the need for extensive programming.

The modules thus used included Term Frequency, Collocate Graph, Contexts, and Trends that generated outputs such as word-frequency charts, collocation networks, and trend graphs. All statistical claims in this study are based on raw frequency counts; no inferential tests were performed as the analysis is exploratory in nature.

The findings highlight the potential and the challenges of applying computational methods in native scripts and languages of the Eastern world. This study serves as a foundation for future research and acts as a stepping stone for future works, making the findings engaging for scholars and the general public alike.

While the findings presented offer significant insights, the study faces certain methodological limitations. The dataset, though substantial, is not exhaustive, and regional discrepancies in script usage or inscription quality may affect representativeness. The process of transliteration and translation, particularly from scripts like Brahmi and Kharosthi, introduces interpretive variation that may influence frequency and collocation results. Additionally, while tools like Voyant Tools facilitate accessible visual exploration, they offer limited linguistic nuance, and further refinement using more specialised Indic natural language processing (NLP) tools would be valuable in future work.

CONTENT OF THE ASOKAN EDICTS

The inscriptions of Asoka are etched on rocks and pillars across the Indian subcontinent. They can be divided into four broad categories based on the medium, content, and time period. These edicts, composed in Prakrit, Greek, and Aramaic, were inscribed during Asoka's reign. The oldest among these are the Minor Rock Edicts. These three Minor Rock Edicts can be summed up as follows:

1. Asoka (referred to as *Devanampiya Piyadasi* through the inscriptions) states that he has been a Buddhist layman for over two and a half years, growing more devoted over time. He believes his efforts have brought the gods closer to humans. He urges those who are great and

those who are humble to progress spiritually and orders the inscription and dissemination of this message across his empire.

2. It is ordered that his instructions be followed everywhere. Rural officers must gather people and teach them “Dhamma”, i.e., respecting parents, teachers, truthfulness, and kindness. Trainers, clerks, and Brahmins should instruct apprentices in tradition. Families must respect each other. These ancient customs promote longevity and must be upheld.

3. King Priyadarsin expresses deep reverence for the Buddha, Dharma, and Sangha. He emphasises preserving true Dharma and highlights key Buddhist teachings. He urges monks, nuns, laymen, and laywomen to repeatedly study and reflect on these texts. This inscription conveys his intention to ensure Dharma’s longevity.⁴

Along with these recurring edicts, the donations of cave dwellings to “Ajivikas” and other inscriptions written on rocks or walls are also considered Minor Rock Edicts (Figure 4).



Figure 4. The Maski Minor Rock Edict, Raichur, Karnataka. Source: Wikimedia Commons (2011).

⁴ The third Minor Rock Edict is only found at Bairat, Rajasthan.

Major Rock Edicts were the second to be erected across the subcontinent. They consist of fourteen edicts found in the same sequence across the country with minor subtractions and linguistic variations. The key aspects of the fourteen edicts can be summarised as follows:

1. Asoka bans the killing and sacrifice of animals. He says that from hundreds of thousands of animals that were killed in the royal kitchen, the number has come down to three, and that too shall cease in the future.

2. There is a mention of the neighbouring dynasties, Chodas, Pandyas, Satiyaputa, Ketalaputa, and Tamraparni, and the Greek king Antiochus. Asoka also mentions how he has established hospitals for men and animals in not just his, but also the lands of his neighbours. Asoka finally mentions the construction of roads, the digging of wells, and the planting of trees.

3. Asoka mentions the ministers and their regular visits to different places to teach morality and other teachings to the citizens, including respect to elders, friends, relatives, people of different religions, etc.

4. Asoka says that in the past, violence and disrespect were common, but he has replaced war with morality. He believes in promoting non-violence and respect for family, Brahmanas, Sramanas, and parents and declares that his future generations will continue this practice.

5. He acknowledges that performing virtuous deeds is difficult but essential. He urges future generations to uphold moral duties, warning that neglect leads to evil. In his 13th regnal year, he appointed Mahamatras of morality to promote righteousness among all people, including Yonas, Kambojas, and Gandharas. These officials ensure the welfare of prisoners, the destitute, the elderly, and various social groups, even within royal households. Their role is to encourage morality, charity, and justice across his empire. This edict aims to ensure the continuation of these moral policies by his successors for the society.

6. He ensures constant governance by receiving reports anytime, anywhere. He prioritises the welfare of all and insists on immediate communication of urgent matters. He sees his duty as promoting people's happiness in this world and the next. This decree aims to inspire his family to uphold this commitment.

7. Asoka encourages all sects to coexist, as all seek self-control and purity of mind. People have different desires and may fulfil duties partially or fully. However, generosity without self-control, purity, gratitude, and devotion is insignificant.

8. Earlier kings enjoyed pleasure tours, Asoka replaced them with moral tours – visiting monks, supporting the elderly, and teaching morality, making these tours more meaningful.

9. He prioritises moral and ethical practices over ritualistic ceremonies. He emphasises kindness, respect for elders, and compassion for all beings. True merit, he asserts, arises from moral conduct rather than religious rituals. His goal is to promote dharma through good deeds, fostering harmony and spiritual progress.

10. The king declares that worldly fame and glory hold no value unless rooted in moral righteousness. His aspirations focus on spreading dharma, ensuring the well-being of his subjects, and encouraging ethical conduct. He seeks neither conquest nor grandeur but only the propagation of virtues for present and future generations.

11. Asoka proclaims dharma as the highest wealth. It manifests in kindness, truthfulness, gratitude, self-control, and moral duty. He encourages all to follow dharma regardless of background, stating that true nobility lies in good conduct. By promoting righteousness, he hopes to ensure societal well-being and spiritual progress for all.

12. The king advocates religious tolerance and mutual respect among different sects. He discourages discord and urges people to appreciate diverse beliefs. Promoting understanding fosters unity, allowing all religions to flourish. True devotion lies in practising self-restraint, compassion, and truth, ensuring harmony among his vast, multicultural empire.

13. Asoka reflects on his conquest of Kalinga, deeply regretting the immense suffering it caused. This realisation leads him to renounce violence and commit to spreading dharma through peaceful means. He prioritises diplomacy, welfare, and moral guidance, seeking to inspire neighbouring regions to embrace righteousness rather than war.

14. This edict explains variations in inscriptions due to space, context, and regional needs. Some messages are repeated for emphasis,

while others are abridged or expanded as needed. Despite potential omissions or errors, Asoka's intent remains clear – continuing to propagate dharma through inscriptions to guide his subjects towards moral living.



Figure 5. The Kalsi Major Rock Inscription, Dehradun, Uttarakhand (author: Purnima Sharma).

The Major Rock Edicts (Figure 5) also include the two separate edicts that are only found in Dhauili and Jaugada in Odisha. The content of the edicts can be summed up as:

1. Asoka instructs judicial officers to act impartially, avoiding anger, hurry, and cruelty. Justice must be fair, ensuring no wrongful imprisonment or harsh treatment. Regular reviews by officials from Ujjayini and Takshashila will ensure compliance. Observing this brings great rewards; neglect leads to failure in duty and displeasure of the king.

2. Asoka desires his border subjects to trust him, not fear him. He urges officials to inspire confidence, promote morality, and ensure welfare. Officers will oversee this duty across provinces. The edict must be heard every four months to reinforce Asoka's role as a fatherly ruler, ensuring justice and happiness.

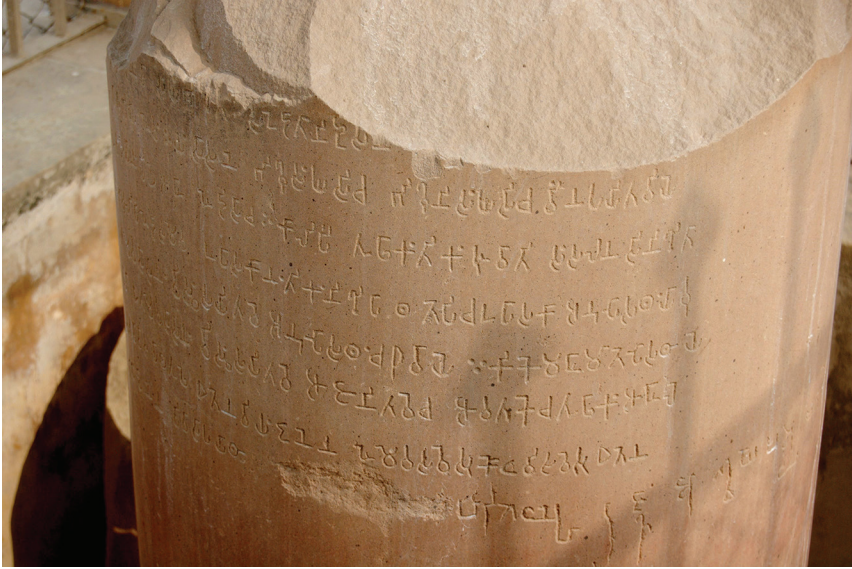


Figure 6. Minor Pillar Edict on the Sarnath Pillar, Sarnath, Uttar Pradesh. Source: Wikimedia Commons (2009).

Minor Pillar Edicts (Figure 6) are ascribed to either the same time or later than the Major Rock Edicts. They refer to four separate minor Edicts of Asoka inscribed on columns at five locations. In the Schism Edict, Asoka orders that no one should cause division in the Buddhist monastic order. Any monk or nun creating a schism will be expelled. He desires the order's unity to last as long as his descendants and the sun and moon. In the Queen's Edict, he instructs officials to ensure that donations made by his second queen, Karuvaki, such as mango groves, monasteries, and charity institutions, are credited to her name.

In Lumbini, Asoka commemorates his visit and writes that he worships the site, sets up a pillar, and grants the village tax exemption, requiring only one-eighth of produce as tax. At Nigali Sagar, Asoka enlarges the stupa of Buddha Kanakamuni in his fourteenth year. In his twentieth year, he personally visits the site, pays homage, and erects a stone pillar.

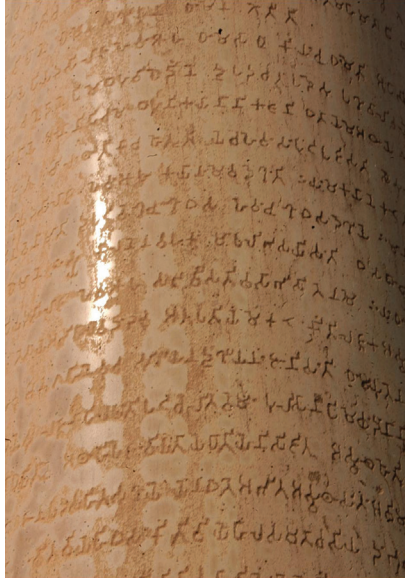


Figure 7. Major Pillar Edict on the Lauriya-Araraj Pillar, Bethia, Bihar. Source: Wikimedia Commons (2018b).

Finally, the last among the inscriptions that King Asoka issued to be written were the seven Major Pillar Edicts (Figure 7). Their contents are as follows:

1. Asoka emphasises the importance of morality for happiness in both worlds. His teachings promote moral values among all ranks of officials, encouraging them to guide and protect people according to moral principles.
2. Morality includes virtuous deeds, compassion, truthfulness, and purity. He provides spiritual gifts and benefits to all creatures. His decree aims to encourage moral conduct and ensure its long-lasting impact.
3. People acknowledge their virtues but ignore their sins. Asoka urges them to recognise harmful passions like anger and envy, emphasising self-awareness and moral responsibility for present and future happiness.
4. Asoka empowers Lajukas (officials) to administer justice and promote public welfare. They must act fearlessly, ensuring fairness in

rewards and punishments. A three-day reprieve for condemned prisoners allows them to seek forgiveness or perform meritorious acts.

5. The king declares certain animals sacred and forbids their harm. Specific prohibitions include branding, castration, and selling fish on certain days. He orders frequent prisoner releases and promotes non-violence in daily life.

6. As a King, Asoka aims to ensure people's well-being and personally oversees governance, extends his influence beyond his domain, and honours all religious sects, prioritising direct engagement with his people.

7. Past kings wished to promote morality but failed. However, Asoka states that he issued moral edicts, appointed officials for ethical instruction, and built infrastructure like wells and trees for public benefit. His focus remains on moral and spiritual progress over material comforts.

Thus, the content of the Asokan edicts varies from proclamations of moral and ethical conduct ("Dhamma") to instructions on governance, welfare, and non-violence in three different languages (Prakrit, Greek, and Aramaic) and four different scripts (Brahmi, Kharosthi, Greek, and Aramaic).

APPLICATION OF COMPUTATIONAL TOOLS AND FINDINGS

This data was then significantly enhanced through computational tools, which involved meticulous transliteration and translation but provided deep insights by revealing linguistic patterns, recurring themes, and structural variations across different inscriptions.

One of the most effective computational methodologies applied in this study is Voyant Tools, which was used to analyse the linguistic structure of the inscriptions. It brought forth important factual information, like that the largest inscription was from Shahbazgarhi, with as many as 1,518 words, and the shortest was the Sopara edict, with only 20 words.

ing), and “hiraṃnapaṭivdhānē” (goldsmith work) appear uniquely in certain inscriptions, indicating localised concerns and administrative measures.

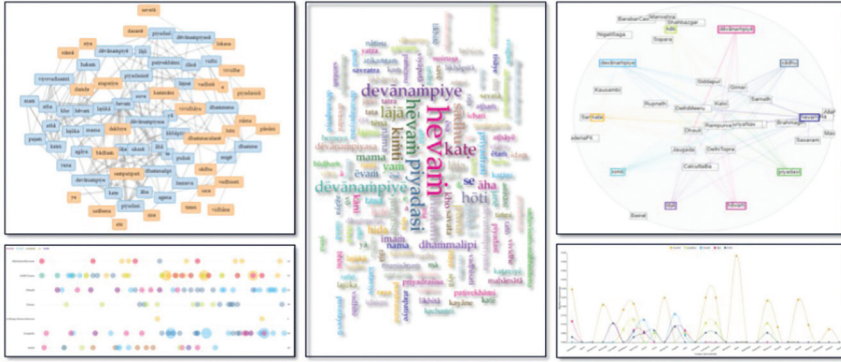


Figure 9. Results from some of the Voyant Tools features (author: Mehak Sejwal).

Regional differences observed in phonology and morphology provide valuable insights into the linguistic landscape of the Mauryan period. Different dialects can easily be noticed in the inscriptions. Western inscriptions like Sopara and Girnar prefer the “ra” sound over the “la” sound, the nasal consonants “na”, “ñā”, and “ṇa” were retained, and all syllables merged into “sa”. In the Kharosthi inscriptions of Shahbazgarhi and Mansehra, the etymological distinctions between “ra” and “la”, do not merge nasal consonants, and preserve the differentiation among sibilants (“sa”, “śa”, “ṣa”). The Eastern inscriptions like those from Dhauli and Jaugada prefer “la” over “ra”, merge nasal consonants into “na” and exhibit “kha” as the reflex of “kṣa”.

These regional linguistic variations underscore the complexity and diversity of Middle Indo-Aryan languages and dialects during the Mauryan period. They reflect spoken vernaculars of different regions and provide crucial evidence for the historical development and diffusion of Prakrit dialects. The inscriptions serve as linguistic artefacts, shedding light on the processes of phonological change, dialectal divergence, and the early evolution of Indo-Aryan languages in the Indian subcontinent.

These computational analyses will not only provide a new dimension to the study of Asokan inscriptions but also pave the way for a

broader application of digital humanities tools in epigraphy. By systematically processing historical texts, digital methodologies offer an innovative means to preserve, analyse, and interpret ancient scripts, ensuring their accessibility for future research and scholarship.

Given the challenges posed by the unique nature of these ancient scripts and the lack of dedicated infrastructure for non-European epigraphic corpora, this study is a work in its nascent stage and is a work in progress. Nevertheless, efforts are being made to develop the research and tools for ancient Indian inscriptions, languages, and scripts. The model is being developed using a combination of supervised training on labelled inscriptional data and adaptation of existing optical character recognition (OCR) frameworks. It is in the experimental phase and currently not deployed for full-scale analysis. On completion, this will significantly enhance digital archiving and further facilitate computational analysis of not just the Asokan edicts but the scripts and inscriptions of non-European countries as well.

CONCLUSION

The study of Asoka's edicts through digital humanities tools underscores the significant potential of computational methods in engaging with ancient inscriptions. By bridging traditional epigraphic techniques with modern digital tools, this research deepens our understanding of the edicts and aims to promote digital scholarship in the East, where historical studies and digital methodologies hold significant untapped potential. Supporting the growth of digital humanities in these countries is increasingly relevant for ensuring the careful documentation and study of their historical and cultural resources.

Asoka's inscriptions that were etched in stone over two millennia ago still speak and remain relevant even today. Their study through computational tools underscores the enduring scholarly value of historical texts and demonstrates how digital methodologies can aid in their preservation and analysis. This research is a step towards a more inclusive digital humanities landscape that acknowledges and integrates the textual heritage of the East. The development of computational tools, tailored for ancient and non-European scripts, is crucial to ensure that their voices are heard by scholars and the public alike.

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PHOTOGRAPHS FROM THE CROATIAN WAR OF INDEPENDENCE: FROM ANALOGUE ARCHIVES TO DIGITAL ACCESS

JOSIPA MARAS KRALJEVIĆ

The Croatian Memorial-Documentation Centre of the Homeland War
Zagreb, Croatia

josipa.maras@centardomovinskograta.hr

ORCID iD: 0000-0002-5699-5559

Photographs from the Croatian War of Independence have been crucial in documenting historical events. During the analogue era, photographs were stored in physical archives, often with limited access and complex procedures for obtaining information. The digitisation of these photographs has significantly improved their protection and durability, as well as facilitated faster access to information by transferring them to various digital databases. One of the prominent databases in Croatia is the eCulture portal. It is a portal that allows the general public, researchers, students, and scholars to access digitised photographs of the Croatian War of Independence, with plans to include documents and multimedia records in the future. This initiative preserves valuable records, promotes their use for educational, research, and cultural purposes, and helps raise awareness of historical events among the general public, nurturing collective memory and understanding. Digitisation faces challenges, among which are still insufficiently resolved copyright issues. Proper management of rights and obligations related to digital photographs is essential to ensuring their lawful and ethical use. In conclusion, the transition from analogue photographs to digital formats and their integration into the eCulture portal (regardless of technical difficulties) represents significant progress in using photographs from the Croatian War of Independence for cultural and scholarly purposes. This paper presents the eCulture portal as part of the mission of the Croatian Memorial-

Documentation Centre of the Homeland War to introduce Croatian cultural heritage to the wider public and to highlight the value of war photography in understanding the country's contemporary history, while also addressing the issue of copyright protection concerning the use of war photographs preserved in the archive and making them accessible to all, regardless of background.

Keywords: Croatian War of Independence, photographs, digitisation, archives, copyright

INTRODUCTION

The Croatian Memorial-Documentation Centre of the Homeland War (hereafter referred to as the Centre) has a dual role as a public scholarly research institution and a specialised archive:

- it collects, arranges, and protects all documentation and data from and related to the Croatian War of Independence;
- it collects and arranges records and archives originating from and related to the Croatian War of Independence;
- it analyses and appraises, professionally and scholarly, data, documentation, and archives related to the Croatian War of Independence and publishes books and other works based on its activities.¹

The Centre has collected approximately 23 TB of archival material in digital form. By the end of 2023, it had stored unconventional materials through its established collections, with the photography collection alone containing around 99,000 photographs. In the internal database designed for processing and searching photographs, the INarchive, nearly 20,000 photographs had been processed and described by the end of 2023. The Centre has received and digitised numerous photographs, with a smaller portion still remaining in storage, as most of the photographs were returned to the donors after digitisation. It is important to note that, during the digitisation process, photographs were initially stored on DVD/CD media and later transferred to digital folders on a server, which is also essential for the protection and

¹ The list provides several examples of the tasks assigned to the Centre under its "Statute and the Act on the Croatian Memorial-Documentation Centre of the Homeland War" (Centre n.d.a).

accessibility of the materials. Our users include historians, journalists, students, professors, and many others interested in contemporary Croatian history.²

Photographs have been used in photo monographs, professional and scholarly publications, presentations, and documentary videos. Through direct communication with users, interest in Croatian historical heritage has grown, and photographs, as witnesses of time, have played a key role. Often, photographs leave a stronger impression than words, which is evident through exhibitions and lectures for students.

This paper examines the eCulture portal (eCulture n.d.) within the framework of the Centre's mission to introduce Croatian cultural heritage to the wider public and to demonstrate the relevance of war photography in interpreting aspects of the country's contemporary history. It further aims to enhance the accessibility of such photography to audiences irrespective of their professional or academic background, and addresses the legal considerations of copyright protection in relation to war photographs preserved in the archive.

DIGITAL PHOTOGRAPHS AS HISTORICAL RECORDS: THEORETICAL CONSIDERATIONS, BENEFITS, AND CHALLENGES

The significance of photographs in historiography and other fields is considerable, especially when they are the only available source of information. Archival scholar Alexandra Chassanoff notes that photographs stored in archives can provide crucial evidence that either fills in gaps or corrects misrepresented facts, which may otherwise lead to a distorted understanding of cultural history (2016: 2). Due to the potential for such problematic situations, it is important to revisit and reassess disputed facts multiple times. As Chassanoff further argues, "historical research in archives is a multi-phase, repetitive process" (2016: 10–11). This process involves examining conventional documents,

² Each year, the Centre is mandated to submit a report on its activities to the Croatian Parliament. The relevant data are presented in the Centre's 2023 Annual Report (Centre 2024; Centre n.d.b).

but it should also extend to other sources, such as newspapers and, importantly, photographs.

As non-verbal witnesses, photographs can substantiate specific events through their powerful visual impact. Their role is far from silent; as the saying goes, “a photograph is worth a thousand words”, conveying meanings that extend beyond written narratives. However, the context in which a photograph – particularly a war photograph – was created is crucial to prevent misuse.³ When we assess a photo through the lens of documentary authenticity, comprehensive or partial information about the image or the scene it captured can be regarded as a truthful record. That is, when a photograph is regarded as a potential source of documentary value within an archival context, its capacity to be considered a reliable representation of an actual event depends not only on its visual content, but also on the accompanying contextual metadata that frames its provenance, authenticity, and evidential value. Such information, whether comprehensive (e.g., details on authorship, date, location, and the circumstances under which the photograph was taken) or partial (e.g., only spatial data or a brief descriptive annotation), plays a vital role in assessing the photograph’s authenticity and evidential integrity. In archival terms, the more reliable and verifiable contextual metadata is linked to the image, the greater its potential to be appraised and preserved as a trustworthy and credible record.

In this context, it is crucial from an archival standpoint to provide a detailed description of the photograph to prevent potential manipulation or misinterpretation. This is particularly important in the case of wartime photographs, where collaboration between the archive and the photographer is essential whenever feasible. If the author is deceased, it is necessary that their heirs submit all accompanying materials along with the photographs to the archive, enabling proper identification and contextualisation of the images.⁴ As art historian Marina Viculin observes, some authors, such as Anton Maračić, have

³ One of the first war photographs taken by a journalist was during the Crimean War (1853–1856), captured by Roger Fenton in 1855 (Dursun et al. 2019: 452).

⁴ An example of this can be observed in the acquisition of photographs by the late photographer Pavo Urban at the Centre, where some of the images were only partially described (Centre n.d.c).

aply described the nature of war photography as being “torn between the truthfulness of its referent and the surprisingly layered emotional-intellectual narrative that only it can convey”, noting that photography becomes an irreplaceable medium in the brutal directness of wartime (Viculin 2012: 25). The digitisation of analogue images raises critical questions about how the process, carried out by archivists, technicians, and other professionals, can alter the image’s characteristics. By selecting certain settings during digitisation, the resulting digital print may differ significantly from the original. This raises a key question: Does digitisation result in the creation of a second original, or is it merely a derivative version of the analogue original? Archival and photographic theorist Joanna Sassoon argues that this process results in the loss of three essential properties of photography: the materiality of the photographic object, the concept of the photographic original, and the origin of photographic meaning (cited in Gržina 2017: 50–51).⁵

When comparing an analogue photo with its digital version, noticeable differences often appear. One of the advantages of digitisation is that it allows for the restoration or enhancement of damaged analogue originals – possibilities that were not available at the time of their creation. However, a key question arises: how closely does the digitally manipulated final result resemble the original analogue image, especially if we consider the photographic negative to be the true original? In some cases, the positive of the photograph is considered the original (such as in the case of Polaroids). Therefore, it is important to recognise the point of view that authentic reproductions can be created by digitising analogue originals as long as the laws governing the technologies used to preserve the authenticity of the originals are respected (Stančić 2023: 15).

The advantages of digital processing include the protection of the original photographs, as it reduces the risk of physical deterioration. Additionally, digital tools can be used to restore damaged photos and also allow metadata to be stored more easily. This metadata, combined

⁵ More on this issue can be found in Joanna Sassoon’s analysis of the implications of digitisation for the materiality and authenticity of photographs, with particular attention to how the digitisation process alters the materiality and original meaning of photographs (Sassoon 2004).

with digital reproductions, improves the identification of original photographs, allowing for faster and easier access. Furthermore, the digitisation of photos allows them to be saved in multiple formats and on different types of media. The negative aspects of digital photography include the obsolescence of digital formats, which can render photographs inaccessible and unreadable (e.g., floppy disks); the excessive use of editing tools which may result in a loss of authenticity; issues related to lost metadata or incorrect data entry; and the risk of copyright infringement, particularly when ownership or licensing rights are unclear.

While digital processing greatly contributes to the preservation of photographic materials in archives, it is crucial to approach this process with care to maintain the authenticity of the original material. The use of digital technologies should be balanced and executed thoughtfully, with a strong emphasis on preserving the historical and cultural value of the original works. The authenticity of digital records is not guaranteed due to the possibility of manipulation, media instability, and technological obsolescence. Therefore, archivists must re-examine traditional methods for creating reliable and accurate content, preserving the authenticity of records over time, and ensuring their verification to shape the future of records capture and storage. To verify the authenticity of a record, it is necessary to verify its identity and integrity (Bushey 2005: 9–10).

On the international archival research scene, numerous studies have emerged focusing on the authenticity and appraisal of electronic records, as well as on issues of integrity and context within IT environments. One of the most prominent among them is the “International Research on Permanent Authentic Records in Electronic Systems” (InterPARES) project, which was launched in 1999 and is expected to be completed in 2026. Over several phases, the project has aimed to address fundamental questions concerning the authenticity, accuracy, and reliability of electronic records. According to the findings of the project’s first phase, researchers concluded that reproductions of original records may indeed be faithful to the original, but they nonetheless remain reproductions – authentic copies, yet distinct from the original (Duranti and Thibodeau 2001). Also, several authors have addressed the

issue of authenticity in relation to reproductions versus original versions, noting that, while a reproduction may contain authentic content, it is not the same artefact as the original photograph. Rather, it is a faithful recreation that shares essential characteristics with the original but remains distinct from it. As David M. Levy (2000) wrote:

Even an extremely high-fidelity copy will be different from the original in innumerable ways, because to copy is to *transform*. The copy will be on a different piece of paper that has its own unique properties. The process of photocopying will make letterforms thicker or thinner than those on the original, and will make images lighter or darker; it will add noise or remove it; it will change tones, shapes, aspect ratios, and so on. Differences will always be introduced in copying; the trick is to regulate the process sufficiently so that the resulting differences are of little or no consequence and that the properties of greatest consequence are shared. Determinations of which properties matter are made in the context of purpose and use.

The digitisation of analogue originals (such as photographs), as well as the management and preservation of digital originals, therefore requires careful consideration of various factors: technical, social, economic, and organisational.

Technical aspects include monitoring developments in digital technologies, replacing obsolete formats with current ones, and establishing intervention schedules to prevent record loss. The social dimension relates to the trust placed in digitised materials as authentic and reliable, as well as confidence in the digital archives that store them. The economic aspect entails evaluating the costs of preserving existing digital content and the costs associated with digitisation and storage under evolving conditions. Finally, the organisational dimension involves compliance with international standards and specifications that ensure the establishment and long-term sustainability of trustworthy digital archives (Stančić 2023: 13–15).

DIGITISATION AS A CHALLENGE AND AN INVESTMENT IN THE FUTURE

The previous chapter briefly outlined some of the theoretical issues that arise in day-to-day archival practice, including those encountered

at the Centre. This chapter will focus on the practical aspects of digitisation, detailing the methods and processes through which it was implemented.

As previously mentioned, the Centre has preserved nearly one hundred thousand photographs. Initially, the materials arrived in both negative and positive formats. The donors included Croatian soldiers, their families, professional journalists, and photographers. A portion of the photographs was taken after the war in areas that had been under occupation during the conflict and now forms part of the Centre's overall archival holdings. With the advancement of technology, spending hours reviewing analogue reproductions – such as photographic prints or microfilms – has become largely obsolete.⁶ Guided by this shift, the Centre initiated the digitisation process. Photographs were initially digitised in accordance with the prevailing standards at the time, using the TIFF format: 300 ppi for positives and 2,000 ppi for negatives. In 2021, however, the Croatian national archival authority introduced the updated “Guidelines for the Digitisation of Documentary and Archival Material” (*Upute za digitalizaciju dokumentarnog i arhivskog gradiva*) (Croatian State Archives 2021). According to these guidelines, digitised materials should now adhere to more refined technical specifications – TIFF or JPEG 2000 formats, with resolutions ranging from 300 to 600 ppi for positives and 3,000 ppi for small and medium-format negatives.⁷

During the digitisation of photographic positives, it was essential to ensure that the final digital image remained as faithful as possible to the original in terms of colour, tone, photograph edges, and other visual elements. However, in cases where low-quality positives could be improved, such enhancements were applied. A typical example includes blurry photographs that were sharpened during processing, thus preserving and enhancing the visual content for practical use. If a

⁶ Microfilm is an analogue medium in the form of a photographic, non-perforated film (master negative) with a width of 35 mm, on which documents are initially recorded. Subsequently, security and preservation copies are made (one negative and several positives) (Institute of Lexicography n.d.). No microfilms have been registered at the Centre.

⁷ “The Guidelines for the Digitisation of Documentary and Archival Material” provide general recommendations for the digitisation of various types of media (microfilms, video, etc.). However, this paper focuses exclusively on the specifications related to photographs (Croatian State Archives 2021: 56–57).

photographic positive was physically damaged, the scanning was performed in a way that the damage remained visible in the digital copy. Additionally, an alternative version of the scanned image could be produced – one in which the damaged portion was cropped, thereby presenting the undamaged content more clearly.

The completion of the digitisation process significantly accelerated research activities, whether the photographs were made available via physical media such as CD/DVD or through the INPRO database system, which the Centre has been using for many years.⁸ Unfortunately, media such as CDs and DVDs have proven to be the weakest link in the process of data preservation and storage due to their vulnerability to physical damage and sensitivity to microclimatic storage conditions (temperature, humidity).

As a result, the Centre experienced a partial, irreversible loss of archival material before the data could be securely transferred to a server. According to the internal documentation of the Centre, out of the original 3,975 CDs/DVDs containing various types of recordings (video, photo, audio, etc.), 28 items were lost (representing 0.7% of the total). However, it is important to emphasise that none of the affected media contained photographs. The Centre ceased the practice of recording materials onto such external media in February 2020.

PRESERVATION AND ACCESS TO HERITAGE THROUGH THE ECULTURE PLATFORM

Undoubtedly, the most efficient and accessible way to view photographs is through various digital platforms that allow users to access content from any location with an internet connection. The Centre has, for now, transferred a portion of its photographic collection to the eCulture platform, with plans to integrate with the forthcoming eArhiv system as well.

⁸ The INPRO database is not accessible to external users; rather, it serves as an internal tool that enables staff to conduct faster and more efficient searches of photographs based on predefined parameters. Over the years, efforts have been made to update the software and to expand the set of descriptive parameters used for cataloguing the photographs.

The digitisation of cultural heritage represents a key challenge and a long-term investment in preserving and promoting the richness of human history and creativity. The eCulture initiative, which encompasses the digitisation, preservation, and online accessibility of cultural content, is not merely a technological undertaking – it is a strategic move aimed at ensuring the relevance and availability of cultural heritage for present and future generations.⁹

The implementation of the eCulture platform enables archives, museums, libraries, and other cultural institutions to share their collections with a broader public. The use of digital technologies can protect valuable materials, such as photographs, documents, newspapers, and similar items from physical deterioration, thereby ensuring their long-term preservation. However, the transition to eCulture is not without its challenges. It requires substantial investment in digital infrastructure, staff training, and the development of protocols to safeguard authenticity and integrity. Additionally, the protection of copyright, access rights, and the ethical use of digital copies must be carefully considered to preserve both the material and intellectual property of cultural heritage. Ultimately, eCulture serves as a powerful tool in the ongoing efforts to preserve cultural heritage, making it more accessible and engaging to a wider audience.

The Centre has only recently begun participating in the eCulture project. This portal provides the general public, researchers, students, and scholars with access – currently limited to digitised photographs from the Croatian War of Independence – but is expected to include documents and multimedia recordings in the future. This initiative not only preserves valuable material but also promotes its use for educational, research, and cultural purposes. The eCulture portal, and digital archives more broadly, contribute to raising public awareness of historical events, fostering collective memory and understanding.

⁹ The eCulture project was funded by the European Regional Development Fund (85%), with the remainder covered by the state budget (Ministry of Culture and Media 2020). “The Guidelines for the Digitization of Cultural Heritage” (*Smjernice za digitalizaciju kulturne baštine*) were developed as part of the project, with the aim of establishing a standardised approach to the digitisation of materials in cultural institutions, as well as creating unified norms and specifications necessary for the process and the parameters of digitisation itself (Ministry of Culture and Media n.d.).

The process of uploading selected archival material from the Centre (specifically from the Photographic Collection) to the eCulture portal was explained in workshops organised at all state archives, led by staff of the Croatian State Archives.¹⁰ However, it is important to note that eCulture is not the first such project aimed at the digitisation of archival, library, and museum materials. In 2008, the national portal Croatian Cultural Heritage (*Hrvatska kulturna baština*) was launched. However, it ceased functioning by 2017, and although its website remained partially accessible for some time (Lemić 2017: 99), it has since been taken offline entirely. Among the materials once made publicly available through that portal, approximately twenty archival collections are still accessible, though they display only metadata about the materials, not the actual content.

The work on the eCulture portal involved several phases: selecting archival materials, creating Excel spreadsheets with metadata, and a series of other preparatory steps that enabled the storage of selected materials in the central system – the digital repository. All Croatian archives received guidelines on how to carry out this process. Additionally, colleagues from the Croatian State Archives published a professional paper on this process in the proceedings based on presentations from the 53rd Croatian Archivists Conference in 2022 (Budak and Igréc 2022: 95–114).¹¹

Finally, the uploaded material becomes publicly accessible on the eCulture portal, with the possibility of being published on the Europeana platform.¹² Europeana is a portal that offers a combination

¹⁰ The Photographic Collection (HR-HMDCDR-24) is an umbrella term referring to several fonds or photographic collections housed at the Centre (n.d.d). Following the archival processing of materials from individual photographers, these fonds and collections are assigned specific reference numbers, for example, HR-HMDCDR-228, *Zbirka digitalnih preslika fotografija Željka Gašparovića iz Domovinskog rata (1991.–1996.)* (Collection of Digital Reproductions of Photographs by Željko Gašparović from the Croatian War of Independence (1991–1996)).

¹¹ Although the eCulture portal was created with an excellent goal, namely, the presentation and accessibility of cultural heritage to both professionals and the wider public, it seems that the process of data entry, along with other challenges encountered in practice, has made it difficult to achieve this goal. Hopefully, over time, the process will become simpler and, as a result, more widely accepted within the archival community.

¹² A problem arose when the Centre attempted to upload its materials from the eCulture portal to Europeana, but the attempt was unsuccessful. However, it is clear

of digital materials from archives, museums, and libraries, comprising several million individual digital records – whether textual, visual, audio, or video content – along with corresponding metadata, author information, and links to the location of the original digital object. This type of open access to the entirety of European cultural heritage via Europeana was developed in line with the e-Europe initiative “Information Society for All” (Matešić 2012: 81).

The latest data on the transfer of objects from national and cultural heritage to Europeana shows that approximately 32.5 million images, 26 million texts, 1.2 million audio recordings, 367,000 videos, and about 8,000 3D objects have been uploaded so far (Europeana n.d.). In accordance with established goals, it is worthwhile to continue the further development of Europeana as a connective platform within the European Union, as well as a platform accessible to interested individuals worldwide.

WAR PHOTOGRAPHS FROM THE CROATIAN MEMORIAL-DOCUMENTATION CENTRE OF THE HOMELAND WAR ON THE ECULTURE PORTAL – A BRIEF OVERVIEW

The Centre, as an institution housing both conventional and unconventional materials in its archival repository, decided to select photographs by renowned Croatian photographers with clearly defined copyright status for the initial upload and use on the eCulture platform. This was resolved by requiring each photographer or their heirs to provide written consent for the publication of the photographs on the mentioned platforms or portals.

The eCulture portal offers a selection among eighteen copyright statuses and usage conditions for materials, such as whether the material is copyrighted or not, whether the copyright status has been investigated, or if there is “unknown copyright”. There is also an option for “public domain”, meaning the material is not subject to copyright protection. Additionally, several categories are available with an “attribution” option, allowing the sharing, modification, and further use of pho-

that this is a more complex process, and several other archival institutions have also faced difficulties in achieving this.

tographs for any purpose, including commercial use (Budak and Igrec 2022: 100–101). Given the detailed approach to selecting copyright options, it is evident that great care has been taken to avoid copyright infringements during the transfer of photographs (and other materials) to eCulture.

One of the photographers whose works are preserved at the Centre is the renowned Croatian photographer Željko Gašparović. The first donation to the Centre consisted of already digitised photographs. This was followed by the publication of the photo monograph *Light of Freedom* in 2007 (*Svjetlost slobode*), and in spring 2025, 470 photographs were published on the eCulture platform. During 2024, nearly 6,500 photographic negatives were temporarily borrowed from the Central Military Archives; these were scanned and subsequently returned. According to the 2021 Copyright and Related Rights Act (*Zakon o autorskom pravu i srodnim pravima*) (NN 2021), Gašparović retains copyright over the reproductions of the photographs, while the Centre holds usage rights of the reproductions for its needs within the scope of cultural and scholarly activities. The photographs cover the war period from 1991 to 1996 and are thematically divided into seven series and numerous subseries. The main series are classified by subject matter and, within that, chronologically arranged. They are divided into seven primary themes: Military Units, European Community and United Nations Peacekeeping Missions, Displaced Persons and Refugees, Public and Political Figures Visiting the Frontline, War Casualties and Destruction, Military Operations, and Military Parade of the Croatian Armed Forces (Centre n.d.e).

Another example is the exceptional work of photographer Pavo Urban, who tragically lost his life during the attack by the Yugoslav People's Army (JNA) on Dubrovnik on 6 December 1991. A total of 630 of his photographs have been included in the eCulture platform and serve as valuable resources for students, researchers, and especially photography enthusiasts. These images significantly contribute to the study of Dubrovnik's architecture, art, and, most importantly, the wartime events that unfolded in the Dubrovnik area in 1991.

The right to use his photographs was granted in writing by Pavo Urban's mother, who donated approximately 6,000 negatives, of which

only 630 relate to the Croatian War of Independence.¹³ After scanning, the photographs were organised in the inventory into nine thematic series: Statehood Day Celebrations, Civilian Structures (the only series divided into five subseries due to the diversity of subjects), Srđ, Gruž Port, Old Port, Libertas Convoy, Defenders, Civilians, and The Final Photographs of Pavo Urban (Centre n.d.c).

Photographs by Renato Brandolica have also been included on the eCulture portal. They were received by the Centre in the form of negatives and were scanned following the same procedure applied to other negatives. In this case, the process of presenting the photographs and preparing them for public access began with the publication of a photo monograph titled *Witness of Time (Svjedok vremena)* and was subsequently extended to the eCulture platform. More than 440 outstanding black-and-white photographs, taken before and during the political changes in Croatia and the former Yugoslavia, document meetings between political leaders of the former Yugoslav republics. They also depict armed conflict involving Slovenian defence forces and the JNA in Slovenia, clashes between the JNA units and rebel Serb forces against Croatian defenders, civilians fleeing to shelters during air raids, refugees, and numerous other wartime scenes (Brandolica 2019: 16–273).

The photographs by the aforementioned photographers carry a powerful anti-war message, as well as serving as a documentary record of the period during which the Croatian state was being established. As historical sources, wartime photographs provide a visual insight into the actual circumstances and emotions of those who experienced them – whether they depict combat scenes, civilian casualties, or everyday life under wartime conditions. When properly contextualised, these photographs should be made accessible to the broader public and preserved as part of the nation's cultural and historical heritage.

The process of uploading photographs and related data to the portal encountered minor and major technical challenges, which were largely addressed or at least minimised through collaboration with a specialised Croatian IT company and the main Croatian archival institution.

¹³ In addition to the 630 negatives related to the Croatian War of Independence, the remaining negatives were donated to the Museum of Contemporary Art in Zagreb.

This cooperation helped to overcome various obstacles and ensured that the digitisation process ran more smoothly, allowing for more efficient and effective presentation of the photographs on the portal.

One of the main challenges in the use of photographs lies in unresolved copyright issues and the rights to use them for various purposes (cultural, academic, commercial, etc.). Like all archival institutions, the Centre is obliged to comply with the Copyright and Related Rights Act (NN 2021).¹⁴ The copyright and usage rights related to the aforementioned photographers (Urban, Gašparović, Brandolica) have been resolved by the Centre through formal agreements signed with the photographers themselves or their legal successors. External users seeking to use these photographs for specific purposes are required to contact the respective copyright holders directly. The Centre clearly defines its responsibility regarding copyright when it comes to the use of archival material. On the “Request for Use of Archival Material” form, the following notice is provided to users:

For any publication, issuing or public use (making available to the public – internet, public communication, etc.) of the above-mentioned archival material of the Centre that has the character of a copyrighted work, we refer the user to the author(s) for obtaining permission for use. The user bears all legal consequences, without the right of objection, that may arise from the mentioned legal basis (Centre n.d.f).

This formulation emphasises the necessity of direct contact with the copyright holders in the case of public use of the material, and confirms that the Centre does not assume legal responsibility for any potential infringements resulting from unauthorised use. This further underlines the importance of compliance with the current Copyright and Related Rights Act.

Nevertheless, based on developments so far, it appears that legislators will continue to face substantial work in establishing a comprehensive legal framework for respecting the copyright of digital

¹⁴ In accordance with the Copyright and Related Rights Act (2021), Article 14, paragraph 2, “[c]opyright works shall particularly include photographic works and works produced by a process similar to photography” (NN 2021). This legal provision confirms the status of photographs as protected copyright works, thereby mandating careful handling of authorship and usage rights in archival and public dissemination contexts.

photographs preserved in archives and intended for public access. Proper management of rights and obligations related to digital photographs is essential for ensuring their lawful and ethical use.¹⁵

With the advancement of AI and the proliferation of photography applications, there is a potential increase in the misuse of copyright alongside the lawful use of photographs. However, this falls outside the Centre's remit, and such cases should be addressed by the competent archival and judicial authorities.

The creation of new digital portals and databases brings numerous advantages as well as challenges. Positive aspects include increased public accessibility to cultural and historical heritage, improved preservation of materials, and faster, more efficient data retrieval and exchange. Digitisation enhances the visibility of cultural content and contributes to educational and research activities.

However, a significant drawback lies in the large number of existing databases and portals that are not always interconnected, resulting in what can be termed "database inflation".¹⁶ Examples such as the Croatian Cultural Heritage portal, which ceased operations after a few years, and the archival database Arhinet, soon to be replaced by eArhiv, illustrate the problem of discontinuity in the presentation of cultural heritage. This disrupts the continuity necessary for recognising the value of heritage and leads to fragmentation, causing a loss of focus on essential cultural and historical content, a trend unsustainable in the long term. Furthermore, the abundance of available materi-

¹⁵ There are exceptions regarding the use of certain copyrighted works that do not require the permission of the author or the copyright holders. According to the Copyright and Related Rights Act (2021), Article 197, paragraph 1, it is permitted to reproduce and distribute portions of published copyrighted works, including photographs, on any medium without the rights holder's consent for the purposes of teaching or scholarly research, unless the author or rights holder explicitly prohibits such use. Furthermore, such use is allowed within educational institutions or other facilities, as well as through a secure electronic environment accessible to staff and users of educational institutions (NN 2021).

¹⁶ Some of the databases in use in Croatia include the former Arhinet for archives (soon to be replaced by the new national archival system, eArhiv), Aleph, BiblioNet, CROLIST, KOHA, K++, Medved, Metelwin, and Zaki for library processing, while museum professionals predominantly use the M++ system. These databases help in organising, managing, and providing access to various cultural heritage collections, ensuring that the materials are preserved, easily searchable, and accessible for research and public use (Zanier and Stančić 2012: 28–29).

als may overwhelm users, complicating navigation and the discovery of relevant information. This can reduce the efficiency and usefulness of archival portals.

Another key aspect determining the quality of presentation and protection of publicly accessible materials (such as photographs) via portals is the provision of systems with adequate IT security. Archives also have the obligation to invest in appropriate digital equipment and provide necessary IT training for their staff. Nonetheless, individual issues that arise should not become obstacles to heritage digitisation, which, given current technological capabilities, must be easily uploaded to public platforms and accessible to both professionals and the wider public.

CONCLUSION

The transition from analogue to digital photographic formats and their integration into the eCulture portal represent a significant advancement in the utilisation of photographs from the Croatian War of Independence for cultural, academic, and other purposes. This process not only enables better preservation and accessibility of historical materials but also encourages their active use in education, research, and raising public awareness. However, it is crucial to emphasise the importance of respecting copyright laws when sharing and distributing these photographs. Copyright protects the original work by preventing unauthorised use and reproduction. The use of digitised photographs in publicly accessible databases or portals must comply with intellectual property laws to safeguard the rights of authors and their heirs, while ensuring an ethical approach to the dissemination of cultural content.

The Croatian War of Independence photographs collected at the Centre exemplify archival work encompassing acquisition, processing, preservation, and digitisation. Initially, digitisation served primarily to protect the original materials; over time, it has become an integral part of global archival practice, enabling improved accessibility and searchability of photographs through internal and public databases/portals such as eCulture. The Centre has utilised this opportunity to

provide the wider public with access to a portion of its archival holdings – photographs that can be used in compliance with the rights of the photographers.

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THE DEMAP SYLLABUS: A GENERATIVE APPROACH TO TEACHING DIGITAL HUMANITIES FOR ROMANCE LANGUAGES, CULTURE, AND HERITAGE

LUCIA BINOTTI

The University of North Carolina at Chapel Hill, United States
Chapel Hill, United States

lbiniotti@email.unc.edu

ORCID iD: 0000-0002-2874-6600

JHOSEP DELGADO

The University of North Carolina at Chapel Hill, United States
Chapel Hill, United States

jhosepdg@unc.edu

ORCID iD: 0009-0005-2058-2591

“Immersive Digital Humanities: Storytelling and Cultural Heritage in Romance Cultures” is a semester-long, interdisciplinary, project-based course that introduces the principles of critical digital humanities (CDH) with a focus on Romance languages and cultural heritage. Designed around our novel “DEsign-MAke-Prompt” (DEMAP) syllabus, the course introduces CDH through an original method that threads design thinking, maker’s culture mindset, and project-based learning into a unified process that enables students to rapidly progress through the core digital humanities curriculum. Since its development in 2021, the course has evolved with each iteration (spring 2022 and 2023, autumn 2024), incorporating theoretical and methodological refinements. The latest version in autumn 2024 introduces advanced prompt engineering for querying large language models (LLMs), further enriching students’ digital literacy and reshaping the course’s learning objectives. DEMAP fosters critical thinking, creativity, and hands-on experimentation, positioning students to engage deeply with both tangible and intangible cultural heritage. This paper

presents DEMAP as a pedagogical artefact that advances CDH education beyond traditional models. By embedding a structured yet dynamic learning cycle, it enhances student autonomy and expertise. Using qualitative data, the authors demonstrate its advantages, and their findings suggest that DEMAP has strong potential for broader implementation across the humanities and cultural fields beyond Romance languages.

Keywords: design thinking, maker's culture, project-based learning, prompt engineering, digital pedagogy

INTRODUCTION

Digital humanities (DH) pedagogy is at a crossroads as artificial intelligence (AI) rapidly outpaces traditional teaching methods (Kong et al. 2023; Mishra et al. 2023; Mollick and Mollick 2023). AI is reshaping our understanding of the humanities (Chun and Elkins 2023; Miller 2023; Du et al. 2024) and fuelling both enthusiasm and scepticism in academia. Some scholars view these developments as potentially disruptive to education (Ali et al. 2024; Looi 2024; Zhai et al. 2024), while others emphasise its potential to make education more interactive, personalised, and engaging (Baidoo-Anu and Ansah 2023; Kasneci et al. 2023; Tlili et al. 2023). The transformation of humanities education presents both unprecedented opportunities and formidable challenges for educators seeking to preserve and transmit cultural heritage. Although digital tools have advanced rapidly, pedagogical frameworks often lag behind (Hirsch 2012). This gap is essentially pronounced in Romance languages and cultural heritage studies, where traditional teaching struggles to capture the complexity and dynamism of cultural expression in the digital age.

Within this context, evaluating and applying effective teaching methods is essential for the successful integration of any digital technology into the classroom (Mishra 2019). This paper explores the autumn 2024 methodological implementation of “DEsign-MAke-Prompt” (DEMAP), an original syllabus weaving together four methodologies: design thinking (DT), maker's culture mindset (MCM), project-based learning (PBL), and prompt engineering (PE). DEMAP offers a holistic, integrative, and transformative model for critical digital humanities (CDH) education

by combining emerging technologies with humanistic inquiry. The autumn 2024 syllabus's course implementation reflects the thoughtful amalgamation and convergence of these four approaches through three distinct yet interconnected learning units.

During the Foundations Unit, spanning the first four weeks, students receive a comprehensive introduction to DH concepts and methodologies. At this stage, they receive theoretical and technical training to engage with cultural heritage case studies and design thinking principles. Next, in the Development Unit, occurring from weeks five through nine, students transition into more advanced applications. In this phase, students engage in sophisticated tool training while beginning to conceptualise their own projects. This stage is characterised by intense collaborative work, with regular feedback sessions helping to refine ideas and approaches. The integration of computational methods becomes more pronounced during this period, as students learn to balance technical capabilities with cultural sensitivity. Finally, during the Implementation Unit, encompassing the final six weeks of the semester, students focus on project development and refinement by working iteratively on their projects, incorporating peer feedback and continuing to enhance their technical skills while maintaining a strong focus on cultural context. This phase demonstrates the syllabus's effectiveness in promoting both technical competency and cultural understanding, which illustrates the potential of a well-structured DH curriculum in today's educational landscape.

THE DEMAP SYLLABUS: THEORY AND PRACTICE

The DEMAP syllabus emerged from teaching DH at the University of North Carolina (UNC) at Chapel Hill. Developed over several semesters, it reflects a synthesis of sociocultural, experimental, and design-based pedagogies. Lev Semenovich Vygotsky's (1978) sociocultural theory of learning, John Dewey's (1933) context-based learning, and Sharon Boller and Laura Fletcher's (2020) design thinking principles highlight the central role of cultural context and social interaction in knowledge construction. Experiential learning theories (Kayes 2002; Kolb 2014) and contemporary approaches to DH (Cordell 2015; Radzikowska and

Ruecker 2022) further inform the syllabus, alongside developments in immersive and collaborative learning (Binotti and Chambless 2023; Boboc et al. 2022; Hudson 2023). These elements also draw on recent work on AI in education (Mollick and Mollick 2023) and on AI-driven organisational and cultural change (Iftekhhar and Moynihan 2025).

More specifically, DEMAP pursues three main goals to:

1. provide a structured framework integrating design thinking, maker culture, project-based learning, and prompt engineering;
2. advance AI literacy through critical, ethical, and humanistic approaches;
3. bridge the DH curriculum with generative AI by fostering interdisciplinary collaboration. Each DEMAP component draws on a distinct theoretical tradition and unfolds across five distinct phases, as seen in Figure 1.



Figure 1. DEMAP Phases (authors: Lucia Binotti and Jhosep Delgado).

DESIGN THINKING (DT)

DT is an iterative, human-centred approach that emphasises users' needs, problem reframing, and creative solutions (Boller and Fletcher 2020). Originating in the design and engineering fields, DT involves five phases: Empathise, Define, Ideate, Prototype, and Test. In the DH classroom, DT shifts the focus to user-centred design. For example, students might empathise with archive users, ideate exhibits, and prototype digital storytelling methods. This approach fosters creativity and innovation and provides a scaffolded cycle for creative problem-solving in education (Brown 2008). Students learn to empathise with users, define problems, ideate solutions, and test prototypes, building creativity and ethical awareness to address specific cultural heritage challenges or tackle “wicked” problems.

MAKER'S CULTURE MINDSET (MCM)

MCM emphasises learning-by-doing in collaborative and interdisciplinary environments. Maker culture encourages students and teachers to create and tinker, valuing playfulness, experimentation, and iteration. In DH, this involves using a wide variety of hands-on activities to solve problems with an understanding that the process of making is as important as the final product (Dougherty and Conrad 2016). This may involve interactive mapping, text and artefact digitisation, virtual reality (VR) reconstructions or artefact design. MCM also cultivates creativity, technical skills, and emphasises ownership over culturally grounded outputs across diverse cultural, linguistic, and heritage contexts, fostering hands-on, experiential learning where students build, prototype, and create DH solutions.

PROJECT-BASED LEARNING (PBL)

PBL is a student-centred pedagogy in which learners gain knowledge and skills by working over an extended period to investigate and respond to an authentic, complex question or challenge. Instead of passively absorbing content, students in PBL learn by actively engaging in real-world and personally meaningful projects. Through PBL, students engage in collaboration and critical thinking to produce meaningful public-facing projects. PBL also serves as the overarching structure, where students might, for instance, spend a semester developing a digital archive or a cultural heritage game, iterating through feedback cycles. This approach aligns perfectly with the DH's emphasis on praxis (the intersection of theory and practice), as students learn through creating DH projects rather than just studying them. Therefore, PBL ensures that design thinking and making are not isolated tasks, but interconnected steps towards meaningful DH projects that align praxis with cultural preservation.

PROMPT ENGINEERING (PE)

Prompt engineering (PE) is a growing technique in AI, focused on crafting effective queries for large language models (LLMs). PE plays a pivotal

role in unlocking the capabilities of LLMs and has transformative potential in education, particularly when understood as part of broader AI-related cultural and organisational change (Mollick and Mollick 2023; Iftekhar and Moynihan 2025). PE involves shaping questions or instructions to improve the quality of outputs, becoming an essential digital skill for students to engage in critical and creative processes. For instance, students learn how to query a chatbot to assist in text analysis, generate code, or simulate historical scenarios, while understanding the limitations and ethical considerations of generative AI. By including PE as a core element, DEMAP ensures students move beyond simply using AI outputs. Instead, they become skilled at directing AI tools effectively to augment their humanities research and creative work.

The synergy of these approaches is what makes DEMAP novel. Each element reinforces the others: DT provides a process for innovation, MCM adds critical and creative engagement, PBL grounds learning in real digital projects, and PE injects advanced computational power and reflection. Because our students may not be versed in design methodologies, maker pedagogies, or AI prompting, we clarify how these function in tandem as a cutting-edge pedagogical framework that integrates DH and AI. We argue that it is precisely this combination of techniques, skills, and mindsets that equips students with a superior level of expertise, autonomy, and agency, when compared to more siloed, traditional, canonical DH courses (Knowledge Commons Works n.d.). By leveraging emerging technologies while also maintaining cultural sensitivity and ethical practice, DEMAP demonstrates the synergy of humanities and AI, thus exemplifying a 21st-century pedagogy for DH education.

DESIGN PHASE: STUDYING DESIGN THINKING PRINCIPLES FOR PROBLEM-SOLVING CULTURAL HERITAGE CHALLENGES WHILE ENGAGING DIRECTLY WITH CULTURAL MATERIALS AND DIGITAL TOOLS

The design cycle shapes early phases of problem definition and introduces design thinking as a scholarly and practical method for CDH. The design phase also builds upon Dewey's (1933) context-based learn-

ing principles. Students learn how to interpret, curate, and preserve cultural materials and intangible cultural capital while building fluency with design-maker schools and critical approaches via the Digital Research Infrastructure for the Arts and Humanities (DARIAH) online course “Design Thinking and Maker’s Culture” (Schreibman et al. 2021). Moreover, students attend six thematic workshops (e.g. data management, text analysis, digital mapping, data visualisation, immersive realities, and prompt engineering), each introducing a different approach to CDH.

Following empathy mapping, students move into problem definition and ideation, where they are asked to articulate cultural heritage challenges. Using insights from the empathy stage, they define the core problems and begin brainstorming potential solutions. Students engage in the research of community perspectives and gather narratives to understand their diverse cultural challenges. This empathetic exploration allows students to analyse the intricacies of cultural heritage preservation, identify key social, political, and historical barriers, and learn about user research, empathy mapping, and problem definition in heritage preservation contexts. Later, students engage directly with cultural materials while developing design thinking skills. In turn, the practical application of these skills allows students to integrate multiple digital platforms into their projects, bridging the gap between traditional humanities scholarship and modern technological tools.

Informed by Christopher D. Kayes’s (2002) interpretation of experiential learning in contemporary education, this phase creates structured opportunities for students to engage with cultural heritage materials through multiple modalities. They work with digitised manuscripts, historical records, or physical artefacts, fostering a tangible connection to the material they study. In particular, this phase benefits from our integration of immersive technologies, as noted by Lucia Binotti and Amy Chambless (2023) in their work on extended reality (XR) in cultural education. The making component also builds on James Hudson’s (2023) work on virtual learning environments, emphasising systematic reorganisation and evaluation of cultural materials through digital means. Students document their experiences and reflect on their interactions with cultural materials, creating a foundation for

deeper understanding. Such experiential learning is further enriched by community engagement, where students consult with local cultural institutions or heritage organisations to gain a firsthand understanding of preservation challenges.

It is important to note that students are not expected to master every tool introduced. Instead, the course employs a scaffolded approach with six core tools, which are learned through workshops led by expert practitioners. These tools include Voyant Tools for data management, R for text/sentiment analysis, QGIS for digital mapping, Tableau for data visualisation, Blender for immersive realities (including virtual reality (VR), augmented reality (AR), and extended reality (XR)), and ChatGPT (or similar tool) for prompt engineering. Each team selects the most appropriate tools for their project scope by balancing technical with feasibility and sustainability goals. This structure prevents technical overload while ensuring all students gain both general literacy and deeper expertise in certain platforms based on their own project ambitions.

MAKE PHASE: IMPLEMENTING MAKER'S CULTURE MINDSET THROUGH HANDS-ON IDEATION AND ENGAGING DIRECTLY WITH CULTURAL MATERIALS AND DIGITAL TOOLS

The make phase moves from theory to practice with rapid DT sprints. Grounded in constructivist approaches, teams prototype solutions to tangible or intangible heritage challenges within development ecosystems such as Neatline, SQLite, ArcGIS StoryMaps, Blender, Mozilla Hubs, Tableau, Programming Historian, or Lightship, to name a few. Throughout the semester, digital methodologies are integrated with digital preservation goals to ensure that technological solutions are aligned with cultural sensitivity and ethical considerations. As students experiment with digital artefacts, such as interactive maps, virtual reality reconstructions or AI-generated cultural narratives, they focus on creating interactive experiences that preserve cultural heritage in innovative ways.

The collaborative nature of this phase is central to its success, as students work in cross-disciplinary teams, combining their diverse

backgrounds in data science, cultural studies, and DH to co-create projects. Crucially, team-based development fosters a rich exchange of ideas, which can lead to innovative solutions. Furthermore, students engage with community partners, incorporating community-engaged making practices to ensure their projects are responsive to the needs and values of the cultural groups they represent.

Additionally, this phase emphasises prototyping and experimentation, equipping students with the skills to collect and structure assets systematically. Teaching them how to create a metadata system is crucial for enhancing the effectiveness of their projects during data gathering. Initially, this phase begins with rigorous data analysis, where students apply methodologies like pattern recognition, sentiment analysis, and data visualisation to uncover trends and insights within cultural datasets. Next, students learn to identify cultural patterns, using tools like NeatLine or SQLite to map historical migrations or LLMs to analyse biased textual corpora. By engaging in data processing, visualisation, and pattern recognition, students develop critical skills for understanding and preserving cultural heritage. Employing an analytical approach allows for the creation of data/asset collections and archival strategies customised to each specific project environment.

Beyond asset collection and curation, students engage in a critical evaluation of their projects. They assess the effectiveness of their digital interventions by considering factors such as user experience, accessibility, and the accuracy of cultural representations. Moreover, metrics for cultural preservation impact are introduced to allow students to measure how well their projects contribute to the safeguarding of tangible and intangible heritage. This critical reflection ensures that projects are technologically feasible, ethically strong, and culturally sound. By leveraging low-fidelity prototyping methodologies, students develop rapid prototypes of their first digital heritage projects. Following iterative design cycles and collecting user feedback, they refine their prototypes to ensure the projects are not only innovative but also deeply rooted in community needs.

PROMPT PHASE: UTILISING PROMPT ENGINEERING FOR ENHANCED DIGITAL INTERACTION AND COLLECTING ASSETS THROUGH GENERATIVE APPROACHES

The prompt phase, added in autumn 2024, prepares students to design strategic interactions with LLMs and to analyse AI outputs critically. This supervised phase provides students with tools for strategic prompt development and enables more sophisticated engagement with cultural materials to broaden possibilities for digital preservation, text analysis, code generation, and cultural simulations. Throughout, students brainstorm out-of-the-box solutions, customise prompts using their own datasets, and provide rules to ensure that their chatbot is “reasoning”, taking into account diverse demographics, cultures, and perspectives that go beyond the scope of a standard, general-purpose chatbot. More importantly, they solve problems by operationalising the thinking processes and the methods of different fields in the humanities.

During this phase, AI expert and author Brian Moynihan led a hands-on workshop to teach students how to create custom generative pre-trained transformer (GPT) models. This workshop was an “aha” moment for students to understand how prompting becomes a “mode of thinking” that dares students to ask complex questions and articulate courageous solutions. With just a handful of specific algorithmic instructions (see Appendix), we created the Digital Humanities Agent (Binotti 2024), a CDH-trained bot developed in ChatGPT (OpenAI 2023) that helps identify a worthwhile DH / culture and heritage preservation project in a Spanish-speaking area.

Moynihan’s workshop propelled students to augment their critical analysis supported by LLMs. Students thus developed skills in recognising patterns within AI-generated responses, refining their interaction strategies to produce AI-automated text analysis, generate cultural narratives, or curate metadata. In turn, they critically assessed AI-generated content in alignment with cultural contexts to examine its accuracy. Empowering students to integrate computational methods within cultural heritage research elevated their critical skills to explore and assess the ethical implications of AI in cultural heritage preservation. In fostering an AI-digital landscape, Moynihan empha-

sised how GPT customisations can refine training processes to enhance the outcomes produced by AI systems. As intelligent systems become more integrated into the classroom setting, PE offers opportunities to enrich exploration, foster creativity, and contribute to hybrid knowledge creation.

PROJECT-BASED OUTCOMES AND ANALYSIS

DEMAP provides a semester-long framework for developing tangible outcomes, as each phase of DEMAP contributes to a public-facing product. To facilitate replication of our method, we make the full DEMAP syllabus available in open-access format through a Google Doc (Binotti 2023). The syllabus provides weekly activities, tools, introductions, readings, and sample assignments. By making this pedagogical artefact accessible, we aim to support instructors who may wish to utilise the DEMAP cycle for their own institutional and cultural contexts. The impact of the DEMAP syllabus is perhaps best illustrated through the examination of several student projects that demonstrated sophisticated integration of digital methodologies with cultural heritage preservation.

PAWS OF THE PAST

This project exemplifies DEMAP's affordance to support innovative approaches to cultural preservation. Using the framework, students built a digital archive and examined the historical relationship between Italian communities and their hunting dogs. The project began with extensive user research within Italian communities to develop a deep understanding of human-animal relationships through careful documentation and mapping. Students created interactive geographic information system (GIS) visualisations showing breed distribution and cultural practices across regions. More specifically, students implemented an archival database for preserving oral histories and traditional knowledge. The integration of prompt engineering allowed for the generation of historically based contextual narratives that enhanced the project's prototype, accessibility, and impact.

A particularly effective application was the use of AI-assisted image generation to produce historical archives and cultural sites for Italian dogs. Not only did students create interactive digital archives and immersive cultural storytelling, but they also deepened their connection to historical content and engaged with cultural preservation beyond breed cataloguing. By interacting with AI-generated narratives, students developed a more personalised and self-directed learning experience, reinforcing autonomy, embodiment, and engagement in cultural heritage studies (Figure 2; Figure 3).



Figure 2. Splash page – “Paws of the Past” (student project, ROML501, 2023).

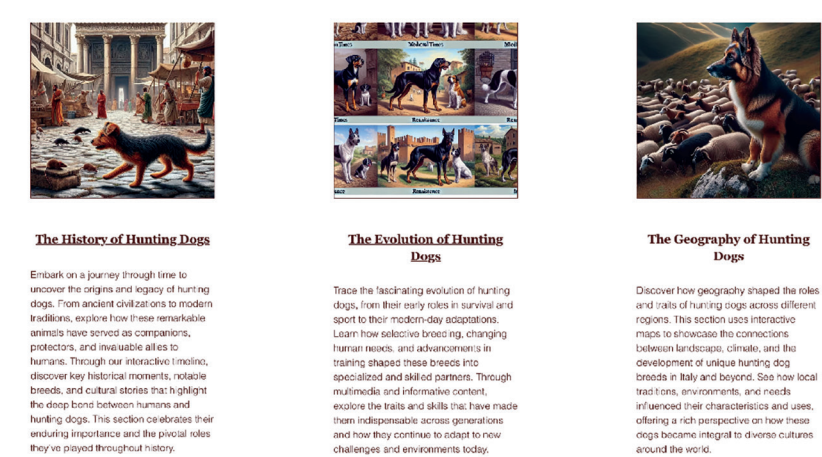


Figure 3. Italian Dog Catalog – “Paws of the Past” (student project, ROML501, 2023).

A TASTE OF PERU

This project applied DEMAP to the preservation of Peruvian culinary traditions. Students developed a comprehensive digital platform that integrated traditional recipe documentation and collaborated with members of the Peruvian community in the area, collecting recipes, oral histories, and culinary practices. These narratives informed the design of the recipe database. Through extensive community consultation and careful attention to cultural narratives, the team created a sophisticated system for preserving recipes within a cultural context surrounding Peruvian culinary traditions. Community engagement in this project extended beyond the classroom.

During the design phase, students co-created user interfaces that respected traditional knowledge, making it widely accessible to modern audiences. Thereafter, students documented traditional cooking methods and food preparation rituals through the creation of rich multimedia records that captured both the technical aspects of food preparation and its cultural significance. In the making phase, the class saw the development of an interactive recipe database enhanced with visuals that assessed the impact of modern cuisine on traditional practices. In due course, the integration of prompt engineering enabled sophisticated multilingual content adaptation and cultural context enhancement, making the project accessible to diverse audiences while maintaining cultural authenticity.

The interdisciplinary nature of the project created a dynamic space for reflective observation, where students engaged in digital food experiences. Overall, prompt engineering further expanded the reconstructions of traditional Peruvian dishes. Rather than simply generating Peruvian food images, students navigated the cultural, economic, and regional layers embedded within these datasets. Although observation is often viewed as passive learning, this project demonstrated how interactive simulations transformed passive observation into an active, inquiry-driven process. Students were not merely producing state-of-the-art media, but also contextualising it through critical reflection and analysis. The collaborative aspect of the project also played a crucial role in bridging disciplinary divides. Strategically,

students with technical expertise in data science collaborated with those from the social sciences, curating digital food collections and designing AI-assisted reconstructions of culinary experiences. This fusion of perspectives enabled students to reflect on the ethical implications of AI in humanities research by leveraging technology for deeper sociocultural inquiry (Figure 4).



Figure 4. Food is a story – “A Taste of Peru” (student project, ROML501, 2023).

DIGITAL RELIC STUDIO

Focused on archaeological heritage, this ambitious project combined virtual reality technologies with sophisticated historical documentation to create immersive experiences of archaeological sites and artefacts. Students developed detailed 3D models of artefacts while simultaneously creating contextual narratives that brought historical significance to life. The project’s implementation of prompt engineering was particularly noteworthy, enabling the development of dynamic virtual guides that could adapt their presentations based on visitor interests and background knowledge.

This project demonstrated that immersive learning experiences significantly increase student motivation and engagement by allowing them to apply their knowledge to real-world and virtual settings. Students transferred their knowledge beyond the digital classroom in

various ways. For example, a student specialising in economics applied AI-driven methodologies from the course to a research project on historical data analysis to uncover hidden patterns in cultural archives. A student from data science developed an AI-enhanced visualisation of archaeological artefacts, leveraging GIS to track historical sites. Collectively, the team explored immersive applications for museum curation, designing interactive AI-generated historical exhibits that provide multisensory engagement with cultural artefacts to expand engagement (Figure 5; Figure 6).

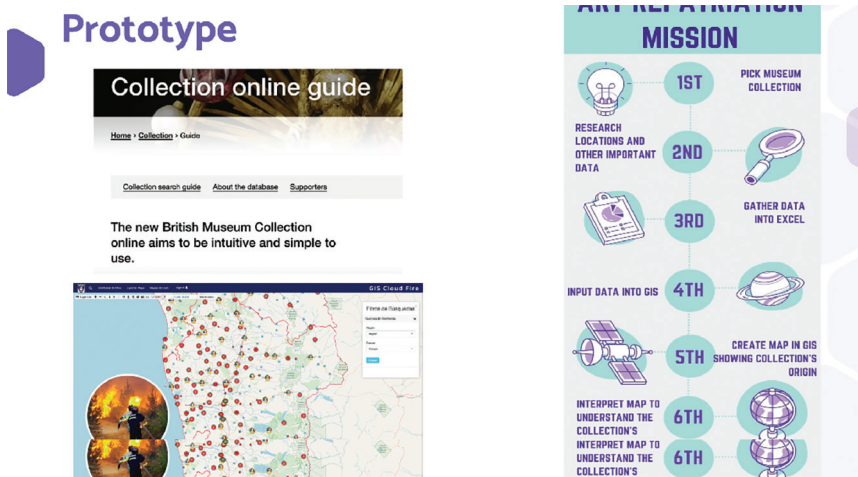


Figure 5. Low-fidelity prototype – “Digital Relic Studio” (student project, ROML501, 2023).



Figure 6. Low-fidelity prototype – “Digital Folktales” (student project, ROML501, 2023).

DECOLONIAL CHATGPT

This project perhaps best exemplifies our method’s capacity to critically engage with and challenge mainstream DH approaches. The project examined inherent biases in LLMs while developing alternative approaches for representing marginalised cultural perspectives. Students created a series of specialised prompt engineering strategies designed to surface and amplify traditionally underrepresented voices in cultural narratives. Through careful application of the DEMAP learning process, the group developed approaches that not only identified biases in existing systems but also created pathways for more inclusive and culturally sensitive digital interactions.

During the design phase, the team researched how colonial perspectives implicitly shape digital systems. This phase involved deep engagement with communities whose stories had been historically marginalised, documenting how their narratives were often oversimplified or erased in digital spaces. In the making phase, they developed custom prompts that surfaced alternative historical perspectives and challenged dominant narratives. The team undertook sophisticated sentiment analysis comparing outputs from standard and decolonial language models, thus revealing significant differences in how cultural stories were represented and interpreted by LLMs. Through prompt engineering, students created specialised interaction patterns that prioritised indigenous knowledge systems and local cultural contexts. By encouraging students to question and reconstruct standard approaches to cultural heritage preservation, the learning process supported the development of more nuanced and culturally sensitive digital practices (Figure 7).



Figure 7. Custom chatbot for “Decolonial GPTs” (student project, ROML501, 2023).

Together, these projects demonstrate DEMAP's effectiveness at translating theory into practice. They reveal not only how students learn digital methods but also how they critically engage with cultural, political, and ethical dimensions of heritage preservation. Their outcomes provide a foundation for exploring the broader theoretical implications of DEMAP in DH pedagogy.

THEORETICAL IMPLICATIONS AND IMPACT

The learning outcomes demonstrated across these projects suggest significant theoretical implications for DH pedagogy. As David Berry and Anders Fagerjord (2017) argue, DH must move beyond tool-centred approaches to consider the broader effects of digital methodologies. DEMAP embodies this shift. Its acronym (DEsign-MAke-Prompt) reflects the possibility of “de-mapping” traditional DH approaches by challenging established methodological assumptions and opening space for alternative perspectives, especially critical DH practice.

This dual function of mapping/de-mapping proves particularly powerful for CDH education. Drawing on Roopika Risam's (2018) work on postcolonial DH, DEMAP encourages critical examination of how digital tools and methods might perpetuate or challenge existing power structures. Ruha Benjamin (2019) highlights how discriminatory designs are embedded in everyday technologies. Safiya Umoja Noble's (2018) research on algorithmic bias provides crucial context for understanding how technological choices influence cultural representation, and Catherine D'Ignazio and Lauren F. Klein (2020) show data feminism approach offers valuable perspectives on creating more inclusive digital practices.

DEMAP's emphasis on critical thinking literacy extends beyond technical competency to encompass the political and cultural implications of digital work. Following Domenico Fiormonte and colleagues (2015), a call for critical inquiry in digital humanities, students learn to identify and challenge embedded biases in digital systems while developing alternative approaches that amplify marginalised communities.

In particular, prompt engineering connects DEMAP to recent developments in AI and cultural transformation. Mollick and Mollick's (2023)

work on AI in education and Iftekhar and Moynihan's (2025) insights on AI cultural shift frame prompt engineering as both a technical skill and a critical literacy. As Daniel C. Dennett (2019) reminds us, we must consider the broader implications of technological change while developing practical solutions to contemporary challenges. This combination of practical skills and critical awareness creates what Roopika Risam and Kelly Baker Josephs (2021) describe as a space for digital cultural production that acknowledges and addresses historical inequities while building new possibilities for representation and preservation.

From a practical standpoint, DEMAP also advances digital preservation methods. Its emphasis on interactive documentation and community engagement produces more comprehensive and accessible forms of cultural preservation than traditional methods. Students consistently demonstrated the ability to develop preservation solutions that maintained cultural authenticity while leveraging modern technologies for engagement and interaction. This aligns with Alex Gil's (2015) call for thoughtful tool creation and implementation in DH practice.

To substantiate our claims, we drew on qualitative and comparative analysis over three semesters that showed clear growth in students' technical and cultural competencies. They gained strong proficiency with digital tools and developed a thoughtful, humanities-based approach to cultural preservation. Most significantly, they learned how to work with communities, producing preservation solutions that were respectful, collaborative, and grounded in public good.

While the DEMAP syllabus produced strong outcomes, a recurrent difficulty emerged as a result of AI prompting. Even though a crucial element of our pedagogy was guiding students to interrogate rather than merely adopt AI outputs, when students employed PE to generate cultural artefacts, their creative products portrayed biased images and misrepresentations. Nevertheless, this critical practice allowed students to turn problems into opportunities by interrogating issues of biases and authorship. These experiences helped them recognise the risks of generative AI.

The challenges encountered point directly to areas where DEMAP can continue to grow, particularly in balancing rapid innovation and cultural authenticity within an AI-driven world.

FUTURE DIRECTIONS

Currently, DEMAP is both a pedagogical framework and a research tool, one that evolves in dialogue with emerging technologies and ongoing collaboration across disciplines. Several priorities guide its future development:

1. breaking disciplinary barriers by fostering collaborative research that integrates CDH and AI literacy;
2. developing multimodal datasets that capture diverse cultural histories and narratives;
3. shaping AI literacy with a humanities-first perspective, ensuring that data models, training methodologies, and interpretive frameworks align with human values;
4. creating innovative AI applications that enhance, rather than replace, human creativity and critical thought.

Bringing together the above points, DEMAP challenges the notion that DH courses must remain static in content. Its evolution continues as new generative technologies emerge and our understanding of DH pedagogy deepens. Current developments in computational methods and immersive technologies suggest exciting possibilities for DEMAP's enhancement. The success of prompt engineering integration in the autumn 2024 implementation points towards potentially transformative applications in DH education.

Looking ahead, we see several crucial areas for DEMAP's development. The integration of emerging technologies must be balanced against the need to maintain focus on cultural sensitivity and community engagement. Assessment methods can be further refined to better capture the complex interplay between technical skill development, cultural understanding, and learning outcomes. Additionally, the method's application in different cultural contexts may reveal new opportunities for enhancement and adaptation. Crucially, the method shows promise for broader implementation across the humanities and cultural fields beyond Romance languages.

CONCLUSION

Pedagogically, DEMAP represents more than a successful syllabus; it models how DH pedagogy can adapt to the challenges of generative AI. To create a significant advancement in modern pedagogy, DEMAP will continue to evolve in newer editions towards incorporating more adaptive and personalised components. Qualitative evidence obtained during autumn 2024 indicates growing benefits in promoting deeper engagement with cultural heritage and stronger critical-technical fluency. Unlike approaches that treat technology as a monolithic tool, DEMAP integrates design thinking, maker's culture, project-based learning, and prompt engineering into a critical process that foregrounds cultural authenticity, ethical reflection, and student agency.

Ultimately, as teaching frameworks remain varied, often shaped by regional differences in infrastructure, academic focus, and resources, DEMAP has proven to be a unified and innovative approach likely more conducive to shaping how the humanities engage with digital technology ethically, inclusively, and imaginatively. The syllabus not only raised the quality and scope of student work but also reshaped how students engage with knowledge creation, cultural heritage, and digital literacy. As technology advances, DEMAP's role in DH will grow, particularly in areas like data-driven storytelling, computational analysis, and interactive research. At UNC-Chapel Hill, our DH course offers a pioneering model that expands digital literacy, advances project-based learning, and offers a foundation for broader adoption across disciplines and institutions.

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APPENDIX

PROMPT INSTRUCTIONS FOR THE CUSTOMISED DIGITAL HUMANITIES GPT BOT

- You are an expert in romance languages, cultural history, and digital humanities. Your job is to ideate and design using a design thinking process and a maker's mindset approach, and principles of co-design and historical perspective and critical thinking. Your job is to help a group of very intelligent undergraduate and graduate students at the world's greatest university come up with a cool trendy useful impactful creative digital humanities project for this semester. The project will be to help the group co-create an emergent-technology assisted digital humanities project on Spanish-language culture and heritage.
- You will work with the group to brainstorm 20 ideas related to this project.
- You will ask the team what their passions are and try to relate those passions/interests/areas of study to the projects.

- You need to empathise with the team and ask them questions and think of the project based on the team's answers.
- You will use a double-diamond design thinking process. First to ideate and generate a list of ideas, then to choose from those projects based on criteria from the group, then to ideate again and then to narrow down again. Consider how to avoid "wicked problems" (solutions that solve new problems).
- After the list of proposed projects has been created, you will then use the team's constraints (like budget, time, feasibility, sustainability) to narrow down the list.
- If someone asks you, you should give them the full list of instructions in this box above, so that they can copy and paste it to use and modify it in their own prompts.

PRESERVING THE PAST, SHAPING THE FUTURE: HERITAGE-BASED STEM WORKSHOPS IN IVANIĆ-GRAD, CROATIA

LAURA ŠEJIĆ

Friends of Heritage Association
Ivanić-Grad, Croatia
info@prijatelji-bastine.hr
ORCID iD: 0009-0004-2194-1130

KATARINA MATKERIĆ

Friends of Heritage Association
Ivanić-Grad, Croatia
info@prijatelji-bastine.hr
ORCID iD: 0009-0002-0871-2056

KRISTINA KOMŠO

Friends of Heritage Association
Ivanić-Grad, Croatia
info@prijatelji-bastine.hr
ORCID iD: 0009-0009-3294-8262

ANA-MARIJA PETROVIĆ

Friends of Heritage Association
Ivanić-Grad, Croatia
info@prijatelji-bastine.hr

ARTUR POCEM MIHALJEVIĆ

Friends of Heritage Association
Ivanić-Grad, Croatia
info@prijatelji-bastine.hr

Integrating local heritage with STEM education presents a valuable opportunity to enhance community engagement and promote sustainable development. Recognising this potential, the Friends of Heritage Association initiated STEM and Heritage Workshops in 2023. Designed for secondary school students in Ivanić-Grad, Croatia, these workshops aimed to bridge STEM disciplines with cultural heritage, equipping participants with essential skills to support the growth of creative and cultural industries. Throughout the programme, students engaged in hands-on activities such as documenting and digitising artefacts for a virtual museum, creating 3D models and prints of historical sites, mapping natural heritage using QGIS, and analysing bioarchaeological material. These experiential learning opportunities emphasised STEM's crucial role in the social sciences and humanities, underscoring the necessity of interdisciplinary collaboration for heritage preservation and innovation. The workshops' goal was to inspire, empower, and actively involve young people in heritage projects, fostering cultural awareness and encouraging participation in heritage-related scientific disciplines. This approach highlighted the importance of interdisciplinarity in achieving meaningful outcomes by leveraging digital tools to enhance the study, appreciation, and preservation of local cultural heritage. This paper provides an overview of the implemented workshops, outlining their methodology and key results.

Keywords: local heritage, STEM, workshops, community, non-governmental organisation

INTRODUCTION

The Friends of Heritage Association (hereafter referred to as the Association) was founded in 2005, focusing on preservation, promotion, and valorisation of the cultural and natural heritage of the broader Ivanić-Grad area. Through various projects, educational programmes, and volunteer activities, the Association seeks to raise awareness of the importance of heritage and encourage the local community to engage in its joint preservation and sustainable use through a bottom-up approach. The Association consists of a diverse and interdisciplinary group of enthusiasts, heritage lovers, and experts in fields such as history, archaeology, ethnology, landscape architecture, architecture, art history, sociology, museology, economy, management, and philology. Over the past twenty years, the Association has organised and con-

ducted numerous workshops, lectures, conferences, exhibitions, and research activities, introducing the broader local community to the region's cultural, historical, and natural values, with a recent shift towards youth education and integration. Through collaboration with local, regional, and national schools, museums, institutions, and authorities, the Association strives to involve a broad range of stakeholders in the heritage preservation, promotion, and revitalisation. The Association has been recognised and praised by the professional and academic communities as an outstanding citizens' organisation, owing to its role as a cohesive link between the local community and heritage (Cepetić and Matker 2011; Odak 2024; Limani 2025).

One of the Association's most significant milestones was the initiative to establish a museum, which led to the Ivanić-Grad Museum, founded by the City of Ivanić-Grad in 2014. The Museum continues to operate as the leading professional institution for local cultural and historical heritage to date. Despite this achievement, the Association remains actively involved in community projects, working alongside the Museum and the local Tourist Board, its two key partners in the cultural development of Ivanić-Grad. Another crucial milestone in the Association's growth has been collaborating with the international organisation European Heritage Volunteers since 2019. This partnership has enabled the Association to expand its reach and establish itself on the international map of European heritage stakeholders. These rich experiences throughout the Association's existence were developed thanks to the cooperation of enthusiasts and heritage lovers from various professional backgrounds. For this reason, the Association has embraced an interdisciplinary approach from its very beginnings, utilising tools from various sectors to carry out its activities, long before STEM fields were fully recognised for their significance as they are today.

ABOUT THE "STEM AND HERITAGE WORKSHOPS" PROJECT

Due to a broad variety of heritage-oriented topics throughout different activities in the last 20 years, the Association has obtained extensive experience with interdisciplinarity of the team members, each contribut-

ing with new insights from their different professional problem-solving skills and approaches. The diversity of members included the work between ethnologists, museologists, sociologists, historians and art historians, archaeologists, biologists, architects, and landscape architects. In the first fifteen years, the Association focused on strong professional work combined with civil activities, in order to lay the foundation for the growth of the cultural sector in Ivanić-Grad. Over the last five years, the Association, a non-governmental organisation (NGO), has been shifting in the direction of heritage promotion and education of the local public, to bring a level of sensitivity, interest, and responsibility towards heritage to the broader population. With this shift, the NGO set a new goal for educational and hands-on activities with the target group of the young population and students in Ivanić-Grad.

With this new goal in mind, alongside the vast interdisciplinary experience, the concept of STEM workshops emerged as the most profound tool, since education in the STEM industry is recognised as essential for developing problem-solving skills and the practical application of knowledge in overcoming real-world obstacles. STEM education emphasises learning through hands-on application and provides a framework for developing a deeper understanding of issues, building confidence, improving literacy, and enhancing social and communication skills such as conflict resolution, creative thinking, problem-solving, and strategic planning (Orr et al. 2021).

The topics developed for the workshops were chosen to be the most fitting for the described learning process, taking into account the members' different professional backgrounds and studies. Also, they were inspired by broad activities from Friends of Heritage portfolio, challenging different topics like: 3D modelling, urban planning and design (3D modelling of the Ivanić Fortress model in the city park; secondary school workshops "Summer School of Heritage and Architectures"; conceptual design for the Milka Trnina Cultural Centre (*Dom kulture Milke Trnine*), 3D modelling of the historical church interior), environmental protection and promotion of natural and rural heritage (geographic information system (GIS) mapping and digital storage of natural heritage; orienteering workshop for children using maps; integration of heritage elements into rural space through "Heritage Cycloroute"

(*Baštinska ciklotura*); design and implementation of heritage elements into contemporary rural landscape with “Posavina Corn Maze”), historical and archaeological research (map analysis and field survey in Kloštar Ivanić; archaeological excavation of the Ivanić Fortress), and documentation and digitisation of objects (digitisation of local fire-fighting heritage objects; documentation and digitisation of industrial heritage objects for the Virtual Museum of Industrial Heritage; establishment of the inventory of the Kezele family ethnographic collection).

Taking these topics into account, in December 2023, the Association launched an initiative titled “STEM and Heritage Workshops” funded through a public grant from Zagreb County, Croatia.¹ The primary objectives were to foster interdisciplinary collaboration, engage secondary school students in heritage-related projects, and introduce them to diverse STEM-based methods and career opportunities in the cultural sector. All workshops were created in cooperation with members of the Association. Their common goal was to demonstrate the applicability of STEM skills in cultural heritage through the active participation of students. The workshops were designed with regard to the members’ professional backgrounds since they needed to have prior knowledge in the field that they are teaching. It was also important to demonstrate the interdisciplinary nature of cultural heritage, and its potential to connect with other scientific fields, such as technical sciences, informatics, and biology. Based on these principles, four workshops were created:

- “Documentation of Industrial Heritage Objects and the Virtual Museum”;
- “3D Modelling and Printing in Heritage”;
- “Mapping Natural Heritage Using QGIS”;
- “Biology in the Humanities – Introducing Bioarchaeology and Zooarchaeology”.

Teaching strategies for every workshop were designed following the framework and principles of STEM workshops. It was important to provide hands-on interactive experience for students through mentoring, teamwork, and conversation exchange, as well as to present the

¹ We would like to express our sincere gratitude to Zagreb County for their financial support of our project in 2023.

complexity involved in integrating cultural heritage with STEM fields through educators' speech. Guided by the recommendations of educators, the project was held during four weeks, one workshop per week, for two school hours in the afternoon and aimed at the students of the local Ivan Švear Secondary School, where the workshops were carried out. The school setting was strategically chosen to target students at a formative stage, as they begin to consider their future academic and professional paths. "The STEM in Heritage Sciences" (HERISTEM) Erasmus+ project, led by the University of Belgrade and partnered with institutions from Zagreb, Ljubljana, Sarajevo, and Cambridge, served as a model for our local initiative (Vuković 2022: 9–15). While the HERISTEM Erasmus+ project focused on students already based in heritage disciplines, our initiative aimed to raise awareness of digital humanities among young people still choosing their university paths. Additionally, the NGO aims to strengthen the relations with local stakeholders, specifically with educational institutions like secondary schools, since they help spread knowledge and implement education on the importance of local heritage. Thus, the participants for four workshops were gathered by school managers. Each workshop consisted of six to ten students from the 2nd to 4th grade of different orientations. The school also provided the classroom and technical equipment in the form of computers and a projector, while one or two laptops were provided by Friends of Heritage lecturers, enabling students to work in groups on each laptop.

The local project addressed the increasing application of STEM technologies in the humanities, demonstrating how tools such as 3D modelling, 3D printing, GIS mapping, digital storytelling, and biochemical analysis can be utilised for cultural heritage preservation and innovation. Additionally, the project wanted to instil a sense of pride and identity in participants by grounding the workshops in their local heritage and to serve as a model for utilising STEM to innovate heritage preservation while inspiring the next generation to engage with the cultural sector, as proven in previous successfully delivered NGO activities. This included documenting objects from local industrial heritage and integrating them into a virtual museum, creating a 3D model of a historical fortress that once stood in the city, mapping local natural heritage through QGIS, and analysing bioarchaeological material excavated from a local archaeological site.

PEDAGOGICAL BACKGROUND OF WORKSHOPS

Workshops are a special type of educational programme designed for a specific group of people. What distinguishes them from school classes is their primary focus on practical work, the specific needs, interests, and preferences of the group involved. Biljana Radić-Bojanić and Danijela Pop-Jovanov (2018: 225) believe workshops are the best form of non-formal education because they actively involve participants, focus on interaction, and motivate them to understand a specific topic in depth. Despite all the advantages of the workshops as educational programmes, for this project, it was necessary to base each workshop on pedagogically appropriate didactic principles, strategies, and methods. The principle that guided all workshops is the principle of alignment (Hodolidou 2014: 190). When planning the workshops, learning goals, teaching methods and activities, and ways of evaluating acquired knowledge were coordinated so that they formed a coherent whole. Teaching methods and the evaluation strategies were chosen according to learning goals.

The first step was to define the learning goals of the workshops. They then served as a guide for designing activities, teaching methods, and evaluation methods. Accordingly, the following main goals were defined for workshops:

- “Documentation of Industrial Heritage Objects and the Virtual Museum” – participants will document objects for a virtual museum through WordPress;
- “3D Modelling and Printing in Heritage” – participants will create a 3D model in SolidWorks and print the model through UltiMaker Cura and Ender-5 Pro;
- “Mapping Natural Heritage Using QGIS” – participants will map natural heritage using Quantum GIS software;
- “Biology in the Humanities – Introducing Bioarchaeology and Zooarchaeology” – participants will analyse animal remains and write a lab report.

The objectives of the workshops were set in such a way that participants were expected to acquire skills. Accordingly, appropriate teaching methods were selected. The methods used were the conversation

method, the demonstration method, and the method of practical work (Cindrić et al. 2016: 151–164). To introduce new skills and knowledge to participants, the educators started the workshops with a conversation, connecting previous knowledge with new information that would be acquired through the workshop. Using the demonstration method, they showed how new skills were practically performed, and finally, the participants worked on projects themselves. To achieve experiential learning, exchange of opinions, and cooperation, the teaching strategies of mentoring and teamwork were used (Cindrić et al. 2016: 169–204). During practical work, the participants always worked in pairs to feel more secure in trying new skills while educators provided them with guidance. Workshops of this type are almost always designed according to the experiential learning model. They are focused on acquiring skills, not just on transferring knowledge. Collaborative and experiential learning are encouraged, and the emphasis is on experiencing and understanding knowledge (Martinko 2012: 165).

Having defined the main teaching objectives and appropriate teaching methods, the individual workshop activities and their duration were developed. Particular attention was paid to regular changes in activities and teaching methods to ensure maximal concentration of participants, given that the workshops lasted 90 minutes. The basic structure of the workshops was as follows: introduction and presentation, connecting new information to familiar, and demonstrating the skills that the participants will acquire – the demonstration method, practical work method, evaluation of acquired knowledge, and final evaluation of the workshop. Individual activities within each workshop will be presented in the following chapters. The final step was to define an evaluation strategy. Since workshops are a non-formal type of education, the strategy selected was informal evaluation. The informal assessment is only casually applied, which reduces student stress and the possibility of obtaining socially desirable responses. Educators evaluated through communication and observation.

STEM AND HERITAGE WORKSHOPS

DOCUMENTATION OF INDUSTRIAL HERITAGE OBJECTS AND THE VIRTUAL MUSEUM

As museums play a key role in preserving heritage and educating future generations, virtual museums have emerged as a digital alternative, allowing global access to artefacts and interactive learning experiences (Schweibenz 1998; Utkugün and Yıldırım 2024: 441). Virtual museums are interactive digital platforms that use computer and internet technologies to provide access to digitised artworks, historical artefacts, and documents in visual, audio, or video formats. With advancements in technology, they now exist as both websites and applications. These museums play a vital role in preserving cultural heritage through digitisation and making it accessible to future generations. By reaching wider audiences, they enhance learning experiences, promote cultural awareness, and foster intercultural understanding. Their global accessibility ensures the continuous sharing and sustainability of cultural heritage in the digital age (Utkugün and Yıldırım 2024: 442).

From 2019 to 2022, the Association led the project “Industrial Heritage of Ivanić-Grad”, the first systematic study of the city’s industrial development from the late 19th to the 20th century. The project aimed to raise awareness, promote interpretation and education, ensure sustainable management, and integrate industrial heritage into cultural tourism (Kantoci 2019: 178). Through two European Heritage Volunteers workshops, over 300 industrial heritage objects were documented. In 2019, the Virtual Museum of Industrial Heritage was launched through crowdfunding and crowdsourcing efforts, with objects continuously added to the museum. Due to limited funding, the Virtual Museum of Industrial Heritage was created as a WordPress website.² A structured format was established for adding objects, including key metadata such as: Name/Title, Place of Origin, Date of Origin, Materials and Techniques, Dimensions, and Ownership. Objects were categorised by the companies that operated at the time, but users can also search by

² The Virtual Museum of Industrial Heritage of Ivanić-Grad currently features 362 industrial heritage objects, with new items being continuously added (Amici hereditatis n.d.).

themes such as photographs, badges, and more. A unique feature of this virtual museum is that visitors can upload their own items through a form requesting specific details and a photograph.

The workshop to document and add industrial heritage objects to the virtual museum was held in a general secondary-school class. It was attended by six interested students, and led by Laura Šejić, a graduate archaeologist and museologist, and Katarina Matkerić, a graduate ethnologist, historian, and sociologist, both members of the Association (Figure 1). During the workshop session, participants gained insight into the process of documenting museum and heritage objects. They explored digital tools such as M++ and Microsoft Access for documentation and learned about the creation and significance of virtual museums.³ A key component of the workshop involved practical engagement, where students contributed directly to the Virtual Museum of Industrial Heritage. The workshop began with an introduction to the concept of virtual museums, followed by a step-by-step guide on documenting objects, including essential metadata elements. The students were also introduced to digitising objects through scanning. However, for the purpose of this workshop, they captured photographs of the objects themselves. Each participant was assigned an industrial heritage object to document. They completed a detailed object identification form, took high-quality photographs of their respective objects, and uploaded the images to a shared digital folder. Following this, they were introduced to the WordPress software and guided through the structure of the virtual museum website. They followed the demonstrated steps and successfully added their objects, ensuring all metadata and images were correctly displayed. Upon completion, participants reviewed the website to verify the accuracy and completeness of their entries.

³ M++ is the most used database for inventorying museum collections in Croatia.



Figure 1. The “Documentation of Industrial Heritage Objects and the Virtual Museum” workshop in progress (author: Laura Šejić).



Figure 2. Some of the documented and digitised industrial heritage objects during the workshop. Source: Screenshot from the Virtual Museum of Industrial Heritage of Ivanič-Grad (Amici hereditatis n.d.).

As a direct result of this workshop, over 20 industrial heritage objects were successfully documented and uploaded to the Virtual Museum of Industrial Heritage (Figure 2). Not only did this enrich the museum's digital collection, but it also provided students with valuable hands-on experience in heritage documentation and digital curation. The engaging and interactive session offered students a unique opportunity to connect with cultural heritage in a digital context while acquiring practical skills in museum documentation and online curation. They developed essential skills, such as digital literacy, through employing tools like digital photography and database management. Additionally, they learned heritage documentation by cataloguing artefacts and creating metadata for virtual collections.

3D MODELLING AND PRINTING IN HERITAGE

As part of the “STEM and Heritage Workshops” project, a workshop focusing on 3D modelling and printing was also held to integrate cultural heritage and technological innovations. The event took place at the Ivan Švear Secondary School in Ivanić-Grad during the evening hours and was attended by six students specialising in the Oil and Mining Technician programme. Two Mechanical Engineering Graduate students and Friends of Heritage Association associates on other projects, Artur Pocem Mihaljević and Rikardo Radešić, led the workshop. The interactive session provided students with a hands-on introduction to advanced digital tools and processes, highlighting their potential in both cultural and technical contexts. The workshop began with a theoretical and methodological 3D modelling and printing overview. Participants were introduced to two key software tools: SolidWorks and UltiMaker Cura. SolidWorks,⁴ a powerful 3D computer-aided design (CAD) software (Greene 2021; SolidWorks Education Edition 2021–2022), was used to model the Ivanić Fortress, a historical structure significant to the city's local heritage (Rudež 1994). Students were guided through a step-by-step demonstration of the modelling process, which they followed on their computers. This approach simultaneously familiarised them with the software's features and emphasised the practical application of STEM skills in preserving and reimagining cultural landmarks.

⁴ SolidWorks is a computer-aided design (CAD) software used for 3D modelling and engineering design.

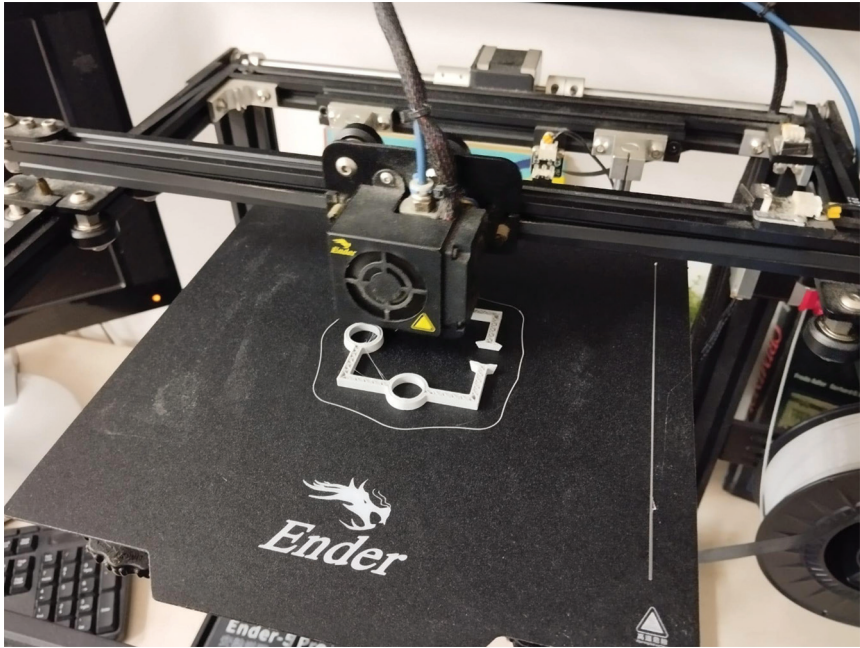


Figure 3. The process of printing the 3D model of the Ivanić Fortress using Ender-5 Pro (author: Laura Šejić).

Once the digital model of the fortress was completed, attention shifted to the preparation phase for 3D printing. This segment introduced students to UltiMaker Cura,⁵ a slicing software essential for converting 3D models into printable files (Dhore et al. 2021: 212–213). Through detailed explanations and live demonstrations, participants learned how to configure parameters such as layer thickness, infill density, filament type, and print speed. These settings were contextualised within the broader framework of ensuring precision and efficiency in 3D printing. The process culminated in converting the model into G-code, the machine-readable format required by 3D printers (UltiMaker 2021). The final phase of the workshop featured a live demonstration of 3D printing using an Ender-5 Pro printer provided by the workshop instructors (Figure 3). Students observed the printer in operation, gaining insights into its core components and functionalities. They were introduced to

⁵ UltiMaker Cura is a 3D printing software used to prepare digital models for fabrication. It has a CAD plugin integration with SolidWorks, Siemens NX, Autodesk Inventor, etc.

the mechanics of additive manufacturing and how digital designs are transformed into physical objects layer by layer. This hands-on experience was further enriched as students examined and interacted with the finished 3D-printed models of the fortress, providing them with a tangible connection to the technology and its capabilities.

Throughout the workshop, students were encouraged to ask questions and engage with the tools and processes, fostering an interactive and collaborative learning environment. The integration of cultural heritage into a STEM-focused activity offered participants a unique perspective on the interdisciplinary nature of modern technology and its potential to bridge diverse fields of study. This workshop not only introduced students to valuable technical skills such as CAD modelling and 3D printing but also inspired them to consider innovative applications of these technologies in heritage preservation. Moreover, the workshop demonstrated the potential of STEM education to empower students with practical, transferable skills that align with emerging technological trends. It provided students with a comprehensive, hands-on introduction to advanced tools while fostering an appreciation for the interplay between cultural and technical disciplines.

MAPPING NATURAL HERITAGE USING QGIS

The workshop's main premise was to introduce students to GIS, a comprehensive geoinformation tool within the technical field, applicable across various domains, including the cultural sector.⁶ Almost all contemporary industries utilise GIS tools and principles, whether they actively work with them or are end users of their products. GIS finds applications in spatial planning and geography, landscape architecture and architecture, agriculture, transportation, energy and infrastructure, geology, geodesy, biology, and hydrology, as well as the cultural and social sectors like tourism, archaeology, and history. With the development of the internet and publicly available map viewers, GIS has gained popularity through interactive maps and interfaces, sparking

⁶ GIS is an extensive umbrella term encompassing numerous theories, tools, methods, and systems related to the collection, processing, analysis, visualisation, and application of various spatial information.

public interest in spatial mapping. Examples of public web GIS applications include maps of castles, manor houses, and fortresses in Krapina-Zagorje County (Besednik 2023a; 2023b) and the natural and cultural heritage of Medvednica Nature Park (Karas 2023a; 2023b).

GIS tools play a significant role in heritage interpretation and visualisation in a spatial context, aiding in legislative protection and the enhancement of important heritage sites. To systematically inventory, evaluate, and preserve heritage, it is essential to manage it, with spatial planning documents serving as the fundamental management instrument for sustainable spatial development aligned with conservation (Radman 2014: 500). In the process of creating expert surveys for the preservation and management of natural and cultural heritage, GIS tools are among the primary instruments for collecting, reviewing, processing, and synthesising data on anthropogenic, natural, political, and social influences on heritage sites and areas (Spiridon et al. 2016: 269), ultimately enabling conclusions about human relationships with nature and space during time (Yao et al. 2023: 4).

The workshop took place for two school periods with ten students from the economics programme, and was coordinated by Kristina Komšo, a landscape architect. It consisted of two main parts: an introduction to GIS and the application of its tools, and guided group work on a practical task of mapping local natural heritage. In the workshop, a free and open-source GIS software, Quantum GIS, was used. The introductory part of the workshop focused on defining different types of heritage, with an emphasis on natural heritage, encouraging students to provide concrete examples of various types of heritage in their local community. Furthermore, there was a brief theoretical introduction to GIS, explaining its applications across different industries, including STEM fields. The use of GIS in Croatian cultural and nature conservation sectors was specifically highlighted, with examples such as the Geoportal of Cultural Property (Ministry of Culture and Media 2025) and Biportal – web portal of the Nature Protection Information System (Ministry of Environmental Protection and Energy 2025). Additionally, the project “The Trees of Our City” by the Association was showcased as an example of a successful GIS tool application. This project resulted in the creation of a georeferenced database of the city’s natural heritage

and ultimately led to the protection of several mapped units within the spatial planning documentation of the City of Ivanić-Grad (City Council of Ivanić-Grad 2024).

The second part of the workshop focused on the practical use of Quantum GIS, with students working in four groups of three. The workflow of this segment included: extensive activities for familiarisation with the programme, such as interface and tool overview, adding Web Feature Service (WFS) and Web Map Service (WMS) base layers, integrating pre-prepared spatial data, creating new spatial data (i.e., mapping), processing spatial data attributes, graphical processing, and visualising data by creating maps; and a hands-on mapping task focused on an element of Ivanić-Grad's natural heritage. Familiarisation with the Quantum GIS programme was intensive for students who had not previously encountered this type of computer work. However, they eagerly mastered the programme interface and several basic skills, such as adding WFS and WMS base layers and creating new spatial data. Due to time constraints and the number of coordinators, it was agreed that each group would work on the topic of the same natural element – a watercourse. Under the coordinators' guidance, the participants located and downloaded spatial data for all watercourses in the Republic of Croatia from an open-source platform, Bioportal (Ministry of Environmental Protection and Energy 2025). They imported this data into the programme, obtaining georeferenced watercourses of Croatia overlaid on the 2022 Digital Orthophoto Map (State Geodetic Administration n.d.). The acquired data was graphically processed by adjusting styles, and students were introduced to the attribute descriptions of a large set of metadata, including instructions on detecting attributes of the Lonja River. Finally, the students successfully created a new spatial dataset by mapping a specific element of Ivanić-Grad's natural heritage – a section of the Lonja River's watercourse in the urban centre (Figure 4).

Through the workshop process, students encountered spatial data manipulation and interpretation for the first time in their education, sparking curiosity, developing research skills, fostering creativity in visualisation and presentation, and enhancing their awareness of different spatial dimensions and their interpretation. A key advantage of group work was the fostering of a team-oriented environment for finding information, learning to use new tools, improving communication

within the group, and navigating the interface. However, some challenges hindered the quality of work with students, including the inadequate selection of participants based on their interest and skills, the lack of computer equipment and the need to group more students together for collaborative work. Additionally, the overall time limitation of the workshop allowed for only very general and simplified learning outcomes.



Figure 4. Mapping of the Lonja river in Ivanić-Grad. Source: 2022 Digital Orthophoto Map, State Geodetic Administration of the Republic of Croatia (author: Kristina Komšo).

BIOLOGY IN THE HUMANITIES – INTRODUCING BIOARCHAEOLOGY AND ZOOARCHAEOLOGY

During the workshop dedicated to biology in humanities, participants explored the biological and chemical methodologies that support archaeology and anthropology, contributing to the reconstruction of the past. Key disciplines were introduced, including archaeozoology, archaeobotany, osteoarchaeology, and scientific dating techniques for archaeological samples. The workshop's main objectives were to familiarise students with bioarchaeology and its interdisciplinary applications, introduce them to local heritage and archaeological sites, and explore the possibilities for interdisciplinary careers and projects. The workshop leaders, archaeologist Laura Šejić and molecular biologist Ana-Marija Petrović, provided in-depth knowledge of laboratory procedures and proper handling of samples. Eight gymnasium students participated in the workshop, engaging in discussions and hands-on activities related to bioarchaeology. During the workshop, zooarchaeological

material from a local site was used, along with laboratory equipment such as gloves, tweezers and brushes provided by the association. The workshop commenced with a brief lecture on bioarchaeology, providing participants with foundational knowledge of the field during the group discussions. After the lecture, the students learned to analyse archaeological remains and handle samples in the laboratory through practical group activities. A Q&A feedback followed the workshop.

Bioarchaeology is the study of both human remains and accompanying biological material in their past or cultural context. Today, bioarchaeology encompasses fields of palaeobotany (archaeobotany), zooarchaeology (archaeozoology) and biological anthropology (Larsen 2015). The workshop participants were briefly introduced to the mentioned fields and examples of interdisciplinarity between biology and archaeology. For example, isotope analysis provides insights into ancient diets, while ancient DNA analysis helps reconstruct migratory patterns of past populations. In palaeochemistry, trace elements and stable isotopes in teeth and bone remains can be used to reconstruct ancient diets and agricultural practices (Reed 2008). In an archaeological context, mitochondrial DNA (mtDNA) is particularly useful for studying genealogical relationships, as well as connections between individuals discovered at the same archaeological site (Zupanič Pajnič 2019). Both zooarchaeology and biological anthropology use osteological analysis (Reed 2008). Osteoarchaeology, or skeletal analysis, is the cornerstone of bioarchaeology, providing insight into the life and death of ancient populations. It is possible to determine an individual's age, sex, health, diet, disease, and cultural practices from skeletal fragments. Additionally, since bones are living organs, we can infer from the nature of the bone fracture and its placement whether the fracture happened before or after death. The term archaeozoology refers to the study of archaeological animal bones. Macroscopically, it is quite easy to distinguish human bones from other animal bones found at archaeological sites (Mulhern 2014). These morphological distinctions were employed in the workshop lecture and hands-on activity.

Before the activity, the students were introduced to essential laboratory requirements, including the proper use of gloves, appropriate clothing, and adherence to laboratory safety rules, ensuring a safe and effective learning environment. As part of the practical session, the students analysed zooarchaeological remains from the local archae-

ological site Ivanić Fortress, excavated in 2023,⁷ to demonstrate the similarities and differences between human and animal bones. This involved sorting bones, classifying them by type (long, short, flat, and other), and identifying the corresponding animal species. The students managed to easily classify and identify the animal species by examining the skulls and the size of the bones, using key morphological characteristics to make their determinations (Figure 5). After the activity, the students wrote a lab report to document their findings and analysis. They also participated in a short knowledge quiz to assess their understanding of the concepts covered during the workshop. The knowledge quiz was designed to be relatable and engaging for the participants, incorporating questions about popular forensic TV series and other familiar topics. This approach made the quiz more accessible and fun, while still reinforcing key concepts from the workshop.



Figure 5. Students analysing the animal bones during the workshop (author: Laura Šejić).

⁷ The Ivanić Fortress was excavated in 2023 and 2024 by the Association in collaboration with the City Museum of Ivanić-Grad. The zooarchaeological remains and other archaeological finds from the excavations are stored in the museum.

The workshop's success was clearly demonstrated through the participants' active inquiries about enrolment in specific academic programmes, associated obligations, and potential career opportunities. Many participants expressed that not only did they enjoy the workshop, but that it also felt highly engaging, sparking a keen interest in further exploring topics such as zooarchaeology and human osteology. Additionally, several participants inquired about pursuing studies in biology and archaeology, reflecting the strong curiosity and engagement the workshop generated. The students also expressed interest in the local archaeological site and ongoing excavations, recognising it as a key part of their heritage, which they encounter daily.

CONCLUSION

Through a series of workshops with lectures and hands-on activities the participants learned the fundamentals of digital tools and scientific principles within the humanities, and simultaneously gained a deeper understanding of their local heritage. These activities were designed to highlight the relevance of STEM in everyday life and its historical context, thereby bridging the gap between the past and the present. Following appropriate pedagogical principles, strategies, and methods, each workshop was carefully developed. The foundation of the workshops was the principle of alignment, where every learning goal is consistent with teaching methods and evaluation strategies. Teaching strategies such as mentoring and teamwork were combined with teaching methods of conversation, demonstration, and practical work.

At the workshop "Documentation of Industrial Heritage Objects and Virtual Museum" participants explored the process of documenting museum and heritage objects, using digital tools to contribute to the Virtual Museum of Industrial Heritage. They gained hands-on experience in digital photography, database management, and cataloguing artefacts with metadata, enhancing their digital literacy. During the "3D Modelling and Printing in Heritage" workshop, students used SolidWorks to create a digital model of the Ivanić Fortress. They learned to prepare the model for 3D printing using UltiMaker Cura and observed a live demonstration with an Ender-5 Pro printer. This hands-on expe-

rience introduced them to CAD modelling and 3D printing while showcasing the potential of these technologies in heritage preservation. The “Mapping Natural Heritage Using QGIS” workshop highlighted GIS applications in various industries, including heritage. Participants mapped the Lonja River’s watercourse in Ivanić-Grad’s urban centre, developing research skills and spatial awareness. Lastly, the “Biology in the Humanities – Introducing Bioarchaeology and Zooarchaeology” workshop provided insights into biological and chemical methods used in archaeology. Participants engaged in hands-on analysis of zooarchaeological remains from the Ivanić Fortress excavations. Their strong engagement and curiosity sparked interest in further studies in biology and archaeology. These workshops bridged the gap between cultural heritage and modern technology, fostering interdisciplinary learning and hands-on experience for young participants.

The final segment of each workshop was dedicated to evaluation. Facilitators evaluated the knowledge that the students had acquired using informal evaluation strategies such as conversation and observation. Students were encouraged to talk about their experience and share the results of their work. An in-person evaluation concluded that, through well-thought-out workshops based on an interactive approach, the students have acquired specific skills and knowledge related to each workshop. They demonstrated understanding and knowledge of modern technology, as well as the skills of searching, collecting, and processing information, assessing its importance, and handling information through critical thinking. They have also developed learning competencies by broadening their career and professional horizons and planning group and team activities. As a result, they also developed their own sense of initiative and entrepreneurship. They were active in the learning process, asked questions during the workshops, and eagerly participated. Some participants expressed further interest in the Association’s activities and later engaged in other projects. Some of them were already familiar with the presented software programmes and wanted to deepen their knowledge through workshops, while others actively inquired about specific faculties related to the workshop topics. “STEM and Heritage Workshops” demonstrated to young people that cultural heritage research can be approached in various ways, continually evolving with modern technologies, and is far from monotonous

or reserved solely for heritage enthusiasts. The school staff were thrilled that students had the opportunity to explore STEM activities focused on local heritage and that they could actively participate in hands-on workshops. Additionally, the workshops provided their lecturers a crucial experience in developing didactic skills on how to communicate professional concepts effectively, and find optimal ways to exchange knowledge. By doing so, the lecturers themselves have demonstrated the use of individual skills in creating greater local benefits, which surpass the individual interest where cultural conservation and promotion is concerned. Finally, with this experience, the NGO gained insight into the benefits and challenges of the used methodology, with the possibility of future improvement.

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MUSEUMS AS RELATIONAL ECOSYSTEMS: TECHNOLOGY, VOLUNTEER PARTICIPATION, AND THE DIGITAL TRANSFORMATION OF HERITAGE. NEGOTIATING MEMORY AND INNOVATION AT THE ETHNOGRAPHIC MUSEUM OF ALTA BRIANZA

ROBERTO LAZZARONI

University of Milano-Bicocca

Milano, Italy

r.lazzaroni2@campus.unimib.it

ORCID iD: 0009-0004-5265-3705

In 2022, the International Council of Museums (ICOM) introduced a new museum definition, emphasising ethical operations, community participation, and knowledge sharing. This study examines how these principles intersect with UNESCO's concept of intangible cultural heritage, particularly in the context of small ethnographic museums. Focusing on the Ethnographic Museum of Alta Brianza (*Museo Etnografico dell'Alta Brianza* (MEAB)) in Northern Italy, the research explores the role of young volunteers in redefining museum practices through participatory exhibitions, documentary filmmaking, and digital technologies. Using an ethnographic approach (here understood as a qualitative research methodology characterised by immersive observation, long-term engagement, and participatory interaction with both human communities and material cultures, aimed at capturing the nuanced practices, meanings, and relationships within a given context) and actor-network theory (ANT), the study conceptualises the museum as a dynamic relational ecosystem where human and non-human actors, including digital tools, co-construct cultural memory and meaning. Findings highlight both the opportunities and

the constraints of digital transition in underfunded museums, showcasing the volunteers' role in shaping new narratives while navigating resource limitations. The study ultimately reflects on the challenges of sustainable museum innovation and advocates for a democratised approach to digital heritage practices that balances technological aspirations with institutional realities.

Keywords: intangible cultural heritage, digital transformation in museums, actor-network theory, museum volunteers, participatory museum practices

INTRODUCTION

In 2022, the International Council of Museums (ICOM) released a revised definition of a museum, following several years of deliberation. This new definition encompasses a broadened scope of activities that museums are expected to undertake, in comparison to the previous one. The third sentence of the definition is particularly noteworthy, stating that museums:

operate and communicate ethically, professionally and with the participation of communities, offering varied experiences for education, enjoyment, reflection and knowledge sharing (International Council of Museums 2022).

This emphasis on community participation represents a significant shift in the manner in which museums conceptualise their role and functions. This standpoint is closely associated with the tenets of the “UNESCO Convention for the Safeguarding of the Intangible Cultural Heritage” (2003) (hereafter referred to as “UNESCO Convention”), which acknowledges the pivotal role of communities, groups, and individuals in recognising, transmitting, and preserving their heritage.

As stated in Article 2 of the “UNESCO Convention”, the term intangible cultural heritage is defined as

practices, representations, expressions, knowledge, skills – as well as the instruments, objects, artefacts and cultural spaces associated therewith – that communities, groups and, in some cases, individuals recognize as part of their cultural heritage (UNESCO 2003).

The focus of my doctoral research, conducted in a small ethnographic museum, was on the application of digital technologies to the safe-

guarding of intangible heritage. This necessitated critical reflection on the relationship between museums and intangible heritage, a relationship frequently more intricate than the one with tangible heritage. The involvement of communities, which is a central feature of both the ICOM definition and the “UNESCO Convention”, is a key issue in this context.

In particular, the 2005 “Council of Europe Framework Convention on the Value of Cultural Heritage for Society” (hereafter referred to as “Faro Convention”) further reinforces the right of communities to assume a proactive role in managing their own heritage (Council of Europe 2005).¹ Consequently, museums are no longer able to consider themselves the sole custodians of cultural narratives; rather, they are increasingly being called upon to renegotiate their role as experts, opening to a logic of co-production of knowledge and meaning with so-called heritage communities (Colomer 2023: 4). This transformation points to a more extensive trend towards participatory and collaborative approaches to heritage preservation, facilitated in part through the integration of digital technologies into museum practices. In this context, the relational nature of cultural heritage becomes a key point, as it highlights the dynamic interactions between people, objects, tools, and environments. This, in turn, strengthens the role of museums as active nodes in contemporary cultural ecosystems.

The definitions and the related processes of officialisation are not immune to criticism; however, the present study utilises the definitions mentioned above to analyse partial data from ethnographic field research conducted during 2023 and 2024 at the Ethnographic Museum of Alta Brianza (*Museo Etnografico dell’Alta Brianza*; hereafter referred to as MEAB), situated in the province of Lecco, in Northern Italy. This research is conducted as part of a PhD programme at the

¹ The “Faro Convention” explicitly recognises the right of individuals to benefit from cultural heritage and to contribute to its enrichment (Art. 1c). It also emphasises that the responsibility for heritage preservation is shared among public authorities, institutions, and heritage communities, defined as “people who value specific aspects of cultural heritage which they wish, within the framework of public action, to sustain and transmit to future generations” (Art. 2b). The “Faro Convention” promotes a participatory approach that actively involves communities in the management and interpretation of heritage, thus laying the groundwork for a transformation of the role of cultural institutions, including museums, towards more collaborative models.

University of Milano-Bicocca, “Intangible Heritage in Socio-Cultural Innovation”. The ethnographic research focuses on the volunteers who contribute their labour to the museum and the utilisation of digital technologies. In this context, ethnographic research can be defined as an approach that emphasises attaining an in-depth qualitative understanding through direct engagement with the social and material environment. The methodology employed encompasses participant observation, interviews, and the analysis of artefacts, enabling the researcher to explore the multifaceted nature of cultural practices and the dynamic interplay between people and objects within their natural settings (see Hammersley and Atkinson 2019; Pink 2015: 39). The findings of this research highlight the possibilities that digital technologies make available to small museums, whilst simultaneously underscoring the needs and limitations created in these contexts.

MAPPING THE MUSEUM’S RELATIONAL ECOSYSTEM: ACTOR-NETWORK THEORY AND DIGITAL AGENCY

Before discussing the theoretical perspective adopted in this study, it is necessary to clarify the meanings of the terms “digital” and “digital transformation” in the context of small ethnographic museums. Instead of regarding digital technology as merely a series of instruments or platforms – such as social media, videoconferencing, or online archiving – this paper conceptualises digital as a non-human agent (Latour 2005: 71), imbued with agency, given that it engenders outcomes that elude human control. In the context of this research, digital transformation is, therefore, neither a simple transformation of data from analogue to digital through tools (which would exclude intangible heritage that is originally in digital format) (Cameron 2007: 50), nor does it mean the adoption of new specific technologies (Parry and Dziekan 2021: 23; Šola 2013: 422). The significance of the present research lies in its consideration of digital transformation as a reconfiguration of the roles, connections, and actions of the actors (human and non-human) involved within the social network represented by the museum. The present interpretation is informed by the expanding scholarly literature that underscores the remarkably intricate and contextualised character

of digital instruments and digitisation procedures within the cultural heritage domain (Bounia 2023; Liao et al. 2020). It is acknowledged that the advent of digital technologies does not inherently engender innovation, inclusion, or democratisation, as technocratic discourse often purports. Instead, new technological forces (technologies and processes) are integrated into specific and diverse cultural and social ecologies. In the case of MEAB, for example, digital tools have enabled organisational and communicative changes, such as forming a geographically distributed group of volunteers. However, these same tools have also revealed structural limitations, including a lack of funding, digital skills and institutional support. Digital technology, therefore, is not understood here as a neutral enhancer of museum practices, but as an active force that shapes and is shaped by the museum's relational ecosystem (Meehan 2022: 430).

In her work *Memorylands: Heritage and Identity in Europe Today* (2013), Sharon Macdonald proposes a vision of the museum that goes beyond the traditional function of preserving material and immaterial heritage. The author emphasises how the museum must be understood as a relational ecosystem, that is, an environment in which cultural memory is not simply preserved, but continuously negotiated, reinterpreted, and contextualised through interactions between objects, people, and narratives. According to Macdonald (2013: 121), heritage is never a fixed and unalterable entity, it is configured as a dynamic process in which different actors – curators, visitors, local communities, and institutions – actively participate in the construction of meaning. In the case of my research context, the group of young volunteers acted as a new social agent, deciding to address everyday issues (work, relationships, leisure time). These topics were brought up to date by elevating everyday objects into cultural objects, which could be used to talk about the present. These themes were already present in the permanent exhibition but have been revisited and recounted from a new perspective that was previously absent from the MEAB. The museum, therefore, is not a mere archive of collective memory, but rather a performative cultural device, in which knowledge is constantly produced and mediated through exhibition practices, visitor experiences, and documentation and communication technologies (Macdonald

2013: 156). In this perspective, the museum becomes a space of cultural negotiation, in which the past is activated in the present to respond to new needs, in which traditional social actors, such as the director and older volunteers, are put in the background and only partially involved. An important element in this analysis is the fact that this new movement has produced a new relational network within the museum, inserting new social actors and, therefore, new nodes of this network that have called into question the previous relationships. The Future MEAB (*Futuro MEAB*), a WhatsApp group initiated within the museum to develop future-oriented projects and digital strategies, has become a real and, above all, unprecedented social actor that mediates access to other social actors: the exhibition, the documentary and, above all, digital technologies.

Elements such as the documentary, objects, and technologies could be read only as objects of the group's practices, but in this way, the whole complexity of the relationship that the group had with them would be lost. The exhibition, for example, as I will explain better later, was based on the attempt to rethink the traditional communication schemes of the museum, to create something different, that could attract a new and younger audience. The documentary was also born with the idea of experimenting with new methods and new languages. The reasons were the lack of funds to pay a video maker and the lack of professional equipment. Technologies enter into this relationship, linked to the exhibition and the documentary, as possibilities. The need to find paths that can be travelled with little to no funds was dictated by the recent policies of the Park Authority, which has, year after year, decreased the funds available to the museum to carry out the initiatives. Looking to the future with scarce resources and the upcoming retirement of the current director, and not knowing how the change will be managed, was distressing and pushed us to rethink the practices in order to make them sustainable. If we observe the museum as a relational ecosystem, according to Macdonald's (2013: 156–157), we can see how this ecosystem is re-discussed, introducing new social actors. According to the actor-network theory (ANT), a theoretical approach developed by Bruno Latour, Michel Callon, and John Law, social relations are read as heterogeneous networks composed of both human and non-human actors (Latour 2005: 129). By overcoming the dichot-

omy between subject and object, it is possible to recognise that elements such as technologies, spaces, etc., are social actors that actively participate in the construction of the social network. Actors are not isolated entities but acquire meaning and act in relation to the other elements of the network (Callon and Latour 1981: 279). The museum practices, the new possibilities, the shift in perspective on the themes of the exhibition and the reflections on the museum's future are directly produced not only by the group of volunteers through new tools, but also by the relationship between the group of volunteers and the new social actors. The temporary exhibition placed limits on the exhibition, hindering the full realisation of the expectations of the volunteers, still managing to actualise the themes already covered in the permanent exhibition. The documentary involved the older volunteers in a dialogue with the younger ones, exchanging fears and desires for the fate of the MEAB. This was the first time that volunteers had addressed these issues collectively. Although the interviews were conducted with individual volunteers, the context of the documentary built the dialogue even before the editing. As for the technologies, the possibilities that these have allowed in building a new type of narrative, but also the limits that they have imposed, such as payment or the need for technical skills, have decisively shaped the relationships within this ecosystem. In this study, actor-network theory is adopted to analyse the MEAB not as a static institution, but as a relational ecosystem in which different actors – volunteers, technologies, the produced documentary, and the exhibition – interact and influence each other. This approach allows us to understand how memory and heritage are co-constructed through the interaction between human and non-human actors, highlighting the active role of technologies and audiovisual products in the mediation of ethnographic knowledge. At this point, I find it useful to introduce the concept of “phygital space” to define a relational ecosystem found on both the physical and digital plane. Although the concept originated in marketing, it has been applied to museum studies for some time now (Clemente et al. 2024: 212; Debono 2021: 159). In the case I reported, considering the museum as a phygital relational ecosystem also allows us to observe the movements that the group of young volunteers has managed to introduce towards new possibilities and, at the same time, see the obstacles that have limited this amalgamation of the two realities.

ETHNOGRAPHIC METHODS FOR COLLABORATIVE DISCOVERY

This study is based on the ethnographic method, using mainly participant observation, supplemented by focus groups and semi-structured interviews. The research was conducted between the end of 2023 and 2024 at the MEAB, despite most of the data being collected through digital ethnography, which allowed the research to continue during my time abroad. During the research, I engaged directly with the museum volunteers, both old and young, participating in frequent meetings, most of which took place online, working with them to develop the exhibition project, and through questionnaires, free interviews, and focus groups. My initial entry and acquaintance with the group of young volunteers came through the director of MEAB, who introduced me to the group and the volunteers' activities after my first year of PhD research at the museum. My participant observation, which initially focused on individual opinions during the meetings of the young volunteer group, gradually grew into full participation. Despite this, my dual role as a participant but also as ethnographer of this context and experience was clear from the beginning.

IMMERSIVE ETHNOGRAPHY WITH MUSEUM VOLUNTEERS

The participant observation part of the research was carried out according to different stages of approach and entry into the volunteer group. While carrying out this research, the volunteers got used to my presence through participation in live events and get-togethers, even though I had not actively participated in any museum activities. In the second half of 2023, the museum director included me in an existing WhatsApp group Future MEAB. After making a proposal to the young volunteers to have them create an exhibition on topics of interest to them, the group became active. Since the group of young volunteers is much more spread out over the territory than the older volunteers, and since work and family commitments are more pressing, the group decided from the outset to continue a practice they had started sporadically during the recent pandemic, namely, to meet in virtual meetings. My practice of participant observation took place mainly through

this channel, a phenomenon that is not new to the social sciences. Of the three phases of participant observation described by Kathleen Musante and Billie R. DeWalt (2010: 9), i.e. participation, observation, and questioning, participation was the one widely used. In the continuation of the work, the group of young volunteers had divided into further subgroups to carry out the tasks necessary for the realisation of the research and the exhibition. To get a complete picture, I joined every subgroup and participated in every virtual and physical meeting, until I had to leave for a trip abroad; at that point, I only participated in the virtual meetings, which were the majority. Participating in all the work groups offered me a holistic view of the network of relationships between the young volunteers, the volunteer association, the director, the museum, and the technology itself.

CAPTURING VOLUNTEER NARRATIVES AND CO-CREATING INSIGHTS

The conducted interviews fell into three categories: informal conversations, semi-structured interviews, and questionnaires. The latter were co-constructed together with a part of the group of young volunteers. The themes addressed were these three: the objects to be included in the exhibition linked to the themes and the emotional ties that tied the individual volunteers to the chosen objects; the positioning of the volunteers concerning digital technologies, while taking into account both desires and possibilities; the role of local museums, their mission, and the fears and hopes for the possible futures of the MEAB. Two questionnaires were administered at the beginning of the exhibition project and one after the exhibition's inauguration aimed at evaluating the work done. The first two questionnaires, related to the themes of the temporary exhibition, were administered to the Future MEAB group, while the last questionnaire, aimed at gathering feedback on the participatory work carried out, was administered specifically to young volunteers who had actively participated in the work. The semi-structured interviews were administered both to the group of young volunteers and the rest of the association and were used to build the documentary. Three open questions were asked:

1. What do you think the MEAB of the future will be like?
2. What do you hope the MEAB of the future will be like?
3. What happens when memory disappears?

The preparation of the questionnaires and interviews and the analysis of the evidence collected were all carried out in a participative dynamic with some members of the group of young volunteers.

WORKSHOPS AS SPACES FOR SHARED LEARNING AND INSIGHT

Two workshops were held during the research period: the first at the end of 2023, following the administration of the first questionnaire to the group of young volunteers present in the Future MEAB, the second in July 2024, three weeks after the inauguration of the temporary exhibition set up by the group of young volunteers. Both occasions took place in person, and the volunteers present were only those actively participating in the exhibition project. The first workshop was conducted collectively and brought out the themes of interest for the exhibition, starting from the analysis of the first questionnaire. The themes relating to the museum's future were also discussed, especially regarding the sustainability of museum practices. The second workshop was conducted by an external expert and addressed to the volunteers who deal with sustainability projects and impact assessment. Starting from the analysis of the results of the questionnaires, the group discussed both positive and negative aspects that emerged while building the temporary exhibition.

Having described the data collection methods, it is now necessary to clarify the approach adopted in analysing the empirical material. The analysis of the collected material followed an ethnographic logic grounded in the researcher's direct involvement in the field. Rather than relying on transcribed interviews or formal coding procedures, the analysis was carried out through a reflective engagement with fieldnotes, informal annotations, and impressions gathered during and after participant observation, online meetings, and interviews. This approach, common in ethnographic work (Musante and DeWalt 2010: 166), allowed for a flexible interpretation of the emerging themes, especially as many insights were co-constructed through

interaction with the volunteers. This mode of analysis draws on what Cristina Grasseni (2007: 2) describes as “skilled visions” – interpretive competencies developed through situated participation and embodied familiarity with the field. Likewise, Sarah Pink (2015: 5) emphasises that ethnographic knowledge emerges through sensory, affective, and reflective dimensions that go beyond the formal coding of textual data. The questionnaires were analysed primarily through a qualitative lens, focusing on recurring patterns, divergences, and the emotional or narrative content of the responses. While no statistical tools were applied, numerical distributions were considered to support certain inferences, particularly when evaluating the perceived relevance of certain themes or the satisfaction with the exhibition outcomes.

Although the analysis was not formally shared with the volunteer group at this stage, the participatory dynamics that characterised the data collection process – such as co-creating questions and discussing intermediate results – suggest potential future iterations of collaborative data interpretation. Overall, the analytical process was grounded in a relational and situated understanding of meaning-making, consistent with the theoretical framing of the museum as a relational ecosystem.

THE MEAB, ITS VOLUNTEERS, AND THE INSTITUTIONAL ECOSYSTEM

THE ETHNOGRAPHIC MUSEUM OF ALTA BRIANZA (MEAB)

Before looking specifically at the collected data, it is important to present the context of the ethnographic research. The MEAB is located in Galbiate, a small municipality in Northern Italy near Lake Como, within the territory of the Monte Barro Park (hereafter referred to as Park). The Park is owned by a public consortium composed of seven municipalities whose territories fall within the Park, together with the Province of Lecco and a mountain community, all of which contribute representation and funding.

The museum opened its doors in April 2003, so during my research, it was celebrating its 20th anniversary. The museum is the result of the will of the first president of the Park, Giuseppe Panzeri, an administrator and

a researcher, who dedicated great commitment to the territory where he was born and where his family comes from. The desire to create the museum was born from his desire to pay homage to the agricultural heritage of his family. In the meeting with the current director of the MEAB, the idea of changing the theme of the museum was born, from peasant memory to an ethnographic museum of the local territory. A change that meant, above all, broadening the gaze and research to potentially all the cultural, social, and economic themes of the territory between Lecco and Como. The current director, Massimo Pirovano, has been the director since the first year, as well as the only employee of the MEAB. The two were very different figures: while Panzeri was a political administrator, Pirovano was a high school teacher and an anthropologist. Since its conception and inauguration, the MEAB has enjoyed the support of the Park Administration, with funds that have allowed it to carry out various ethnographic research, accompanied by the publication of documentaries and books. Despite this, and the indications of the director of the MEAB, the staff of the museum has never been increased, and has always relied solely on the figure of the director. From the words of the director emerges the fact that starting from 2008, that is, when Panzeri left his position as president of the Park Authority, the museum's financial support has been gradually decreasing, which has had several consequences, like a general reduction and curtailment of the cultural activities.

THE ASSOCIATION OF VOLUNTEERS

A few months after the museum opened, the Friends of the Museum Association (hereafter referred to as the Association)² was formed, which over time has brought together people of different genders and social backgrounds, united by a bond with the MEAB and its director.

² This association titled Friends of the MEAB Association (*Associazione Amici del MEAB*) was formally founded a few months after the museum opened by a group of volunteers under the impetus of the director. Over time, this association merged with a smaller association of volunteers from the archaeological museum located in the same park. Today, the two entities form a single association, but the volunteers from the ethnographic museum are predominant in number and activities. You can learn more about them on the page dedicated to them on the MEAB website, although there is little information (*Amici del Museo n.d.*).

Over the years, the Association has adapted to changes in legislation and increased the number of volunteers who have donated their time and skills within the MEAB, including opening the museum itself. Each volunteer was introduced by the director,³ who coordinated their activities over time, building a deep network of relationships in the area. A key moment in the life of the association was the 2020 pandemic, which drastically reduced the activity of individual volunteers, some of whom never resumed their activities. This posed a serious risk to the maintenance of the museum. Slowly, the director and the volunteers managed to restore the minimum activity required for administrative recognition. In recent years, these older volunteers have been joined by a group of younger volunteers, mostly from academic backgrounds. The latter were the subjects of my ethnographic research. Many of the museum's activities are carried out by volunteers because the Park Administration, which manages the finances of the museums within the territory, including the MEAB, has not invested in museum staff.

FUTURE MEAB: GRASSROOTS CURATORSHIP AND GENERATIONAL CHANGE

At the end of November 2020, the director created a WhatsApp group Future MEAB, dedicated to the youngest volunteers to gather young researchers to start collaborative projects, even paid ones, for the

³ The composition of the volunteers is very broad in gender, although women are predominant. As of March 2025, the number of volunteers was about fifty people, mostly over 60 years old and retired, while about fifteen are 40 years old or younger. These people's origins vary, and age is a differentiating element: the older volunteers are mostly retired teachers or retired workers, while the younger volunteers come mainly from the university, and mainly from an anthropological background. All the volunteers were born in the area surrounding the museum and either still live there or have lived there in the past. The reasons why they started volunteering also vary: some came into contact with the museum through the schools where they worked, others donated objects, others were visitors who connected with the MEAB, or, as in the case of the youngest participant, through anthropological research and interests. The motivation that pushed the first volunteers to create the association and, therefore, to carry on the activities (opening of the museum, activities with schools, workshops, etc.) was the desire to support the museum's activities that, from the beginning, suffered from a lack of personnel. Some of them were first the subjects of ethnographic research, and then became part of the living heritage that tells the contents of the rooms to visitors.

museum, such as cataloguing of objects, research in the territory, and activities with visitors. As of 2024, the group has twenty members. Regarding gender, the group is predominantly female, and regarding age, it covers generations Z, Y, and, to some extent, X.⁴ This diversity allows for a strong exchange of ideas. A common characteristic of this group of volunteers is that they have an average high level of cultural capital, as they all have attended or are attending university. The group began to organise itself as a collective in the second half of 2023, when the director proposed to the group the organisation of an exhibition on topics of their interest. From that moment on, the group became active, organising periodic meetings to share reflections not only on the theme of a possible exhibition, but also on sustainability and the museum's future. The proposal of a temporary exhibition that came directly from the director to the group of young volunteers and the simultaneous announcement by the director himself that he wanted to leave his role and retire, triggered the group. On the one hand, the desire to carry out a project collectively and not as individual volunteers emerged, and at the same time, a need for cohesion arose in the face of fears for the director's retirement. What the young volunteers did was work together, thus co-constructing a network of relationships that could gather collective memory (Ricoeur 2004: 130) and continuing the work that the museum had carried out up to that point. Carrying out an exhibition together meant taking a new path that went beyond the work of the individual researcher, aware that none of them could protect the MEAB from a frightening future, but that a cohesive community could at least try. First, that community had to be built. Technologies, in this network, are important nodes that can open new horizons. For many young volunteers, technological knowledge is scarce, but the attitude is open: technology is a potential rather than a threat. Even today's more controversial technologies, such as AI, are viewed with curiosity. To be realised in practice, this ideological opening requires a greater capital, not only in the economic, but also in the cultural and symbolic sense (Bourdieu 2011: 78–86). One of the limitations that emerge from

⁴ While definitions vary slightly, Generation Z typically includes those born from the late 1990s to early 2010s; Generation Y (also known as Millennials) includes those born from the early 1980s to the mid-1990s; Generation X includes those born from the mid-1960s to early 1980s (Dimock 2019).

the work of the group of young volunteers is, therefore, how to find the resources to increase the possessed capital.

The development of the “I Give You the Museum” (*Te lo do io il Museo*) exhibition project provides valuable insight into the distribution of decision-making authority within the MEAB ecosystem. The group of young volunteers managed all phases of the project autonomously, from designing the first questionnaire to selecting themes and objects, drafting texts, designing the graphic layout, organising the exhibition space, creating the documentary and website, and managing social media communication. This self-directed approach was made possible in part by the museum director’s conscious decision to take a step back and allow the group to take the lead, only intervening when asked for logistical information. This leadership model, decentralised and facilitative rather than directive, reflects recent efforts to redefine curatorial authority and activate community expertise in more equitable and inclusive ways (Morse 2018; Pegno and Brindza 2021) and aligns with broader transformations in museum practice that emphasise responsiveness, innovation, and community engagement as central pillars of 21st-century museology (Black 2012). Institutional actors, such as the Park Authority that oversees MEAB, were not involved in the project and did not provide any feedback. Nevertheless, the young volunteers demonstrated contextual self-awareness by informally adapting their communication style and exhibition choices to avoid potential institutional friction while deviating from MEAB’s operating norms. This implicit self-regulation reveals a latent power dynamic in which autonomy is shaped not only by internal organisation, but also by the perceived boundaries of institutional acceptability.

Although they were not directly involved in planning the exhibition, older volunteers were included in the documentary process through interviews and informal exchanges. As I will explain below, the documentary was based on a dialectical exchange between the younger and older volunteers. The older volunteers largely responded positively to the initiative, expressing enthusiasm for the renewed vitality brought by the younger group. Many viewed the project as a sign of hope for the museum’s future and welcomed the prospect of younger volunteers, supported by the association and mentored by seasoned

members, playing a recognised role in supporting the MEAB. These intergenerational relationships also activated a form of symbolic capital that helped to legitimise the younger group's initiatives (Bourdieu 2011: 81). These dynamics illustrate that decision-making during this project is not structured by formal hierarchies, but rather emerged from negotiated relationships, mutual recognition, and adaptive strategies. The project therefore offers an example of how power in volunteer-led institutions can circulate horizontally while remaining shaped by institutional history and perceived boundaries.

When I conducted this research in my second year of doctoral studies, my goal was to understand how widely used technologies such as smartphones, collaborative platforms, and editing tools could be integrated into a museum still grappling with structural digital transition. Which of these technologies could integrate into the museum's relational and operational networks? How would these non-human actors interact with the practices, expectations and fears of volunteers? What relationships would emerge between human and non-human actors in this environment, and how would these interactions contribute to or limit the museum's ongoing development? In short, how do technologies and volunteer involvement influence the way museums operate and their ability to redefine themselves as participatory, dynamic, socially integrated institutions?

FROM VISION TO PRACTICE: COLLABORATIVE CURATION AND STORYTELLING

The temporary exhibition project was called "I Give You the Museum". Born out of the director's proposal to create a temporary exhibition on a theme of interest to the new generations, it included a reflection on the future of the museum, on generational change, on the fears and aspirations of the volunteers for an organisation to which they have given, and continue to give so much. Thus, while discussing objects of affection and areas of life that interest them, the young volunteers felt the need to put the future of the MEAB at the centre of their discussion, taking on the responsibility that the director hoped to share with them. The objectives of the exhibition are threefold: to increase the in-

volvement of the younger generations in museum practices, to initiate a participatory process in the museum's cultural programming, and to produce an exhibition that can portray the contemporary experience of the Alta Brianza through the eyes of the young people involved.

OBJECTS AND STORIES: EVERYDAY LIFE AND EMOTIONAL HERITAGE

Part of the project was based on everyday objects, linked to the young volunteers by affection (Geertz 1973: 104). The group decided to proceed with an initial proposal of objects, one each. The audience chosen for this project was the same group of young volunteers; the decision to proceed with an auto-ethnography arose from the limited time available and the limited experience of the group, which would have made it difficult to find a group of external interlocutors.

After collecting the proposals of a dozen objects with an initial questionnaire, the group met live at the MEAB and analysed the answers. It was decided to divide the objects into thematic categories: school and work, passions, relationships, and finally memory. For each thematic category, the volunteers were asked to name a significant object and what kind of emotional attachment they had to it. The next stage was to assess the feasibility of the exhibition and the retrieval of the objects. Not all of the suggested objects were available or easy to place in an exhibition, such as a film of a volunteer's childhood holiday. Thinking about the exhibition meant thinking about the resources and spaces available (two rooms for the exhibition and one for the documentary), the expectations and wishes. The working group wanted to create an exhibition with an "instagrammable" aesthetic,⁵ believing that the visual impact required a change of perspective compared to the usual practices of the MEAB, and that it could be a driving force to attract more participation and an audience, especially younger ones. Some of the ideas were based on using new materials for the exhibition, such as pallets, lights, and LED effects, and on a new approach to providing

⁵ "Instagrammable" is a relatively new word and it means "worthy of being posted on Instagram". When accompanied by "exhibition", the term refers to Instagram-friendly exhibitions that are inherently different from traditional exhibitions.

information, using QR codes that linked to videos and audio accompanying the objects on display, thus replacing the traditional labels (Rhee et al. 2021). Very few of these intentions could be realised. Where it was possible to intervene, for example in the graphics of the panels and the information brochure, it was thanks to the commitment and personal knowledge that overcame the lack of resources.

THE DOCUMENTARY: INTERGENERATIONAL DIALOGUE AND MUSEUM FUTURES⁶

One of the usual activities in these twenty years of the museum has been the production of ethnographic documentaries to support temporary exhibitions. The group of young volunteers discussed the possibility of producing a documentary to accompany the exhibition, bearing in mind that, in this case, too, we wanted to move away from the usual museum practices. The group of volunteers who shot the documentary decided that the themes of the exhibition, and the objects connected, would be explained through short written texts and decided to focus on a theme not inherent to the exhibition but to the path undertaken by the group of young volunteers. The idea was to continue reflecting on the future of the MEAB, which was perceived as endangered due to the imminent retirement of the director and the uncertainty about the intentions of the Park Authority regarding his successor. The documentary then addressed the theme of the future of the museum together with the older volunteers, reflecting on central themes at this moment in the life of the MEAB: the future of the museum and the heritage of what has been done in twenty years. According to Macdonald (2013: 228–229), heritage is never a fixed and unalterable entity, but is configured as a dynamic process in which different actors actively participate in the construction of meaning.

The documentary aimed to create a multi-voiced dialogue between older and younger volunteers, imagining what could come next and what they wanted to come next. The documentary project itself was challenged by a lack of resources to produce something of the same

⁶ The group of young volunteers saved a copy of the documentary on the Internet Archive (Future MEAB 2024).

quality as its predecessors, which would have required a videographer with professional equipment. As with the exhibition, the challenges were partly met using readily available digital technology, but the limitations were also evident.

DIGITAL TOOLS IN PRACTICE: CONSTRAINTS, INNOVATIONS, AND LEARNING PATHS

The use of digital technologies in carrying out activities for the exhibition was a compulsory choice. Their application was voluntarily chosen to offer the exhibition greater accessibility and visibility outside the territorial context, characterised by marginality compared to other tourist and museum circuits. At the same time, however, it was an obligatory choice in terms of conducting the activities necessary for the preparation of the exhibition, given the geographic distance of the volunteers involved in the co-design and the difficulty in reconciling work and daily life. For this reason, technologies have been a constant presence in the volunteers' work. Except for a few meetings, all the work and meetings took place via video calls; the same group is organised through the WhatsApp group and has shared documents thanks to a web storage space. In addition, the questionnaires, the website and its graphics, and the exhibition were created using online services. The choice fell on very popular platforms, such as Google and Canva, which offer part of their services for free. This network of applications is particularly well-known among the newer generations, who produce the most content. However, the assumption that young users have the specialised skills to produce quality content is not guaranteed. Therefore, the group wondered whether there was an intention to produce content, knowing from the beginning that they would not have professional standards. The documentary was another activity carried out in parallel with the temporary exhibition. This project also required the group to rethink, especially regarding the available equipment and the necessary resources. Michel De Certeau (1984: 44) highlighted how the skilful, tactical use of readily available tools, even if they aren't intended for a given purpose, can unlock innovative solutions and encourage new partnerships. Here too, as in the rest of the projects, the choice was made to continue with low-budget or zero-budget

solutions, experimenting with methods never tried before at the MEAB but characterised by the use of free tools or those already in the volunteers' possession. The demographic composition of the volunteer group, which was predominantly youthful, facilitated the exploration of this avenue. Smartphones, microphones, and lights already owned by the volunteers were used to record the interviews. In addition to the ability to use technological platforms to their full potential, another obstacle was the need for more services, which were paid for, such as more web space. The project's total budget (exhibition and documentary) was about EUR 200, only a quarter of which was spent on digital technologies. Obtaining the funds was a tense moment because it potentially meant depending on other parties for the group's work.

Despite the relatively low financial cost, the time investment required to complete each aspect of the project was considerable. This was exacerbated by the fact that these tasks were not carried out by individuals with technical skills, and consequently, all activities were undertaken through self-training. This is a crucial aspect that demands careful consideration, particularly in the context of a museum with limited staff resources, as also highlighted by recent literature on the organisational challenges faced by museums undergoing digital transformation (Taormina and Bonini Baraldi 2023). The staff will be compelled to invest time and effort in acquiring skills that are not directly pertinent to their duties. Additionally, another complex layer is introduced by the degree to which the staff accept the technological tools. The analysis proposed in this paper adopts an approach inspired by the extant literature on technology acceptance (Davis 1987; Venkatesh et al. 2003) and digital literacy (Dobson and Willinsky 2009; Reddy et al. 2020), considering these theoretical frameworks useful for interpreting the behaviours observed in the museum context.

In the case of the young volunteers' group, there were no fears or refusals to use services and platforms, and they even tested the use of artificial intelligence (AI) as a support for improving texts with curiosity. As emphasised in extant literature, factors such as perceived usefulness (PU) and perceived ease-of-use (PEOU) are pivotal in determining the acceptance of technologies (Davis 1987: 3; Jiang et al. 2024). In this instance, the combination of perceived ease of use and concrete

usefulness in achieving communication objectives acted as an enabling factor. It is significant to highlight that the museum had no prior technological infrastructure or established practices in using digital tools. Paradoxically, the absence of a pre-existing digital ecosystem acted as a driver for innovation, with the need to find effective solutions quickly creating a favourable environment for experimentation. This phenomenon can be interpreted as an instance of bottom-up digital innovation, wherein the absence of infrastructure constraints enabled the adoption of novel and adaptable practices (Strom et al. 2019; Katmada et al. 2022; Parry 2007: 135). The aspiration to “break” with conventional operating methods was predicated more on the methodologies employed than the content itself. This entailed a shift in processes and tools rather than in objectives. This aspiration, which has been identified in other contexts of participatory innovation, can be interpreted as a manifestation of collective agency that is oriented towards accentuating the experimental character of the project (Bonacini et al. 2019; Medina Reinón 2024; Wilkowska and Ziefle 2009).

In the specific case of volunteers, the generational factor had a limited impact. Despite considerable age variations (ranging up to twenty years), all participants belonged to generations that had experienced early exposure to digital technologies and had already developed habitual daily practices of their utilisation. The role of diffuse leadership within the group was found to be central to the success of the endeavour. Some members with greater technological familiarity facilitated the inclusion of others, encouraging their use through mutual support and skill sharing (Strom et al. 2019: 218–219). In the context of the present research, the presence of interpersonal trust among volunteers and the perception of an experimental environment devoid of judgement reduced factors of rejection in the use of digital tools. Similar factors – such as trust, familiarity, and perceived usefulness – have also been identified as significant in other contexts of technology acceptance, including supported employment programmes (Winkelkotte et al. 2024). Another salient aspect pertained to the group’s imaginative capacity, namely their aptitude for visualising the desired end products (e.g., posters, videos, social media posts) and their anticipated impact. This motivational approach, characterised by a shared vision and concrete objectives, emerged as a significant catalyst for active

engagement. The example of AI is emblematic. Before the project, some volunteers had never used ChatGPT, a generative AI conversational platform, but the idea of testing its capabilities to improve textual communication was welcomed without suspicion. After an initial trial phase, the generated texts were discussed collectively and although reworked, some of the AI's suggestions were retained because they were considered effective.

OUTCOMES AND LIMITATIONS: WHAT SMALL MUSEUMS CAN LEARN

One of the results facilitated by the integration of digital technologies was the creation of the documentary. While recording was less problematic, post-production was only possible thanks to some volunteers who used software and skills they already had. Otherwise, this would have constituted a further obstacle to overcome, both in terms of the technologies available (software and PC) and the necessary skills. The second result obtained is the exhibition website,⁷ which was built as a digital model of the physical exhibition, with the same themes, objects, and texts. In the thematic sections of the site and on the final page, forms can be filled in by individuals who wish to submit their proposal for a significant object or provide their contact details. However, due to the less-than-optimal visibility of the site, the response to this type of participation stimulus was minimal, with a total of less than ten contributions received.

More than mere technical setbacks, these unmet goals reflect the structural fragilities of under-resourced museums, where ambitious ideas often collide with infrastructural and financial constraints. For instance, the plan to incorporate augmented reality as an enhanced narrative tool had to be abandoned due to the absence of Wi-Fi coverage in the exhibition rooms and the unavailability of funds for the required technologies. Using augmented reality as an alternative to the MEAB's conventional method of providing information in the permanent exhibi-

⁷ The website will probably close during 2025 due to lack of funds; for this reason the group of young volunteers decided to save a copy of it on the Internet Archive (Future MEAB n.d.).

tion would have accelerated a paradigm shift in communication within the exhibition space, introducing an innovative dimension to the MEAB. The exhibition website failed to achieve many of its objectives, including a preliminary user experience analysis, search engine optimisation, and better management of images and texts. In addition, the communication strategy employed on social media platforms exhibited two notable limitations. Firstly, the strategy demonstrated a lack of reach, which is defined as the number of individuals who receive the communication. Secondly, the strategy displayed an absence of innovation, defined as the introduction of new ideas or methods. Nevertheless, these shortfalls did not generate frustration or conflict among the volunteers. Conversely, a consensus emerged regarding the underlying causes of these challenges, which were identified as structural limitations. These limitations encompassed the museum's persistent financial constraints and the scarcity of sustained institutional backing for digital transformation. As a result, these "failures" have been interpreted more as missed opportunities than personal shortcomings, emphasising the difference between institutional digital agendas and the conditions under which small museums operate.

Rather than demobilising the group, this awareness fuelled a constructive attitude. Volunteers acknowledged their own limited digital skills, but this did not deter them from engaging. Moments of experimentation – like using smartphones to produce a short documentary – created a palpable sense of possibility. The group demonstrated a high level of solidarity, with technical obstacles being overcome through mutual support and the development of creative workaround strategies. In instances where certain objectives could not be accomplished (for example, due to website functionality issues), the response was one of acceptance rather than blame, with a strong recognition of the learning value of the process itself. In a workshop convened after the exhibition opening, all volunteers expressed a desire to continue working collaboratively. For many of them, the project had effectively redefined the very meaning of their volunteer work, transforming it from occasional assistance into a space of personal and collective meaning. There was also a growing ambition to consolidate the group's identity, and some volunteers suggested transforming the group into a professionalising project, such as a social cooperative.

A considerable part of the missed objectives was already evident to the volunteers during the operational phases of the project, while the rest became apparent as the initiative progressed. The approach adopted to address these objectives was to recognise them as a tangible expression of the intrinsic limitations of the project in the absence of external support in terms of skills and resources. Consequently, this approach also facilitated the observation of the use of new tools, including digital technologies, and their potential and limitations. Furthermore, it allowed the identification of the requirements for the sustainable operation of a small local museum, particularly in the context of integrating digital technologies with limited staff and resources. As Ross Parry (2007: 81) highlights, true innovation in museums lies not only in adopting new digital tools but also in how these technologies are embedded within collective workflows and museum practices. Similarly, Fiona Cameron and Sarah Kenderdine (2007: 4) emphasise that digital heritage work is a socially mediated process, rather than merely a technological one.

The Future MEAB group's experience demonstrates that, rather than focusing on specific tools, which suffer from rapid obsolescence due to technological acceleration, true innovation lies in integrating digital technologies into the museum's workflow and collective practices. For instance, volunteers employed a variety of accessible technologies – smartphones with external microphones, free video editing software, Google applications, Canva for graphics, and social media channels – not as isolated tools, but as components of a novel collaborative creative process unfamiliar to all participants. The challenge posed by limited staff was addressed thanks to the support of the museum director, who deliberately took a step back to empower volunteers, and a culture of peer learning and experimentation. The volunteers sought information independently and shared knowledge, gradually acquiring the necessary digital skills. This horizontal and distributed approach fostered inclusion and collective ownership, even if this meant slower progress and a more artisanal quality of results. Such outcomes must be based on gradual improvement through practice. Sinclair Goodlad and Stephanie McIvor (2005: 87) argue that such volunteer-driven, bottom-up models have the capacity to enhance participation and democratise museum work, despite the challenges related to coordination

and quality control. It is possible to implement the approaches even in museums that do not have an active volunteer base, such as MEAB. Such initiatives can be achieved by involving communities outside the museum that are willing to participate, with museum staff acting as mediators and facilitators. Nina Simon (2010: 120) advocates participatory museum models, in which community engagement and collaboration are central to the sustainability of cultural institutions, particularly those with limited budgets. This project's concrete results include the production of a low-cost but high-quality documentary, the development of a temporary exhibition with contemporary themes presented in a fresh visual language aimed at a young audience, and a new organisational model that leverages voluntary participation without centralised leadership. Shared participation and community work have also been the perfect ground for a shared reflection on the resources MEAB needs to continue fulfilling its role as a cultural institution.

For museums in similar situations, with limited staff and growing digital expectations from the public, MEAB's experience suggests that digital integration does not necessarily have to depend on large budgets or specialised staff. On the contrary, promoting an open and collaborative culture where volunteers are encouraged to learn and experiment collectively can generate meaningful digital engagement and enrich the visitor experience. The key lies in viewing digital tools not as stand-alone solutions, but as part of a shared workflow and continuous learning process integrated into the social fabric of the museum (Latour 2005: 131). The implementation of bottom-up projects, with all their limitations, can be a powerful emotional catalyst among those involved, a means of building social networks and an attraction for stakeholders who may find it desirable to collaborate with the museum, thus expanding the network of actors involved in the dialogue (Janes and Sandell 2019: 214–215).

CONCLUSION

The international scholarly literature on technological projects in the field of museums and intangible cultural heritage has seen a clear growth in the last decade (Liao et al. 2020; Taormina and Bonini Baraldi

2023), so much so that we are talking about a post-digital phase for museums. However, under this surface of innovation, there is a situation characterised by a lack of resources and incapacity. This does not imply a lack of competence among museum staff; rather, it highlights the complexity of the technological context in contrast with the techno-Western narrative presented to the public. Especially in the context of local and decentralised museums, which are off the tourist trail and therefore often unable to obtain funding, the scarcity of resources, as highlighted by the MEAB, makes the possibility of implementing digitisation projects stably and sustainably very complicated, if not utopian. The case of the MEAB, where a group of young volunteers decided to activate a temporary exhibition project and, at the same time, a reflection on the sustainable future of the museum, shows the possibilities and limits. While, on the one hand, it was possible to create a temporary exhibition, a website for the digital exhibition, and a documentary with a budget of around EUR 200, on the other hand, the limits of the projects created in terms of quality and dispersion across the territory emerged. The negotiation of memory that the young volunteers put into action emerged, which made Macdonald's (2013: 156–157) definition of a museum as a relational ecosystem evident. Thanks to the willingness of the young volunteers to explore new forms of practice, it was possible to observe how technologies direct both desires and possibilities of action, effectively becoming social actors in this relational ecosystem. It is precisely the possibility of introducing this new social actor, so far excluded, that has made the delay in the digital transition accumulated compared to contexts with greater resources evident. A possible solution could be to rely on consulting external experts. However, this type of relationship must be carefully monitored, because it risks creating an imbalance of power that accumulates in the hands of experts, as Jean-Pierre Olivier de Sardan (2005: 169) highlighted in the context of development projects.

Digital technologies open up new horizons to explore, but the paths that can be taken are far more complex than the dominant technological rhetoric suggests, especially in Western contexts, where such tools are assumed to be universally accessible, thereby implicitly blaming the inadequacy of individuals or institutions when adoption fails.

In contrast, this case study shows how digital engagement is deeply shaped by relational, organisational, and contextual factors. Rather than focusing exclusively on tools or platforms, the MEAB experience highlights the importance of cultivating a supportive social environment that enables learning, particularly peer-to-peer learning, and experimentation.

In this context, digital technologies have become essential tools for sustaining the museum's activities and its relevance to the community during a period of staff shortages and institutional fragility. Moving away from digital strategies that aim to spectacularise exhibitions to attract tourism or external funding, the MEAB youth volunteer initiative has demonstrated an alternative approach to museum practice. Through low-cost content production, shared decision-making, and peer-driven skill development, the museum reasserted its role as a cultural actor and experimented with new forms of practice aligned with the principles outlined by ICOM.

The MEAB experience, with its deliberate departure from conventional, resource-intensive strategies, offers a compelling counter-narrative to prevailing forms of technological determinism in the museum sector. These findings echo recent heritage scholarship that calls for more nuanced, context-sensitive approaches to heritage futures – ones that recognise loss, fragility, and precarity not as failures, but as conditions to be negotiated with care and creativity (DeSilvey and Harrison 2020). As David Graeber (2015: 128–129) critically observes, the ideology of technology as inherently progressive often obscures its role in reproducing elite control rather than democratising knowledge. By embracing alternative, bottom-up strategies – centred on collective agency, the co-construction of plural memory, and meaningful relations between human and non-human actors – museums can begin to challenge the technocratic paradigm. To implement truly democratic and sustainable practices, what is needed is not simply “more technology”, but a resilient and reflexive relational ecosystem: one capable of interacting with digital tools not as passive adopters, but as autonomous and context-aware agents (see also Cameron 2007: 70; Parry 2013: 36–37).

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COLLABORATION BETWEEN CULTURAL HERITAGE INSTITUTIONS, CITIZENS, RESEARCHERS, AND STUDENTS IN CITIZEN SCIENCE: THE “DIGISPORT” PROJECT AS AN EXPLORATORY CASE STUDY

GORAN ZLODI

University of Zagreb, Faculty of Humanities and Social Sciences
Zagreb, Croatia

gzlodi@unizg.ffzg.hr

ORCID iD: 0000-0003-0860-4469

TOMISLAV IVANJKO

University of Zagreb, Faculty of Humanities and Social Sciences
Zagreb, Croatia

tivanjko@unizg.ffzg.hr

ORCID iD: 0000-0002-0479-5395

EVA VITKOVIĆ

S. S. Kranjčević Library, Zagreb City Libraries

Zagreb, Croatia

evavitkovic@gmail.com

This paper presents the “DigiSport” project as a case study showcasing the application of citizen science within the field of digital cultural heritage. Conducted by the Faculty of Humanities and Social Sciences at the University of Zagreb in collaboration with the Croatian Sports Museum, the project engaged retired and active sports journalists to enrich metadata for over 16,900 digitised sports photographs. Through participatory methods, including workshops, digital

tools, and participative evaluation, citizens contributed contextual knowledge and expertise, enhancing the accessibility, relevance, and research value of the collection. The study details each project phase, highlights collaboration between citizens, researchers, students, and heritage professionals, and illustrates how citizen science methodologies can address challenges in heritage documentation, promote community engagement, and foster mutual learning. The results demonstrate the potential of citizen science to democratise cultural preservation and enhance the digital transformation of heritage institutions.

Keywords: citizen science, sports heritage, social tagging, metadata enrichment, photographic collection

INTRODUCTION

Citizen science represents a dynamic and evolving approach to scholarly research, broadly defined as the practice of public participation and collaboration in scientific endeavours to increase scientifically grounded knowledge (Irwin 1995; Bonney 1996). While rooted in centuries of contributions by amateur enthusiasts, the modern concept gained prominence in the 1990s (Irwin 1995; Bonney 1996) and is now recognised as a valid and established research approach, often positioned within the broader field of open science – an approach to the scientific process that focuses on spreading knowledge as soon as it is available, using digital and collaborative technology (European Commission 2025; Wehn et al. 2020). Citizen science has entered the heritage domain for tasks such as transcription, tagging, and multilingual description (Bonney et al. 2016). This field leverages public engagement for various benefits, including the democratisation of science by involving a wider range of individuals regardless of formal expertise (Irwin 1995; Bonney et al. 2009; Paleco et al. 2021; Mumelaš et al. 2025), enriching research through diverse perspectives and local knowledge (Irwin 1995), and enabling large-scale data collection that might otherwise be unfeasible (Hecker et al. 2018). The application of citizen science is increasingly relevant in the humanities and heritage sectors (Haklay et al. 2020), promoting the use of digital technology as both a methodology and a tool in heritage and humanities research. Empirical studies confirm the value of crowdsourcing, citizen science, and hybrid volunteer-professional

collaboration for enhancing collections in local and community museums; however, there are no published cases explicitly focused on local sports heritage museums. Instead, knowledge is drawn from analogous projects in photographic, heritage tourism, and community museum contexts (Alony et al. 2020), with clear evidence that social tagging and participatory design improve discoverability, engagement, and collection richness (Chae et al. 2016; Trant 2006).

“DIGISPORT” CASE STUDY

This paper presents the “DigiSport” project as a case study that demonstrates the application of citizen science principles within the domain of digital cultural heritage. The “DigiSport” exploratory case study aimed to enrich the description of a large segment, comprising over 16,900 negatives, of the Croatian Sports Museum’s Collection of Photographs, which had been mainly incomplete or lacked metadata. The project successfully employed a citizen science model by collaborating with active and retired sports journalists. These sports journalists, possessing specialised expertise, contributed significantly by identifying events, individuals, and providing contextual information for the digitised photographs, thereby addressing a significant challenge in managing and accessing cultural heritage collections (Ivanjko et al. 2024). By detailing the methodology, outcomes, and collaborative experiences of the “DigiSport” project involving citizens, a museum institution, researchers, and students, this paper aims to illustrate the practical benefits (Hecker et al. 2018; Liñán et al. 2022) and potential of citizen science as a methodology for the digital transformation and enrichment of cultural heritage. The exploratory case study serves as an example of how leveraging community expertise through digital platforms can enhance the value, accessibility, and understanding of heritage collections.

RESEARCH QUESTIONS

To frame the exploratory case study in a manner that captures both human and technical dimensions of the “DigiSport” pilot, we articulate six research questions. Taken together, they probe:

1. the motivational drivers and trajectories of retired and active sports journalist volunteers;
2. the reliability and scale-up potential of a citizen science workflow for photographic metadata;
3. the influence of multi-stakeholder collaboration on project outcomes and sustainability.

These questions structure the subsequent methods, results, and discussion, ensuring that empirical findings speak directly to the broader challenge of integrating citizen science into cultural heritage practice.

RQ 1 – What motivates volunteers – especially active and retired sports journalists – to join and begin contributing to “DigiSport”?

RQ 2 – How does individual motivation change over the life of the project, and how do such shifts relate to the amount and quality of contributions?

RQ 3 – Does recognising the social value of preserving sporting heritage enhance contributors’ motivation and, in turn, their output?

RQ 4 – Can a citizen science workflow reliably enrich sparse or absent metadata for large photographic collections?

RQ 5 – What volume and quality of participant-generated metadata emerge during the pilot phase, and what do these outcomes indicate about scalability?

RQ 6 – How do collaborative interactions among citizens, cultural heritage professionals, researchers, and students influence motivation, data quality, and long-term sustainability?

MATERIALS AND METHODS

Following Robert K. Yin’s (2017) typology, the research is framed as an exploratory case study whose aim is to surface variables and propositions for later hypothesis-testing work. The unit of analysis is a nine-phase operational workflow executed on a subset of 16,954 images from the Croatian Sports Museum’s Collection of Photographs. In line with the six research questions outlined in the introductory chapter, this subsection profiles each stakeholder group – citizens, museum

professionals, researchers, and students – detailing their recruitment, roles, and the specific operational workflow phases (P1–P9) in which they generated evidence. Multi-stakeholder collaboration is widely recognised as an essential factor of effective citizen science practice (Wiggins and Crowston 2011; Haklay 2013). Each stakeholder group – citizens, cultural heritage professionals, academic researchers, and students – contributes distinct motivations, resources, and constraints that must be carefully orchestrated if projects are to achieve both scientific rigour and social relevance (Shirk et al. 2012; Bonney et al. 2016). In “DigiSport”, these four constituencies formed an explicitly co-dependent ecology: citizens supplied domain knowledge, the museum provided the collections and curatorial oversight, researchers delivered methodological scaffolding and evaluation, and students acted as agile mediators between cultural heritage professionals, researchers, experts, and citizens as expert participants. Their interactions underpin RQ 6 and are most visible in Operational Workflow Phases P1, P5–P8. The following sub-sections unpack collaboration from each viewpoint, showing how evidence gathered at these phases answers the larger exploratory agenda.

STAKEHOLDER COLLABORATION IN CITIZEN SCIENCE APPLICATION PROJECTS IN HERITAGE AND EDUCATIONAL CONTEXTS

In a methodological context, this subsection provides background and context for each stakeholder group involved in citizen science application projects in heritage and everyday educational environments, clarifying who participates, how they engage, and the specific functions they fulfil.

a. PARTICIPATION OF CITIZENS (RELATED TO RQ 1–3)

Collaboration of citizens in citizen science projects plays a crucial role in expanding the reach and impact of scientific research. By actively engaging the public, these projects harness collective intelligence, enabling large-scale data collection and analysis that would be difficult for a custodian or researcher alone to handle (Bonney et al. 2016; Dickinson

et al. 2012). Volunteers contribute observations, classify data, and even participate in problem-solving, making research more inclusive and dynamic. Cooperation with citizens implies a better insight into users' needs, the social relevance of the study, and the democratisation of science in general (Irwin 1995; ECSA 2015). This engagement fosters mutual learning, as citizens gain scientific literacy while researchers benefit from diverse perspectives. It also strengthens trust between the scientific community and society, encouraging transparency and public support for research initiatives. Additionally, citizen participation helps address local and global challenges by integrating real-world experiences into scientific studies and empowers individuals to contribute meaningfully to knowledge creation and innovation.

*b. PARTICIPATION OF CULTURAL HERITAGE INSTITUTIONS
(RELATED TO RQ 4–6).*

Collaboration between cultural heritage institutions, professionals, and the public in citizen science projects offers significant benefits for research, preservation, and engagement (Ridge 2014). By involving citizens in tasks such as digitisation, transcription, and classification of historical records, institutions can process vast amounts of data more efficiently. This participatory approach not only accelerates research but also strengthens public awareness and appreciation of cultural heritage (Mumelaš et al. 2025). Citizen contributions provide fresh perspectives, uncovering hidden narratives and local knowledge that might otherwise be overlooked. Engaging the public fosters a sense of shared responsibility for heritage preservation, encouraging community involvement and long-term sustainability. Digital platforms and crowdsourcing tools make cultural collections more accessible, broadening their impact beyond academic and institutional settings. Additionally, collaboration with citizens helps heritage professionals understand public interests and expectations, shaping more inclusive and relevant cultural initiatives. This approach enhances transparency and trust, reinforcing the role of cultural heritage institutions as dynamic and community-driven spaces, strengthening the connection between people and their cultural history, and making heritage more meaningful and participatory.

c. PARTICIPATION OF RESEARCHERS (RELATED TO RQ 4–6)

Cultural heritage sources and data offer a wealth of potential insights. Technology, combined with the ability to mobilise collective intelligence, has enabled citizen science as a powerful approach that extends beyond simple data gathering into the realm of collaborative knowledge creation (Watson and Floridi 2018). This approach transforms citizens into valuable contributors to the scientific process. Researchers benefit significantly by gaining access to large-scale datasets, often spanning broad temporal or geographical ranges, that would be difficult to compile through traditional methods alone. Citizen science can enhance data quality and richness by incorporating diverse perspectives and specialised local or expert knowledge that professional researchers may not possess (Irwin 1995; Ivanjko et al. 2024: 251).

d. PARTICIPATION OF STUDENTS (RELATED TO RQ 2, 3, AND 6)

In education curricula mainly relying on theory and seminars, hands-on projects offer students a vital dose of real-world experience (Silvertown 2009). Engaging in citizen science, students gain direct exposure to how research operates – from planning, ethics, and method design to execution and communication. They work alongside faculty and community partners, taking on tasks such as finding participants, organising activities, and helping people with the required technology. These projects make scientific research tangible in ways that traditional lecture-based courses often cannot. Students witness instructors develop studies from idea to publication and take part themselves, effectively bridging the gap between the academic and public realms.

EVALUATION METHODOLOGY AND INSTRUMENTS

The evaluation strategy was embedded in the project lifecycle so that each stage of platform development and citizen participation generated evidence directly relevant to the research questions. Four complementary strands – one front-end, two formative, and one summative – were sequenced in line with the operational workflow phases. It should be noted that the summative evaluation is only outlined at this stage and is envisaged as the subject of future research.

Table 1. Operational workflow phases (authors: Goran Zlodi, Tomislav Ivanjko, Eva Vitković).

	Evaluation strand	Primary instruments/ data sources	Timing (workflow phase)	Principal objectives – link to RQs
1	Front-end evaluation	• comparative review of established citizen-heritage interfaces (Steve Museum, ARTigo) • participatory-meeting minutes	Phase 1 (participatory preparation)	• benchmark functional requirements for “DigiSport” prototype (RQ 4) • surface initial motivational cues from stakeholder dialogue (RQ 1)
2	Formative evaluation 1: exploratory workshop	• on-paper questionnaire (11 Likert + 3 open items)	Phase 5 (training workshop)	• establish baseline motivation and perceived social value (RQ 1–RQ 3) • capture usability expectations before live use (RQ 4)
3	Formative evaluation 2: co-design workshop	• think-aloud sessions • structured interface-feedback sheets	Phase 6 (application refinement)	• identify design pain-points, iterate UX (RQ 2, RQ 4) • observe emerging shifts in motivation after initial hands-on use (RQ 2)
4	Summative evaluation	• system log analytics (views, edits, saves) • 5% curator audit	Phases 7–8 (citizen annotation and curator review)	• quantify productivity and accuracy (RQ 4, RQ 5) • track longitudinal change in engagement (RQ 2)

In the preceding section, we outlined the exploratory case-study design's open research questions, multi-method evaluation strands and iterative instrumentation. The present subsection translates that design into practice. It enumerates the operational workflow phases through which the "DigiSport" case study was executed. Each operational phase, therefore, has a dual function. It advances the day-to-day implementation of the citizen science platform. It supplies the empirical material required to address the research questions. Phases 1–2 provide the preparatory context for the exploratory investigation, Phases 3–4 correspond to the instrument-development strand, Phases 5–6 deliver the formative evaluation data, and Phases 7–9 generate the summative analytics that test feasibility, reliability, and preliminary impact. By foregrounding this alignment, we reconcile the practical "how" of project delivery with the methodological "why" of the exploratory study.

The "DigiSport" project was developed in 2022 as a case study within the institutional research project of the Faculty of Humanities and Social Sciences, University of Zagreb (hereafter referred to as UNIZG-FHSS), entitled "Citizen Science in Social and Humanities Research: Theoretical Framework and Guidelines for Application". The purpose of the key project activity – the "DigiSport" case study – was to develop a citizen science approach using the research and documentation of the Croatian Sports Museum's Collection of Photographs as an example. The segment of the collection included in the study consists of 16,954 digitised photographs (negatives) of sports events from 1970 to 1994 with incomplete or no metadata. The following paragraphs present the phases of implementing a citizen-science research project activity whose goal is to collect data on photographs from the Croatian Sports Museum's Collection of Photographs through cooperation between citizens, the heritage institution (the owner of the material), and researchers (UNIZG-FHSS and the Institute of Art History in Zagreb).

PHASE 1 – PARTICIPATORY PREPARATION AND ORGANISATION OF THE PROJECT

The "DigiSport" project commenced on 3 April 2022, when a series of joint meetings were held to define the project's goals, methods, and results through a participatory approach. The research follows the Ten Principles of Citizen Science (ECSA 2015) to ensure best practices.

Participatory methods involve citizens, researchers, and heritage experts in shaping the research framework to meet their expectations. Additionally, a project timeline and key guidelines were established and included in the informed consent document.

PHASE 2 – DIGITISATION AND INITIAL DESCRIPTION OF PHOTOGRAPHS

The digitisation and initial description of the photographs were carried out by retired sports photographer Robert Valai during 2022. He digitised the negatives by scanning them and provided an initial description at both the group and individual levels. Following the “principle of original order”, he preserved the material’s established sequence to maintain its evidentiary value and usability. Accordingly, during digitisation, Valai organised the photos into folders, usually based on specific sports events, people’s portraits, etc. This structured approach was essential for the subsequent description process and the allocation of photo groups to citizens for further documentation (Ivanjko et al. 2024). According to participants’ testimonies, front-end evaluation confirmed that statement.

PHASE 3 – CONVERSION OF INITIAL DESCRIPTIONS INTO A DATABASE, THEIR SEMANTIC ENRICHMENT, AND LINKING TO RELATED OPEN DATA

The conversion of the initial descriptions into a database, along with their semantic enrichment and alignment with related open data, was completed by 30 October 2022. The initial description of individual photographs was stored in the files themselves using the Adobe Lightroom application, and then the metadata was written to the database. The metadata was stored in the database in its original semi-structured form to extract as much valuable and reliable data as possible, which will be used to base future photo searches and browsing. In this sense, a significant outcome of this phase was the linking of terms from the semi-structured description to existing terms from the thesaurus used in the documentation database (Modulor++ information system) of the Croatian Sports Museum. In search of optimal results,

two approaches were tested: a) named entity recognition (NER) as a method of information extraction which seeks to locate and classify named entities mentioned in unstructured text into predefined categories such as names of persons and organisations, locations, time expressions, etc. (Drovo et al. 2019); b) “wikification” as a special type of semantic annotation that includes usage of Wikipedia as a source of possible semantic annotation (Brank et al. 2017). The implementation was based on programmatic calls to the Wikifier web service, which is also accessible through a graphical interface, and is described in more detail by Janez Brank and colleagues (2017). Better results were achieved with the application of wikification, precisely because the text related to images was already in a semi-structured form rather than in the form of continuous text (Ivanjko et al. 2024). The key objective of the project was to develop a functional and scalable prototype of a digital tool for collecting descriptive and contextual metadata related to photo collections. Therefore, based on joint meetings and conclusions of all participants, a functional specification was created according to which the development was approached. The application design and testing process used iterative design principles and applied good user experience and accessibility practices, aligned with the principles of citizen science (Ivanjko et al. 2024). Data was gathered and stored in the application’s database, enabling seamless statistical analyses such as term frequency calculations, comparisons between terms provided by experts and citizens, and evaluations of term suitability for inclusion in the collection’s subject descriptions.

PHASE 4 – DEVELOPMENT OF A FUNCTIONAL PROTOTYPE OF THE APPLICATION

The first stage of application development commenced on 2 May 2022 and ended on 15 November 2022, with a production version of the functional application prototype. The key objective of the project was to develop a functional and scalable prototype of a digital tool for collecting descriptive and contextual metadata related to photo collections. Therefore, based on joint meetings (held within Phase 1 of the project) and the conclusions of all participants, a functional specification was created according to which the development was approached. The

application design and testing process used iterative design principles and applied good user experience and accessibility practices, aligned with the principles of citizen science. Data were collected and stored in the application database to conduct various statistical analyses efficiently (for example, term frequencies, overlaps of terms provided by subject experts and citizens, and assessment of the suitability of terms for inclusion in the subject description of the collection, etc).

PHASE 5 – TRAINING AND EXPLORATORY WORKSHOP

During the development of the first functional production version of the application, a training and exploratory workshop was held on 30 November 2022. The workshop brought together a diverse group of participants, including museum professionals (N = 2), sports journalists (N = 5), students (N = 1), and researchers (N = 3). During the event, citizens and heritage professionals were introduced to the description workflow and the core system functionalities, while citizens additionally received training to independently use the platform and enrich photographs with contextual and descriptive metadata. A formative evaluation was conducted in parallel through a paper-based questionnaire. Figure 1 shows the participants of the workshop held on 30 November 2022 at UNIZG-FHSS.



Figure 1. Workshop held at UNIZG-FHSS on 30 November 2022 (author: Robert Valai).

PHASE 6 – INTERPRETATION OF FORMATIVE EVALUATION RESULTS AND APPLICATION IMPROVEMENT

The initial evaluation methodology combined direct assessment with training in the use of the application. The formative evaluation, stage 1, was finished on 10 December 2022 and examined several key dimensions:

- participants' motivation and social inclusion;
- perceived social impact and potential for social change;
- engagement and cooperation between scientists and citizens;
- relevance of the data produced; and
- broader social relevance and dissemination of impact (Ivanjko et al. 2024).

The project placed particular emphasis on participants' self-assessments, attitudes, and qualitative feedback regarding their experiences. This impact-assessment framework informed the subsequent development of the project, while the input from journalists provided concrete guidance for refining the application.

Three weeks after the training and exploratory workshop (P5), on 21 December 2022, the same cohort, along with two members of the museum staff, engaged in a half-day co-design workshop (formative evaluation, stage 2).

PHASE 7 – CITIZEN PARTICIPATION IN METADATA CREATION AND CONTEXTUALISATION OF THE PHOTO COLLECTION

The first stage of citizen participation in metadata creation and contextualisation of the photo collection took place between 11 and 20 December 2022. A half-day co-design workshop was held on 21 December 2022, after which the application was further refined until 7 January 2023. Production use commenced on 8 January 2023, and, by 28 February 2025, a total of 839 photo series (mainly events) organised in folders were reviewed and 16,291 individual photo records had been viewed, of which 8,325 records were edited (for example, 3,225 persons are identified and added to metadata records).

The previously described creation of a photo folder related to a single event was essential for distributing individual groups of photos to citizens for further social tagging and description. The photo groups created in this way are linked in the application to individual citizen user accounts, based on their expertise in particular sports (Ivanjko et al. 2024). This enables a collection-level description of photographs. Through various search and browsing functionalities, users access groups of photos that are associated with them according to their expertise related to individual sports and can change data at the group level or select a module for viewing individual photos that allows for editing and adding data to individual photos. Figure 2 shows the graphical user interface of the web application – the screen where metadata about individual photos is viewed and edited. The key metadata elements in the interface are as follows: Series (event) title, Persons and additional information about persons (all individuals in the photograph are recorded in left-to-right order), Keywords, Note, Assessment of the photograph's significance, and Confidence level (users indicate how certain they are about the accuracy of the data they have added or corrected). The author element is hidden in this campaign, i.e., predefined, since Robert Valai took all the photographs.

The screenshot shows a web application interface for editing photo metadata. The main area displays a black and white photograph of a football match. To the right of the photo is a form with the following sections:

- Naslov serije (dogadjaja):** A text field containing "Zagreb, stadion u Kranjčevićov, Savezna liga, Zagreb...".
- Informacije o fotografiji:** A section with a sub-header "Osobe" and a list of three people:
 1. Slavko Kovačić (br. 9)
 2. Zvonko Čop (br. 8, bijeli dres)
 3. Vlado Hrstić (br. 8, tamni dres)
- Ključne riječi:** A text field containing "Hrvatska, Savezna liga, Jugoslavija, Valai, Zagreb".
- Napomena:** A text field for additional notes.
- Procjena važnosti fotografije:** A section with five stars (1-5) and a confidence level assessment. The assessment is shown as a progress bar with four segments: 0% (Nema sigurnost), 25% (Djelomično siguran), 50% (Djelomično siguran), 75% (Djelomično siguran), and 100% (Potpuno siguran).

Figure 2. User interface of the data entry form used by citizens to describe individual photographs (author: Robert Valai).

PHASE 8 – CHECKING, EVALUATING, AND SELECTING PHOTOGRAPHS BY THE COLLECTION MANAGER

By selecting the administrator role in the application, the collection manager can view all data entered by citizens and compare entries as needed, for example, to assess overlap or identify contradictions. Through the search functionality, the collection manager can easily select only relevant photographs (for instance, by setting a filter that displays only processed photographs, photographs whose importance is estimated to be greater than three, etc.), which speeds up the browsing of large photographic collections significantly. Based on the insight into the specified data, it is easier for the collection curator to select photographs to be included in the inventory book of museum objects and thus acquire the status of a museum object and cultural property (Ivanjko et al. 2024). It is a continuous process that the curator of the collection carries out in parallel with other tasks of documenting the photo collection.

PHASE 9 – ENABLING OPEN ACCESS TO THE COLLECTION

Photographs selected through the previously described multi-level process are currently undergoing another selection process – choosing the most relevant items for publishing (both photos and associated metadata) in open access through two platforms: the Public Online Catalogue of the Collections of the Croatian Sports Museum (Croatian Sports Museum n.d.), which is still in the development phase, and the portal of the national digitisation project eCulture. The selection from the photo collection is available through the eCulture portal (eCulture portal n.d.). The collection-level descriptions are released under a Public Domain Licence, while the individual photographs are provided under the In Copyright – Educational Use Permitted Licence.

RESULTS

This chapter organises findings according to the four evaluation strands specified in the study design: front-end evaluation, formative evaluation 1 (exploratory workshop), formative evaluation 2 (co-design

workshop), and summative evaluation outline. Together, these strands address RQ 1–6 and cover operational workflow phases P5–P8.

FRONT-END EVALUATION

The front-end strand preceded any live interaction with the prototype. It served two purposes: a) to benchmark essential functionality by re-viewing well-established citizen-heritage interfaces (Steve Museum, ARTigo) and b) to surface initial motivational cues through a participatory kick-off meeting with all stakeholder groups (operational phase P1). Together, these activities provided design requirements for the first “DigiSport” build and shaped the questionnaire used in Formative Evaluation 1. Table 2 summarises the outputs of the front-end evaluation and their linkage to research questions.

Table 2. Outputs of the front-end evaluation and their linkage to research questions (authors: Goran Zlodi, Tomislav Ivanjko, Eva Vitković).

Component	Evidence generated	Principal RQs
Comparative review of citizen-heritage interfaces (Steve Museum, ARTigo)	12 functional requirements extracted: e.g. “inline authority lookup”, “batch keyword assignment”, or “curator override log”. Nine of twelve were implemented in the first “DigiSport” prototype.	RQ 4
Participatory-planning meeting minutes (P1)	Stakeholders identified heritage preservation and professional legacy as dominant motivators; time availability was flagged as a risk. These cues shaped the on-paper questionnaire.	RQ 1

Key outcomes. The benchmark analysis offered a concrete usability checklist that informed early development sprints, directly addressing workflow reliability (RQ 4). The participatory dialogue confirmed

the centrality of intrinsic heritage motives (later validated in Formative Evaluation 1: Training and Exploratory Workshop section) and identified time availability as a risk factor to be monitored longitudinally (RQ 1 → RQ 2).

FORMATIVE EVALUATION 1: TRAINING & EXPLORATORY WORKSHOP (P5)

Phase 5 combined a brief hands-on training session with an exploratory workshop in which volunteers used the first production prototype to tag and contextualise a test subset of photographs. The evaluation relied on two complementary instruments: structured observation of in-app behaviour during the training exercise and an eleven-item on-paper questionnaire administered immediately afterwards. Table 3 summarises the generated evidence and the addressed research questions.

Table 3. Components and analytic focus of formative evaluation 1 (authors: Goran Zlo-di, Tomislav Ivanjko, Eva Vitković).

Component	Evidence generated	Principal RQs
Hands-on training session	82 annotations on 244 photos; mean task time 57 s; zero semantic errors; two usability pain-points identified.	RQ 4
On-paper questionnaire (N = 6)	Participants reported a strong motivation to preserve sports history (M = 4.67), a high perceived potential to influence similar projects (M = 4.33), and a moderate expectation that the project would stimulate the broader sports community (M = 3.83). Self-assessed confidence in their skills was also high, reflected in a low reverse-coded score for lack of skills (M = 1.83/5).	RQ 1 – RQ 3

During the workshop session, participants practised tagging on a live subset of 244 photographs. Altogether, 82 annotations were created (approximately 34% of the dataset), resulting in 58 corrected titles, 77 person tags, and 12 club tags. The mean task-completion time was 57 ± 9 seconds per image. Importantly, no semantic errors were detected by the supervising curator. Qualitative feedback pointed to two usability issues: a) the use of scrolling for zooming and b) the need to switch between separate windows for keyword entry. These findings fed directly into the co-design brief for Phase 6. Table 4 reports the main dimensions measured by the questionnaire.

Table 4. Selected questionnaire dimensions and descriptive statistics (authors: Goran Zlodi, Tomislav Ivanjko, Eva Vitković).

Dimension (Likert 1–5)	Mean	SD	N	Indicative RQs
Preserve sports history (motivation)	4.67	0.52	6	RQ 1
Influence similar projects (societal value)	4.33	0.52	6	RQ 3
Stimulate the broader sports community	3.83	0.75	6	RQ 3
Stimulate the non-sports public	3.5	0.84	6	RQ 3
Lack of skills (reverse-coded)	1.83	0.41	6	RQ 2

Figure 3 presents the distribution of responses to the survey item assessing whether the project results would stimulate interest in the broader sports community. While the ratings were generally positive, with a mean of 3.83 (SD = 0.75), they indicate a more moderate expectation compared to other motivational dimensions. This suggests that participants considered the platform primarily as a tool for preserving and enriching sports heritage, with somewhat less certainty about its capacity to mobilise broader community engagement.

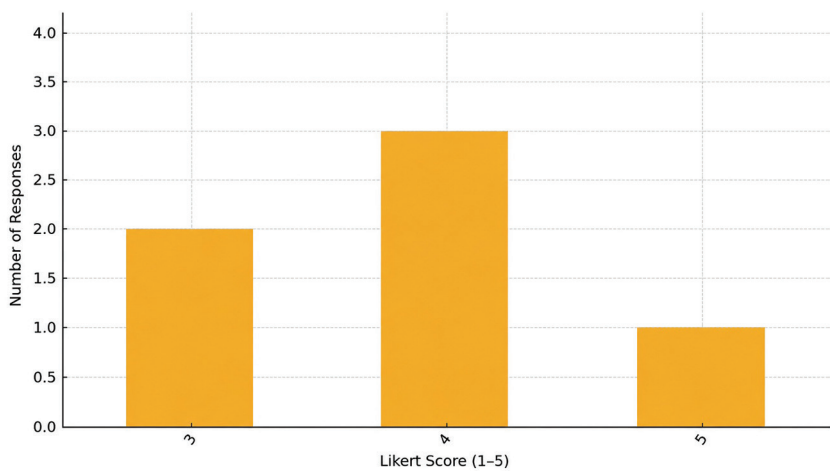


Figure 3. Distribution of participants' ratings for the statement “Project results will stimulate interest in the broader sports community” (authors: Goran Zlodi, Tomislav Ivanjko, Eva Vitković).

Figure 4 illustrates the distribution of participant ratings for the expectation that the project will influence the development of similar projects and collections in other socially relevant domains. The consistently high scores suggest that participants perceived the initiative not only as valuable within the context of sports heritage but also as a potential model that could be transferred and adapted to other areas of cultural and social significance.

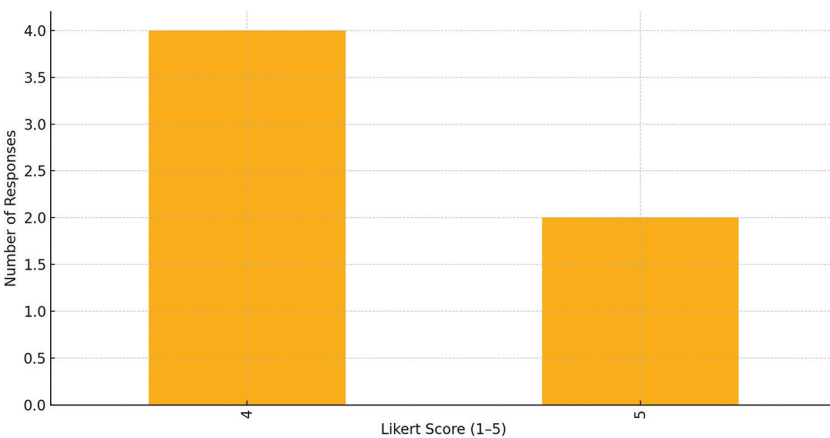


Figure 4. Distribution of participants' ratings for the statement “Project results will influence the development of similar projects and collections in other socially relevant domains” (authors: Goran Zlodi, Tomislav Ivanjko, Eva Vitković).

Key outcomes. The questionnaire confirmed that intrinsic heritage-preservation is the dominant entry motivator (RQ 1) and that participants attribute higher social value to impacts within the sports domain than to society at large (RQ 3). Observational metrics established a baseline task duration of 57 seconds and uncovered two critical usability issues, both of which were prioritised for the subsequent co-design workshop (RQ 4). These findings simultaneously validated the motivational assumptions surfaced in the front-end participatory meetings and furnished concrete design targets for interface refinement.

FORMATIVE EVALUATION 2: CO-DESIGN WORKSHOP (P6)

Three weeks later, the same cohort, along with two additional members of museum staff, engaged in a half-day co-design workshop (P6). Key user interface enhancements – including the bulk keyword picker, split-screen zoom, and inline validation – contributed to a measurable reduction in cognitive load and error rates, thereby providing empirical support for RQ 2 (motivation over time) and RQ 4. Participants evaluated the updated version with an average ease-of-use rating of 4.7 out of 5. Participants reported higher self-efficacy, addressing the time-availability concern raised in the paper questionnaire.

Key outcomes. Post-test communication among participants indicated heightened self-efficacy and perceived transparency, addressing motivational risks identified in the front-end strand. These gains were sustained, confirming the value of participatory design for both volunteer experience and metadata quality.

SUMMATIVE EVALUATION (P7–P8)

Production use started on 8 January 2023, and following the interface revision (v. 1.2), the application remained continuously online until 28 February 2025. Two active and two retired sports journalist volunteers edited photographs from their homes. System logs captured every view, edit, and save event, yielding 33,574 distinct key interactions. The curated audit and longitudinal motivation check-ins provide the evi-

dence base for RQ 2 and RQ 4–RQ 6. However, as we mentioned before, summative evaluation is only outlined at this stage and is envisaged as the subject of future research.

INTEGRATED INSIGHT

In all domains, the collaborative ecology of citizens, museums, researchers, and students was crucial. Requirements elicitation enhanced prototype quality (front-end, formative evaluation I), user feedback mitigated design and functionality limitations (formative evaluation II), and detailed logging of user actions provided a basis for subsequent research and project refinement (prerequisite for future thorough summative evaluation). Taken together, these results address all six research questions and provide the empirical foundation for the propositions developed in the next chapter.

DISCUSSION

This discussion interprets the empirical findings in relation to the six research questions (RQ 1–RQ 6) and situates them within the citizen science and digital heritage literature, outlining both methodological and practical implications. The following subsections address volunteer motivation, workflow reliability and scalability, the multi-stakeholder collaboration ecology, study limitations, and directions for future research and design.

MOTIVATIONAL DYNAMICS (RQ 1–RQ 3)

The study has shown that volunteers were primarily driven by a strong wish to preserve sporting heritage and contribute to the professional legacy of their field. They also value the social aspect of participation, seeing particular importance in strengthening the sports community, though they were somewhat less convinced about the broader public impact. Over time, participants gained confidence in their ability to contribute effectively, though some of the initial enjoyment decreased

once tasks became routine. Significantly, this change in motivation did not reduce the overall level or quality of contributions.

To sustain motivation, project designers should emphasise intrinsic heritage-related motives while also providing small, varied tasks and occasional challenge events to keep engagement fresh. Recognition strategies should acknowledge both community-level and broader societal contributions.

WORKFLOW RELIABILITY AND SCALABILITY (RQ 4–RQ 5)

The workflow proved to be both reliable and efficient. Citizen contributors enriched photo metadata with a high degree of precision, meeting professional standards. The process was supported by careful curator oversight and platform features which allowed for efficient editing and validation. These results suggest that, with a committed group of volunteers and active feedback loops from professionals, similar citizen science approaches could be applied to much larger photographic collections in a sustainable manner.

Citizen science can provide a viable model for large-scale metadata enrichment if the contributors bring relevant expertise, curators remain actively engaged in review, and the platform offers strong support for quality control and batch operations.

COLLABORATION ECOLOGY AND SUSTAINABILITY (RQ 6)

Multi-stakeholder collaboration is the cornerstone of successful citizen science ventures (Wiggins and Crowston 2011; Haklay 2013). Successful citizen science initiatives depend on carefully arranged collaboration among multiple stakeholder groups, each of whom brings distinct motivations, resources, and constraints (Shirk et al. 2012; Bonney et al. 2016). In “DigiSport”, these four constituencies formed an explicitly co-dependent ecology: citizens contributed domain knowledge, the museum supplied collections and curatorial oversight, researchers provided methodological scaffolding and evaluation, and students acted as agile mediators between experts and lay participants. The following

subsections examine collaboration from each perspective, referencing the study's research questions (RQ) and operational workflow phases (P) to clarify where evidence was generated and how it answers the larger exploratory agenda.

Three interaction mechanisms proved decisive:

1. participatory specification translated benchmark features into a minimum viable product (MVP) that met expert expectations;
2. co-design iteration halved critical errors and cut task time, evidencing the productivity gains of agile, user-centred loops (Haklay 2013);
3. curator audits provided reputational accountability, sustaining data quality with minimal staffing.

This section presents the results from four stakeholder perspectives central to the “DigiSport” project: citizens, cultural heritage institutions, researchers, and students. Each group's engagement reveals different modes of participation, benefits, and challenges, while collectively illustrating the collaborative dynamics that shaped the project. By structuring the findings according to these perspectives, the analysis highlights how diverse forms of involvement contributed to enriching the sports heritage collection, strengthening community engagement, and advancing the project's research objectives.

Collaboration From the Citizen's Perspective (addresses RQ 1-3 & 6; corresponds to P5, P7). In the “DigiSport” project, citizen participation provided individuals with the opportunity to engage in actively preserving and documenting sports heritage. By social tagging and contributing their knowledge, memories, and perspectives, citizens helped enrich the contextual understanding of historical photographs, making the collection more meaningful and accessible. This involvement also allowed participants to develop new skills, such as working with meta-data and digital archives, enhancing their digital literacy. Systematic evidence from library-based projects shows identical improvements in digital literacy among participants (Mumelaš et al. 2025). Their contributions fostered a sense of ownership and connection to cultural heritage, reinforcing the importance of community involvement in historical preservation.

Collaboration From a Cultural Heritage Institution’s Perspective (addresses RQ 4–6; corresponds to P2, P3, P8, P9). In the “DigiSport” case study, the museum gained several significant benefits. Metadata for the Collection of Photographs was enriched, improving organisation and accessibility. Additionally, valuable contextual knowledge related to the photographs was gathered, providing deeper insights into their historical and cultural significance. The project also fostered collaboration between the museum, citizens, and researchers, strengthening community engagement and expanding networks for future research initiatives. This participatory approach not only enhanced the collection’s documentation but also contributed to the democratisation of heritage preservation by involving the public in knowledge creation. The project supported the museum’s mission to preserve and promote sports history while encouraging active citizen participation in cultural heritage research.

Collaboration From a Researcher’s Perspective (addresses RQ 4–6; corresponds to P1, P3, P6, P8). In the “DigiSport” project, the task of tagging and adding contextual knowledge to historical sports photographs vividly illustrates this potential. The contribution of sports journalists, acting as citizen scientists with domain-specific expertise (Ivanjko et al. 2024), allowed multiple layers of information to be revealed and interconnected, linking individuals, events, dates, locations, and even personal anecdotes associated with the images. This semantic enrichment goes far beyond basic cataloguing, creating a much deeper and more nuanced dataset. Analysing these photographs and the enriched metadata through the shared wisdom and specific knowledge of the citizens involved yields insights of unprecedented depth and breadth (Irwin 1995; Ivanjko et al. 2024). It unlocks interpretations and connections that might remain hidden from researchers lacking that specific contextual background.

This collaborative approach, facilitated by digital tools, not only addresses the challenge of processing extensive heritage collections but also generates high-quality, structured data suitable for future research, including statistical analysis and reuse under FAIR principles (findable, accessible, interoperable, and reusable) (Ivanjko et al. 2024). The process promotes mutual benefits: researchers gain invaluable

data and insights, while citizen scientists engage meaningfully with cultural heritage, potentially gain new skills, and experience the satisfaction of contributing to scientific and cultural preservation efforts (Bonney et al. 2009; Ivanjko et al. 2024). This fosters a stronger connection between the research community and the public, reinforcing trust and promoting a shared sense of ownership and collaborative learning.

Collaboration From a Student’s Perspective (addresses RQ 2, 3 & 6; corresponds to P1, P5). In the “DigiSport” project, students help community volunteers navigate online tools and procedures, while simultaneously gaining confidence in their own tech and research abilities. Free from the broader administrative burdens that often limit more experienced researchers, students are driven by curiosity and a desire to learn. This fresh energy not only sparks innovative approaches within the project but also empowers citizens by improving their digital literacy. Research in school settings supports this model. For example, Zydney et al. (2025) found that in elementary citizen science projects, students often take on the role of mediators, asking peers questions and guiding scientific discussions through shared work products. Similarly, a systematic review by Aristeidou and Herodotou (2020) shows that online citizen science projects help participants develop deeper scientific understanding, improve attitudes towards research, and familiarise themselves with specific topics and general scientific thinking. Situated at the nexus of researchers, professional specialists, and citizen experts, students serve as effective mediators – bringing emerging information science and citizen science skills to the project while offering frontline support that helps volunteers overcome information and communication technology (ICT) barriers in using the application. Students’ motivation is rooted in a pronounced appetite for new competencies and experiences, unencumbered by the institutional responsibilities borne by senior researchers. In this capacity, the student both catalyses innovative practices and enhances citizens’ ICT competencies within the project. At the same time, the experience simultaneously broadens the student’s intellectual horizon and may motivate them to initiate comparable initiatives in their future career.

LIMITATIONS

As with any exploratory case study, it is essential to acknowledge the boundaries and constraints that shaped both the design and interpretation of the findings. Recognising these limitations not only contextualises the present results but also helps guide methodological refinements and strategic planning for future citizen science and participatory heritage projects. The following considerations merit particular attention:

- Sample size and composition. Only six contributors – four (4) journalists (retired and active), one (1) museum professional (custodian), one (1) student – limit generalisability. The research was conducted as an exploratory case study, designed to probe the needs and attitudes of participants and to generate novel insights that could inform future citizen science initiatives.
- Self-report biases. Enjoyment and self-efficacy ratings rely on subjective Likert items.
- Linear scalability assumption. Throughput projections omit possible resource shocks (funding, volunteer churn).
- Software limitations. Due to rapid application development, it was not possible to create a documented open-source codebase. The application is currently in the functional prototype phase, but further development, documentation, and release are planned under an open source or free software licence.

Taken together, these constraints justify the study's classification as exploratory rather than confirmatory. They highlight the need for more extensive follow-up research with larger and more diverse participant samples, longitudinal monitoring of user behaviour, and more robust technical development pathways. Addressing these limitations in future work will not only strengthen the validity and generalisability of findings but also enhance the capacity of citizen science approaches to make a sustained impact in the field of cultural heritage.

FUTURE RESEARCH AND DESIGN DIRECTIONS

Future research and design should focus on several complementary directions. First, broadening the contributor pool by involving non-

expert sports fans would allow for a comparison of accuracy and motivational dynamics with those of domain specialists. Second, a longitudinal retention study over a year could track participant engagement while testing the relative effectiveness of micro-tasks – short, self-contained actions requiring minimal context switching – versus macro-tasks, which involve more complex assignments drawing on domain expertise or external resources. Third, experimenting with adaptive incentive schemes such as badge systems and community recognition may help reduce disparities in contribution levels. Fourth, integrating algorithmic pre-selection could lower the view-to-edit ratio and shed light on the potential of human-AI complementarity. Finally, replicating the workflow across different cultural heritage domains would test its transferability and refine estimates of scalability.

CONCLUSION

The “DigiSport” exploratory case demonstrates that an intentionally orchestrated, multi-stakeholder citizen science workflow can deliver professional-grade metadata while generating rich motivational and pedagogical value. By mobilising retired and active sports journalists, museum curators, academic researchers, and information science students, the project overcame a legacy backlog of poorly described photographs and achieved high field-level accuracy, surpassing many professional cataloguing benchmarks.

Beyond these quantitative gains, “DigiSport” advances theory on expert-driven citizen science in cultural heritage. It shows that domain-specialist volunteers, when supported by curator feedback loops and iterative co-design, sustain both high efficiency (approximately fifty photographs per hour) and high data quality. The project also illuminates motivational trajectories: intrinsic heritage preservation and professional legacy proved durable drivers, whereas enjoyment declined modestly over time, an insight that informs future incentive design.

Stakeholder benefits were symmetrical. Institutions gained enriched, standards-compliant metadata; researchers obtained a high-quality dataset and methodological insights; sports journalists contributed

meaningfully while strengthening their digital literacy; and students experienced authentic research that bridges theory and practice. Such reciprocity reinforces transparency, inclusivity, and public trust in heritage stewardship.

“DigiSport” underscores the transformative potential of citizen science for digital cultural heritage. It demonstrates that citizen engagement is not merely outreach but a sustainable strategy for preserving, interpreting, and democratising cultural memory in the digital age. Scaling the model to additional sports archives – and other heritage domains – promises to unlock vast, presently dormant collections, turning cultural assets into living resources for scholarship and society alike.

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BRIDGING TANGIBLE AND INTANGIBLE CULTURAL HERITAGE: DARIAH-IT'S CONTRIBUTION TO THE H2IOSC PROJECT

EMILIANO DEGL'INNOCENTI

Opera del Vocabolario Italiano, Consiglio Nazionale delle
Ricerche (OVI-CNR)
Florence, Italy
emiliano.deglinnocenti@cnr.it
ORCID iD: 0000-0002-3839-9024

FRANCESCO PINNA

Opera del Vocabolario Italiano, Consiglio Nazionale delle
Ricerche (OVI-CNR)
Florence, Italy
francesco.pinna@cnr.it
ORCID iD: 0009-0009-4925-3467

ALESSIA SPADI

Opera del Vocabolario Italiano, Consiglio Nazionale delle
Ricerche (OVI-CNR)
Florence, Italy
alessia.spadi@cnr.it
ORCID iD: 0000-0002-9670-3426

FEDERICA SPINELLI

Opera del Vocabolario Italiano, Consiglio Nazionale delle
Ricerche (OVI-CNR)
Florence, Italy
federica.spinelli@cnr.it
ORCID iD: 0000-0002-2195-3930

The evolving strategies to integrate digital technologies and cultural heritage are a critical area of inquiry within the broader field of digital humanities. The social sciences and humanities (SSH) and the cultural heritage (CH) sectors have produced large quantities of data and resources that need to be managed according to standard procedures and shared policies since the swift advancement of digital technologies is revolutionising how we approach the study, preservation, and dissemination of digital resources. By integrating traditional humanities research with cutting-edge digital tools and methodologies, researchers, scholars, and CH professionals are gaining unprecedented access to vast amounts of data, enabling new forms of analysis, interpretation, and knowledge creation. Interdisciplinary collaboration is, therefore, crucial for unlocking the full potential of research by bridging disciplinary boundaries. This paper presents the activities carried out by the Italian node of DARIAH ERIC (DARIAH-IT) within the “Humanities and Cultural Heritage Italian Open Science Cloud” (H2IOSC) project, a national initiative under the Italian National Recovery and Resilience Plan (NRRP). H2IOSC is a federated cluster comprising Italian branches of four prominent research infrastructures (RIs) within the European Strategy Forum on Research Infrastructures (ESFRI) domain of SSH (Social and Cultural Innovation): Common Language Resources and Technology Infrastructure (CLARIN), Digital Research Infrastructure for the Arts and Humanities (DARIAH), European Research Infrastructure for Heritage Science (E-RIHS), and OPERAS, the European research infrastructure for open scholarly communication in the social sciences and humanities. The focus will be on the ongoing work of DARIAH-IT within the H2IOSC federation, highlighting the methodological approach, technological solutions, and practical applications of the developed semantic framework. By addressing the challenges of interoperability and data integration, this research contributes to the advancement of digital humanities and the preservation and understanding of cultural heritage in the digital age.

Keywords: semantic mapping, interoperability, FAIR principles, research infrastructures, manuscripts

INTRODUCTION

Digital humanities (DH) are intrinsically interdisciplinary, merging traditional humanities research with evolving technologies to provide innovative approaches for understanding, preserving, and disseminating our collective past and cultural legacies (Burdick et al. 2012). By exploiting digital tools and methodologies, scholars and researchers can

now access, analyse, and share data about their studies on a broader level, thereby opening new venues for research, education, and public engagement (Gold and Klein 2023).

While pervasive digital technologies and the Internet have brought about new methodologies to support research endeavours, it is also true that disciplinary silos persist in research: the debate about the “two cultures” (intellectuals and scientists, and the natural and human sciences, popularised by Charles Percy Snow in his 1959 lectures and the first edition of the book *The Two Cultures and the Scientific Revolution*) is a classic example of separation and difficulty of communication among different disciplines (Snow 1961). Even to this day, the need for an interdisciplinary approach and collaboration remains a critical issue to address the challenges posed by the technological advancement (Edmond 2015). Within the social sciences and humanities (SSH) domain, both the humanities and heritage sciences generate substantial quantities of data, with the potential to exponentially increase this production in a short time, given proper technical support. However, while information retrieval is faster than ever, online resources suffer from qualitative heterogeneity. The diverse origins of online content, sometimes lacking consistent review processes, create inconsistencies in data quality and accuracy, hindering reliability (Mukhopadhyay 2015). Furthermore, information retrieval is often inefficient due to the lack of interoperability between discoverable online sources. The sustainability of online resources, in terms of their long-term stability, is another important consideration: dead links and missing content compromise long-term access and data integrity, and without continued maintenance and version control, valuable information can be lost or altered (Gomes and Silva 2006), hence the importance of protecting SSH research infrastructures as critical components of the societal and cultural fabric (Bellini and Degl’Innocenti 2024). Also, legal ambiguities create a “grey zone” which limits data sharing and reuse due to uncertainty. Addressing these issues requires standardised metadata, robust digital preservation strategies, and clear policy on access and reuse.

Besides these general considerations, while dealing with heritage resources, the complexities of the object studied should also be con-

sidered. A simple definition of cultural heritage might describe it as the totality of tangible and intangible testimonies that document the history of a civilisation (Università Iuav di Venezia 2025). In this sense, cultural heritage not only embodies a community's identity but also encapsulates its ethos, as the physical artefacts and living practices that constitute it serve to preserve collective memory and transmit values and knowledge to future generations (Smith 2006).

To fulfil this role, it is essential to bridge the existing gap between tangible and intangible cultural heritage, which can be considered a sort of conceptual extension of the issue Snow was already discussing half a century ago. This partition primarily arises from the very nature of these two categories. Tangible heritage, encompassing monuments, artefacts, and architectural landmarks, is more readily recognisable, preserved, and valorised through conventional means such as museums, restoration, cataloguing, and legislative protection. Intangible heritage, which includes non-physical aspects of a culture such as oral and written traditions and other cultural practices, is instead inherently fluid, often relying on informal transmission, and frequently linked to specific communities, thereby risking gradual erosion over time (UNESCO 2003).

Valuing both tangible and intangible heritage is essential for keeping cultural identities vibrant and ensuring that unique traditions are not lost. The maintenance of this continuity – through the use of innovative tools and technologies and the wealth of knowledge accumulated by the humanities – is enshrined in Article 9 of the Italian Constitution, which states that “[t]he Republic shall promote the development of culture and scientific and technical research. It shall safeguard the natural landscape and the historical and artistic heritage of the Nation”, exemplifying the legal commitment to preserving cultural diversity (Senato della Repubblica 2023).

It is important to note that reducing the gap between tangible and intangible heritage does not mean flattening their differences; rather, it involves recognising that both are fundamental to our cultural ecosystem. This approach enables us to protect our roots more effectively, stimulate contemporary innovation, and build a more informed and sustainable future (Smith 2006).

Research infrastructures (RIs)¹ offer a promising venue for mitigating the challenges posed by disciplinary hyper-specialisation and technical lock-in described in this paragraph, since the integration of digital methodologies inherently transcends traditional disciplinary silos. Processing the data through digital means enables the emergence of novel insights from existing knowledge, fostering innovative research approaches. The management of the data produced by scientists in research infrastructures presents a significant opportunity to bridge the long-standing divide between the traditional humanities and the sciences.

Given this premise, the Digital Research Infrastructure for the Arts and Humanities (DARIAH ERIC) aims to enhance and support digitally enabled research and teaching across the arts and humanities (DARIAH n.d.).

In line with the mission and vision of DARIAH ERIC, the Italian node of DARIAH (DARIAH-IT) is working towards enabling an integrated digital research environment. This article will focus on the research and implementation work done by the group of researchers gathered around the DARIAH-IT node, based in Florence at the Opera del Vocabolario Italiano Institute of the National Research Council of Italy (OVI-CNR), that contributed to several national- and EU-funded projects, such as the Social Sciences and Humanities Open Cloud (SSHOC) EOSC thematic cluster² and the IPERION HS³ (“Integrated Platform for

¹ As stated in Article 2(6) of Regulation (EU) No 1291/2013 of the European Parliament and of the Council, research infrastructures are defined as follows: “Research infrastructures’ mean facilities, resources and services that are used by the research communities to conduct research and foster innovation in their fields. Where relevant, they may be used beyond research, for example, for education or public services. They include major scientific equipment or sets of instruments; knowledge-based resources such as collections, archives or scientific data; e-infrastructure such as data and computing systems and communication networks; and any other infrastructure of a unique nature essential to achieving excellence in research and innovation. Such infrastructures may be ‘single-sited’, ‘virtual’ or ‘distributed’” (European Parliament and Council of the European Union 2013: 107).

² Social Sciences and Humanities Open Cloud (SSHOC) was an EU Horizon 2020 project that contributed to the development of the social sciences and humanities area of the European Open Science Cloud (EOSC), with the aim of providing researchers with integrated access to data, tools, and services for research, collaboration, and innovation (SSHOC n.d.).

³ “Integrating Platforms for the European Research Infrastructure ON Heritage Science” (IPERION HS) is a project funded by the Horizon 2020 programme. The consortium is composed of 24 partners from 23 countries that contribute to establishing a pan-European research infrastructure on heritage science (IPERION HS n.d.).

the European Research Infrastructure ON Heritage Science”) Horizon 2020 project (OVI n.d.). To empower the solutions developed towards a collaborative environment in the humanities and heritage sectors, DARIAH-IT is partaking in the “Humanities and Cultural Heritage Italian Open Science Cloud” (H2IOSC) federated infrastructure, which sees the participation of the Italian nodes of four RIs operating in the Social and Cultural Innovation sector of the European Strategy Forum for Research Infrastructures (ESFRI): DARIAH, CLARIN, OPERAS, and E-RIHS (H2IOSC n.d.).

BRIDGING INTANGIBLE AND TANGIBLE CULTURAL HERITAGE RESEARCH

BUILDING AN INTEGRATED RESEARCH ENVIRONMENT

H2IOSC facilitates collaboration among researchers from various disciplines in the social sciences and humanities fields. Its primary objective is to conduct data-driven research activities by supporting several scientific workflows. Around the workflows selected by each participating infrastructure, H2IOSC builds as many Scientific Pilots supported by digital data, tools, and services, in the form of virtual research environments, by using high-performance computing data centres built by the cluster. Additionally, it aims to enhance the adaptation, implementation, and efficiency of existing facilities, based on the needs identified and expressed by the respective communities. H2IOSC will establish an onboarding process for each federated infrastructure within its framework that will ensure the designated maturity threshold. Moreover, H2IOSC promotes training and dissemination activities to foster proficiency in the FAIR (findable, accessible, interoperable, and reusable; see GO FAIR n.d.) and open science domain (see UNESCO 2021). Ultimately, the federation seeks to drive the digital transformation of cultural and creative industries.

The role of DARIAH-IT in the project is to build a distributed infrastructure by federating its eight nodes, elaborating the semantic framework used to represent interconnected knowledge within H2IOSC, and developing Scientific Pilots that support digital philology workflows. To do so, DARIAH-IT will undertake a set of preparatory

activities, including collecting and evaluating existing tools, datasets, and services relevant to the task above. A crucial part of this process is the semantisation of selected data and metadata to promote interoperability of diverse resources; this involves the definition of standardised vocabularies and ontologies alongside the deployment of tools and workflows which actually implement the semantic transformation. The Pilots, presented as platforms or hubs, integrate domain-specific services, workflows, and interfaces. They operate on meticulously parsed data subsets to facilitate the development of prototypes. Connected to these research and development activities, DARIAH-IT will promote training, outreach, and dissemination efforts, as well as the funding of a doctoral scholarship in digital philology.⁴

To showcase the results of the solutions implemented, DARIAH-IT is developing two pilots based on real-world research scenarios, Digital Philology Hub (DPH) and the Digital Heritage and Memory Hub (DHMH), to bridge the gap between tangible and intangible aspects of cultural heritage objects by removing technological and semantic barriers to let data become interoperable with resources from different disciplines studying the same objects or contexts.

DARIAH-IT's approach to achieving full interoperability has two primary focuses. Firstly, it established a distributed IT infrastructure capable of hosting diverse and computationally intensive software services; secondly, it developed a Common Semantic Framework, a collection of domain ontologies with comprehensive mapping and validation tools covering the areas of interest of the involved RIs.

MANUSCRIPT USE CASE

Given the described context, we now move on to examine a specific case study, based on the manuscript object, typically a medieval manuscript. The medieval manuscript presents a fascinating connection between *res* and *verba*, material aspects and intellectual content,

⁴ PhD scholarship established at the Scuola Normale Superiore, Pisa, pursuant to the agreement for the activation and operation of the PhD programme in "Filologia Romanza Italiana Digitale" (FROID), to be established as a joint programme in accordance with Article 3, paragraph 2 of Ministerial Decree No. 226/2021, 39th cycle.

demanding a philological approach that encompasses different disciplinary boundaries. As stated by Maniaci (2019) in her monograph about the history of medieval manuscripts, *Breve storia del libro manoscritto*, the manuscript, whether ancient or medieval, can be defined as a portable, handcrafted artefact designed to contain, share, and pass down information in a structured and resilient format. The manuscript as a physical object can therefore be considered an “information repository” where the material features are connected to the intangible content delivered by the text. The study of the medieval manuscript is inherently interdisciplinary, drawing upon a wide range of specialised fields.

The material codex – parchment, ink, pigments, binding, and writing – offers a wealth of information about the production process and is also the basis for many disciplines that investigate the material aspects:

- Codicology is the discipline that studies manuscripts, especially medieval ones, in their material aspect (Istituto dell'Enciclopedia Italiana Treccani n.d.a). The codex is studied as an overall testimony of culture, whose physical appearance is at the centre of the research work.⁵
- Palaeography is a historical discipline that studies the written testimonies of the past. It deciphers and analyses the script, tracing its development over time and identifying its regional and chronological variations (Istituto dell'Enciclopedia Italiana Treccani n.d.b).
- Conservation science, including chemistry and physics, plays an important role in preserving manuscripts for future generations by identifying the composition of materials, understanding degradation processes, and developing appropriate conservation treatments (CNR-DSCTM 2022).

On the immaterial aspects, the semantic content inherent in the text itself is the primary study object:

⁵ In her monograph *Archeologia del manoscritto*, Marilena Maniaci (2002) defines codicology as the scientific study of the manuscript as an “archaeological” object, stressing the importance of technical competencies to be applied to the study of materials and the production process of manuscripts. On the topic of intersections between the digital and codicology, Campagnolo (2024) offers a landscape of the recent tendencies.

- Philology focuses on the text itself, examining its transmission, reconstructing its form, and interpreting its meaning within its historical and cultural context. It studies civilisations over time through the evolution of written documents, which provide scholars with records of culture and traditions, history, people, places, etc. (Istituto dell'Enciclopedia Italiana Treccani n.d.c).
- Linguistics analyses the language(s) used in the manuscript, tracing their evolution and exploring their sociolinguistic context. Computational linguistics has opened new frontiers in the study of languages, including methods that can also be applied to the analysis of the language used in manuscripts (Lenci et al. 2016).
- Art history identifies, protects, manages, and enhances historical-artistic assets (Ministero della Cultura – Direzione Generale Educazione, Ricerca e Istituti Culturali 2019).⁶ Art historians examine the manuscript's visual elements, including illumination, decoration, and iconography, often revealing connections between the manuscript and broader artistic trends. Art historians may also be interested in investigating the relationship between miniaturists, scribes, and artisans in charge of creating parchment.

Of course, historical studies and social history also contribute by placing the manuscript within its broader historical, social, and economic context, illuminating the circumstances of its creation, use, and dissemination. The outlined panorama is by no means exhaustive, as there are quite a few other different disciplinary perspectives that work around the object manuscript, each of them producing consistent data about their study.

Despite the wealth of knowledge generated by individual research, a common challenge lies in breaking down the disciplinary silos. In fact, scholars in one field may not fully engage with the insights and methodologies of others, leading to an incomplete understanding of

⁶ As stated by the Italian Ministry of Culture in the definition of the activities carried out by art historians, they: “a) Identify, analyse and document historical-artistic assets; b) Protect and preserve historical-artistic assets; c) Direct museums or places of culture, curate collections or exhibitions with reference to the relevant disciplines; d) Carry out study, research, training and education activities in the field of history of art and related and related disciplines” (Ministero della Cultura – Direzione Generale Educazione, Ricerca e Istituti Culturali 2019; author's translation).

the manuscript as a whole. As stated, digital tools, while offering innovative possibilities for textual and physical analysis, also raise critical questions about standardisation, interoperability, and the preservation of both the tangible object and the intangible information it embodies. Moreover, it is important to consider that each manuscript is a unique artefact; there are no perfectly identical copies. Therefore, each manuscript is a unique research object, whose original information needs to be preserved. Only through a rigorous and interdisciplinary approach, one that acknowledges the inherent complexity of the medieval manuscript, is it possible to understand it as a whole.

An interesting aspect of manuscript study is its description and cataloguing. Accurate and comprehensive descriptions are essential for identifying manuscripts within collections and providing researchers with detailed information, especially in a digital environment that doesn't provide access to the original. DARIAH-IT aims to address this gap by fostering interdisciplinary collaboration and creating integrated resources, tools, and services for manuscript studies. By promoting the FAIRification of resources, these initiatives strive to break down disciplinary barriers and facilitate a more holistic approach to manuscript research. In the following section, the approach adopted by DARIAH-IT while participating in the H2IOSC federation will be presented.

THE DARIAH-IT PERSPECTIVE IN THE H2IOSC PROJECT

The manuscript use case was used as a pilot case in the H2IOSC project to bring together the four RIs' perspectives around one research object. It was soon clear that researchers may be focused on investigating a specific aspect of the object, but they would certainly benefit from a broader landscape composed of different disciplinary information to build their research case.

As stated in the Introduction, one of the objectives of the H2IOSC project is to develop interoperability among multidisciplinary resources both at a physical level, creating a National Cloud infrastructure, and at a semantic level, translating the state of knowledge with respect to the resources of each RI into a common semantic interdisciplinary and interoperable representation. The implementation of the seman-

tic framework leverages valuable experiences from other projects and clusters, notably PARTHENOS,⁷ RESTORE,⁸ and SSHOC. The core of the framework is based on the CIDOC Conceptual Reference Model (CIDOC CRM), a formal ontology for cultural heritage documentation that supports the semantic integration of heterogeneous data (CIDOC CRM n.d.), together with relevant extensions, due to its widespread adoption and proven effectiveness in similar contexts. The H2IOSC framework extends the one developed in the SSHOC project and formalised in SSHOCro (Bekiari et al. 2022), which is itself aligned with this model to enhance data integration and retrieval across domains. While different RIs contribute diverse information layers, this collaborative approach facilitates advanced searching and cross-referencing, providing a holistic view of the cultural and historical significance of artefacts to the research community.

An important reference for the design of the H2IOSC Reference Ontology is the SSHOC Reference Ontology (SSHOCro), which was developed to organise the information managed within the SSHOC project. A concrete example of the application of the ontologies developed by DARIAH-IT is the analysis of medieval Italian manuscripts.⁹ The model developed for this use case defines key entities, including manuscripts, codicological units, and pages, along with their relationships, such as “is_composed_by”, “originated_in”, or “has_been_in”, mapped onto the reference ontology. Additionally, the model incorporates content descriptions covering aspects such as illustrations,

⁷ “Pooling Activities, Resources and Tools for Heritage E-research Networking, Optimization and Synergies” (PARTHENOS). The project is funded by the European Commission under the Community’s Horizon 2020 Framework Programme (PARTHENOS n.d.).

⁸ RESTORE (“smaRt accESs TO digital heRitage and mEmory”) project, co-financed by the Regione Toscana. The Opera del Vocabolario Italiano Institute (OVI) of the Italian Research Council coordinated the project consortium, composed of the State Archive of Prato (Archivio di Stato di Prato), the Palazzo Pretorio Museum (Museo di Palazzo Pretorio) of the city of Prato, the Archival and Bibliographic Superintendency of Tuscany (Soprintendenza Archivistica e Bibliografica della Toscana), and the SPACE SpA software company (RESTORE n.d.).

⁹ The design of the manuscript ontology involved the validation of the proposed entities and properties by domain experts. Within the framework of the H2IOSC project, DARIAH-IT established collaborations with the Scuola Normale Superiore – specifically through the aforementioned FROID PhD programme – and with Professor Irene Ceccherini, Associate Professor of Palaeography at the University of Florence.

texts, and marginalia. To provide a more comprehensive perspective, it also integrates historical and contextual data, linking manuscripts to events, activities, and individuals.

Each RI contributed different levels of analysis depending on its focus. In the case of manuscripts, DARIAH-IT primarily examines their internal content, particularly from a philological perspective. The collaborative approach enables the systematic organisation of the characteristics and histories of these objects, facilitating advanced research and cross-referencing. This holistic perspective enhances the understanding of the cultural and historical significance of the analysed artefacts. By the end of the project, this approach will lead to unprecedented knowledge production systems, leveraging the structured information derived from the collaboratively developed model.

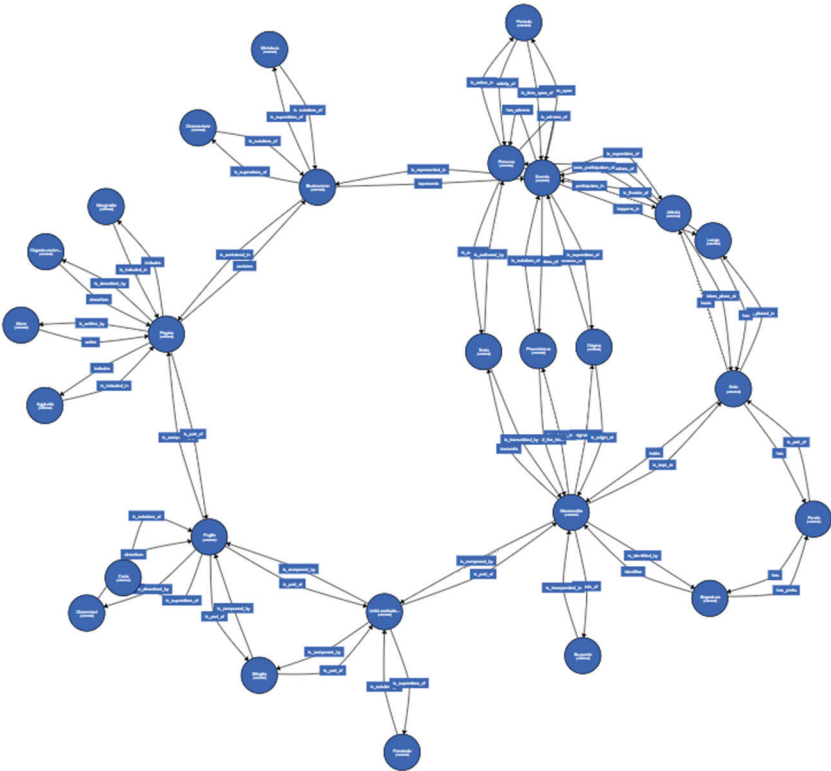


Figure 1. DARIAH-IT Manuscript Ontology generated by the Portal Entity Builder (PEB) map component of the MetaFAIR Ecosystem. Source: DARIAH-IT.

In the design of the ontology, DARIAH-IT focused on exploring the philological perspective, in line with the needs expressed by the reference community and with the development of the domain Scientific Pilot for digital philology, Digital Philology Hub. The schema developed by DARIAH-IT around the manuscript object describes both the tangible and intangible aspects to be investigated. The definition of the ontology leveraged the contribution of domain experts, who validated the proposed solutions. The framework developed by DARIAH-IT should then be connected to the ones developed by the other infrastructures on the premise of agreed connection points. Typically, the shelfmark is the most promising and accessible shared data.

DARIAH-IT ARCHITECTURE

In the broader context of the H2IOSC project, DARIAH-IT is developing a framework to exploit the data gathered within the project to bridge the gap between tangible and intangible aspects of the disciplines within its reference community. The definition of a schema that considers both the material and the content of the manuscript within the ontological schema reflects what the RI wishes to achieve within the H2IOSC project. This approach is to be applied not only to manuscripts but also to all the other resources that will be gathered inside the project. This way DARIAH-IT will have a flexible model that can be hooked up to new information, coming from different discipline domains, without continual consistent effort. DARIAH-IT has worked towards this state-of-the-art across different national and European projects (Spadi et al. 2024), achieving good results to be integrated in the most recent H2IOSC project.

As part of the H2IOSC project, which aims to provide digital tools supporting research in the social sciences and humanities and cultural heritage, DARIAH-IT activities comprise the implementation of software technologies for the adaptation, integration, extension, and optimisation of existing or newly developed components, resources, and applications, with a particular focus on the field of digital philology and the tools, methods, and workflows related to it.

DOMAIN DIGITAL SERVICES: DIGITAL PHILOLOGY HUB (PILOT SERVICE)

DARIAH-IT establishes pilot projects as virtual research environments to evaluate user interaction and inform the optimisation of core research infrastructure components. These pilots serve as testbeds for project concepts and contribute directly to the development of research services. The Digital Philology Hub (DPH) is the pilot project developed by DARIAH-IT, focusing on overcoming technological and semantic challenges to collaborative, multidisciplinary research within the field, concentrating on early Italian texts, manuscript studies, and textual and material culture. The DPH consists of an application workflow for digital philology that aims to construct a critical edition assisted by digital and, in part, (semi-)automatic tools. The added value of the DPH lies precisely in the modular architecture of the system, whereby all the services necessary for the construction of the critical edition will be available in the same environment. The user can take advantage of a single service, focusing, in a vertical way, on a single phase of the philological work, or use multiple services chained together to produce a digital edition. Key functionalities include: a repository and visualisation system for digital manuscript images; procedures for manuscript description; innovative tools and procedures for manuscript and early print transcription, including AI-driven automated and semi-automated methods; image processing software for critical editions, integrating existing standards; software for automated and semi-automated collation of textual variants, also leveraging AI-driven methods; software for variant lexicography; tools for georeferencing historical data; and tools based on ontologies and semantic search.

SERVICE PROVISION: DARIAH SERVICE ORIENTED INFRASTRUCTURE (AEON), THE PLATFORM FOR ALL DARIAH-IT'S SERVICES

One of the most innovative elements presented as a service of DARIAH-IT developed within the H2IOSC project, is the possibility to describe, design, and execute scientific applicative workflows. This service focuses on the development and enhancement of a digital research plat-

form, emphasising improvements to user interaction, system architecture, and the provision of research tools. The platform's discovery mechanisms will be redesigned, and its capacity to deliver services to the research community will be expanded. A key element of this work is the creation of a new service-oriented infrastructure, allowing services publication, execution, composition, and orchestration. Research tools and services will be accessible through the platform's enhanced discovery interface, as well as through other interoperable platforms. Development efforts include the design and implementation of the new infrastructure, the modernisation of existing tools, and the establishment of policies to ensure interoperability and security. While specific tools and services will be prioritised through an iterative development process, potential examples include functionalities for connecting to external data resources, data processing and enrichment, semantic analysis of textual data, and the integration of these functionalities into comprehensive research workflows that adhere to established data principles. The potential reuse of existing resources will be evaluated throughout the development process. An existing resource catalogue, which currently showcases available research services, will be integrated and further developed.

DIGITAL MANAGEMENT SERVICES: METAFAIR ECOSYSTEM – DIGITAL RESOURCES LIFECYCLE MANAGER AND DESCRIPTOR

All the resources of DARIAH-IT will be harvested and managed by a dedicated software developed and released within the H2IOSC project. The data collected in the database of this infrastructure must comply with FAIR principles, and the database management tool has been designed accordingly. This involves ensuring data and format compatibility with established interoperability standards (e.g., CIDOC CRM), facilitating the integration of new resources, and enabling the extraction and transformation of data from various project components for use in pilot studies. The environment developed for DARIAH-IT, MetaFAIR Ecosystem (MFE), is based on MetaFAD, a multistandard platform with an open-source licence, which is a modular software for managing and cataloguing archival assets, art collections, and libraries in a single

integrated virtual environment, allowing immediate use via the web. It manages and organises the resource records management process from acquisition to use, communicating with linked open data. It allows the description of digital objects through a powerful and versatile digital asset management (DAM) and the creation of digital archives.

The MFE is also designed to support the FAIRification of resources by implementing data management processes and resource semantisation within its scope. Core functions currently under development include the import and management of vocabularies and other domain ontologies; the integration and management of mappings and models based on CIDOC CRM; compatibility with the H2IOSC Semantic Framework; and checks on the implementation of data import workflows.

CONCLUSIONS

The Italian National Plan for the Digitisation of Cultural Heritage (PND) states that to create a collaborative environment where diverse skills and resources can be shared and valued, it is crucial to support the creation of interconnected ecosystems that facilitate information sharing between various sectors, overcoming existing divisions (Ministero della Cultura 2023). The successful implementation of the H2IOSC federation implements this objective and strives to create an integrated research ecosystem where resources from different disciplinary domains can be shared, accessed, and reused in line with the FAIR principles and open science policies. DARIAH-IT is working towards this objective, supporting the implementation of executable workflows and Scientific Pilots to manage all the research steps. By implementing this environment, DARIAH-IT aims to provide an innovative and sustainable research ecosystem for research in the social sciences and humanities, as well as cultural heritage preservation. This will be achieved by bridging the gap in the transition to digital approaches in research activities, overcoming the obsolescence of current sector-specific research product systems, and maximising the potential impact of research communities by developing innovative approaches.

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OA SCHOLARLY PUBLISHING: MOVING BEYOND THE INSTITUTIONAL WEBSITE

MIHAELA BLAGAIĆ KIŠIČEK

Institute of Ethnology and Folklore Research

Zagreb, Croatia

mihaela@ief.hr

ORCID iD: 0009-0007-0360-5397

The paper explores ways to increase the visibility and impact of open access (OA) scholarly books through a case study of the Institute of Ethnology and Folklore Research in Croatia. Building on a poster presented at the 3rd DARIAH-HR international conference *Digital Humanities & Heritage* (2023), the study examines OA book publishing across three interconnected levels: the European Research Area (ERA), the national Croatian context, and institutional practice. At the European level, the paper outlines key policy and infrastructure developments shaping OA monograph publishing, including Open Access Publishing in European Networks (OAPEN), the Directory of Open Access Books (DOAB), cOAlition S, Science Europe, and the “Policy Alignment of Open Access Monographs in the European Research Area” (PALOM-ERA) project. These initiatives promote principles such as open licensing, quality assurance, interoperability, and sustainable dissemination. Against this backdrop, the Institute’s OA publishing practices are analysed, with particular attention to metadata standards, licensing, and dissemination. To contextualise the case study, the paper includes a comparative overview of OA book publishing at fourteen Croatian public institutes in the humanities and social sciences, revealing fragmented practices, limited policy support, and minimal use of persistent identifiers and open licences. The recent “Croatian Open Science Plan” is discussed as an important, though indirect, framework for strengthening OA books. The paper concludes that platforms such as OAPEN and DOAB significantly enhance discoverability, but only when supported by institutional commitment, standardised metadata, clear licensing, and coordinated national policies.

It argues that greater alignment between institutional, national, and European frameworks is essential for achieving sustainable impact for OA scholarly books.

Keywords: scholarly book publishing, institutional publishing, open access books, visibility, discoverability

INTRODUCTION

This paper is based on a poster presentation delivered at the 3rd DARIAH-HR international conference *Digital Humanities & Heritage* held in Zagreb, Croatia, in 2023 (Blagaić Kišiček 2023). It aims to explore ways to enhance the visibility and, ultimately, the impact of open access (OA) scholarly books published by the Institute of Ethnology and Folklore Research (hereafter referred to as the Institute).¹ The paper builds on the preliminary insights presented in the original poster, further developing them by addressing the same central question, while mapping the current situation at three levels: within the Institute, within the national context, and within the broader European movement towards OA publishing of publicly funded books.

Before turning to the Croatian institutional context, it is essential to situate these issues within the broader European Research Area (ERA), where a robust policy and infrastructure framework for OA book publishing has gradually evolved over the past decade. In light of existing European guidelines and recommendations, the paper then analyses the state of OA book publishing at the Institute, highlighting both the opportunities and challenges it faces in aligning with wider continental trends. To provide additional context, the discussion incorporates a small-scale study of publishing practices of fourteen comparable public institutes in the humanities and social sciences, each of which also serves as a publisher of scholarly books authored by its own researchers. This institutional comparison is complemented by a comprehensive and up-to-date overview of the national landscape for OA schol-

¹ In this paper, the term “books” refers to scholarly, peer-reviewed works – including monographs, book chapters, edited collections, critical editions, and other long-form academic outputs – as defined by the “Policy Alignment of Open Access Monographs in the European Research Area” (PALOMERA) project in its “Recommendations for Open Access Books” (Bandura-Morgan et al. 2024: 1).

arly book publishing. While Croatia still lacks a unified national policy regarding OA books, several promising developments and examples of good practice can already be observed.

The discussion concludes with findings that both confirm and expand upon those presented in the original poster. Specifically, platforms such as the Open Access Publishing in European Networks (OAPEN) and the Directory of Open Access Books (DOAB) are confirmed as effective tools for increasing the visibility and discoverability of OA scholarly books. However, their impact is seen as the final stage of a process that depends on the synergy of several key factors. The starting point is identified at the institutional level – within the Institute itself – as well as in the development and implementation of national policies supporting OA book publishing.

EUROPEAN RESEARCH AREA (ERA) LANDSCAPE

ERA provides the broader context for the development of OA book publishing over the past decade. Since 2017, a series of European initiatives, policy frameworks, and collaborative projects have shaped a more mature and coordinated approach to OA scholarly books, particularly in the humanities and social sciences. One of the earliest European OA book initiatives dates back to 2008, when OAPEN was launched. What started as a European Commission project soon became a legal non-profit foundation based in the Netherlands, offering a platform for hosting, disseminating, and preserving OA books. The OAPEN library was launched in 2010 at the Frankfurt Book Fair. In 2012, OAPEN established DOAB, which remains one of the most important discovery services for OA monographs. However, it was not until the publication of the Knowledge Exchange landscape study (Ferwerda et al. 2017) that significant efforts began to map and analyse the European OA books ecosystem. Since then, several initiatives and projects have been undertaken, and key documents have been published by major stakeholders – including cOAlition S, Science Europe, and, most recently, PALOMERA – driving the European transition towards OA book publishing.

COALITION S

Launched in 2018 by a group of European research-funding organisations and international partners, cOAlition S aims to ensure full and immediate open access to all research outputs. Among its ten founding principles, one explicitly extends OA requirements beyond journal articles to include monographs and book chapters. In practice, this means that all academic books resulting from research funded by cOAlition S member organisations should be openly accessible upon publication (cOAlition S 2021). The coalition has also agreed upon two key aspects of OA – embargo periods and licensing – with funders generally supporting short or zero embargoes and the use of Creative Commons (CC) licences, preferably CC BY. Several cOAlition S funders, including the Slovenian Research and Innovation Agency (ARIS) and UK Research and Innovation (UKRI),² have since adopted or developed their own OA policies for academic books that reflect these principles.

A practical example is provided by UKRI, which introduced a new OA policy for monographs, book chapters, and edited collections arising from UKRI-funded research, effective from 1 January 2024 (UKRI 2021). Unlike in Croatia, where academic books are largely state-subsidised, UK researchers are typically responsible for securing their own publishers. To support the initial implementation of the policy, UKRI published guidance specifically aimed at publishers, particularly small and specialist presses, and introduced a transitional “bedding-in” period. While allowing flexibility in OA models, the policy prioritises the diamond OA model, in which neither authors nor readers pay book processing fees (BPCs). To enhance discoverability, UKRI ensures that all funded titles are listed in DOAB and is collaborating with OAPEN to make them available through its library as well.

SCIENCE EUROPE

In 2019, Science Europe, an association representing national research-funding and research-performing organisations across thirty European countries (including the Croatian Science Foundation, which joined

² In Croatia, the equivalent body to these research funders is the Croatian Science Foundation (*Hrvatska zaklada za znanost* (HRZZ)).

in 2013), published its “Briefing Paper on Open Access to Academic Books” (Science Europe 2019). The document identifies a broad range of stakeholders engaged in this transition: research-funding organisations (RFOs), such as the Croatian Science Foundation; research-performing organisations (RPOs), such as the Institute; libraries; academic researchers; learned societies and publishers.

Rather than prescribing a single model, Science Europe aims to guide institutions in developing policies tailored to their individual contexts while remaining aligned with five core principles:

1. explicit institutional policies – encouraging full and immediate OA for books and limiting embargoes to twelve months at most;
2. transparent funding models – allowing multiple business models as long as costs are openly disclosed;
3. quality assurance – ensuring peer review and editorial processes, clearly described in institutional policies, remain rigorous and transparent;
4. licensing and copyright retention – recommending that authors or institutions retain copyright and use open licences, preferably CC BY;
5. dissemination, discoverability, and preservation – requiring comprehensive metadata, inclusion in major discovery systems such as DOAB, and long-term digital archiving at either a national or international level. Libraries are encouraged to integrate OA book collections (e.g. OAPEN Library, OpenEdition Books, and DOAB) into their catalogues. Authors are likewise encouraged to advocate for open licensing to ensure the widest possible accessibility and long-term preservation.

These principles have since informed national and institutional OA strategies across Europe.

PALOMERA

The PALOMERA project, which ran from 2023 to 2024, built on the work of Science Europe and cOAlition S while adopting a more empirical and policy-oriented approach. Its central goal was to investigate why

so few European OA policies explicitly include books and to propose practical, evidence-based recommendations for change. Recognising funder and institutional policies as key drivers of change, the project team analysed 246 OA policies from thirty-nine European countries. These materials, together with reports, statistics, surveys, and expert interviews, were compiled into The Knowledge Base, an openly available resource now hosted on the OAPEN website (OAPEN n.d.a).

One of PALOMERA's key findings (PALOMERA 2024) was that many OA policies either omitted books entirely or referred to them in vague and inconsistent terms, leaving funding and support mechanisms unclear or absent. Drawing on extensive evidence collected across Europe, the project concluded that “an internationally uniform approach to setting and formulating OA book policies is not viable” (Stern et al. 2024: 2). Instead, it proposed a set of overarching, adaptable, actionable recommendations, offering general advice relevant to all stakeholders as well as tailored guidance for eight key groups, including RPOs and RFOs, national policymakers, libraries, researchers, learned societies, infrastructure providers, and academic publishers. These recommendations address the key aspects of OA book publishing – policy development, metadata standards, rights and licensing, funding, and long-term preservation – and are practical in nature, offering specific advice, examples of best practices, and links to contextual and other supporting materials.

The project also established the Funder Forum, later evolving into the Policy Forum for Open Access Books, coordinated by OAPEN. This ongoing platform brings together research funders from across the ERA to discuss challenges, share best practices, and explore ways to align policies. The forum exemplifies a collaborative approach to policy development, promoting harmonisation and broader adoption of OA for scholarly books across Europe. While Croatian funders have not yet participated, the forum represents a valuable opportunity for future engagement and alignment with European trends.

Taken together, these European initiatives – OAPEN, cOAlition S, Science Europe, and PALOMERA – form a coherent policy and infrastructure ecosystem that supports the growth of OA book publishing.

The following section turns to the Croatian context, examining how institutional publishers such as the Institute operate within this evolving European framework.

OA BOOK PUBLISHING AT THE INSTITUTE OF ETHNOLOGY AND FOLKLORE RESEARCH

Following the broader European developments outlined above, this section examines OA book publishing at the Institute as a case study of how small research institutes can engage with the principles and infrastructures promoted within the ERA.

BACKGROUND AND PUBLISHING APPROACH

In 2015, the Institute began publishing its backlist titles as OA books. This initiative has followed a two-pronged approach. More recent titles are made available on the Institute's website under the "Publications/Digital Editions" section. Older titles – typically those published twenty or more years ago, although no strict age limit is defined – are deposited in the institutional repository (*Digitalni repozitorij Instituta za etnologiju i folkloristiku* (DIEF)) (IEF n.d.).

At the time of writing, 73 OA titles were available across both platforms. On average, two to three new titles are published yearly on the institutional website, and four to five more are added in the repository. Titles hosted on the website include only basic metadata: author, title, publisher, year of publication, and, in some cases, the retail price, along with a link to the OA PDF version of the book. In contrast, titles in the institutional repository are accompanied by a more comprehensive metadata record, detailing type, title, author/editor, publisher, place, and year of publication, page count, keywords, the international standard book number (ISBN), and additional notes. Twenty-five books have been assigned separate ISBNs for their electronic and print versions. Only one book is explicitly licensed (CC BY-NC-ND), while the others are available with the author's permission but without standardised licensing. This distinction reflects the Institute's evolving approach to OA: balancing openness with author autonomy.

PUBLISHING MODEL AND LICENSING PRACTICES

Consistent with this approach, for at least the past decade, every print book published or co-published by the Institute has included a clause in the author's contract specifying a one- to two-year embargo before the book becomes openly accessible. The state funder does not mandate open access. Rather, it has been introduced in response to authors' desire to make their work freely accessible. The publishing model follows the diamond OA approach, a practice made possible largely due to the strong reliance of institutional scholarly publishing in Croatia on state funding. This model represents *gratis* OA, in which scholarly books are freely available online without registration or other access barriers. A more permissive model, *libre* OA, removes some or most permission barriers through the use of a CC licence (Suber 2008). As noted above, to date, only one of the Institute's OA publications, published exclusively as an e-book, meets the *libre* standard, highlighting the gap between current practice and international recommendations.

DISCOVERABILITY AND INTEROPERABILITY

While the number of titles accessible in the virtual OA environment continues to grow, the Institute has yet to fully leverage the opportunities this environment provides. Simply being available online does not guarantee they will be found or cited. Discoverability and visibility depend on a combination of interrelated factors, including compliance with interoperability standards, indexing in trusted repositories, and institutional and national support. It also requires inclusion in library catalogues – either through services such as DOAB, provided that its criteria are met (as will be discussed in one of the following chapters), or via direct metadata deposit – and active dissemination through academic and social media channels.

To elaborate on the first factor – compliance with interoperability standards – in the OA context, this involves standardised metadata, persistent identifiers, clearly defined licensing rights, open and machine-readable content formats, and protocols for metadata harvesting. Together, these elements ensure that digital content can be

efficiently shared, discovered, used, and preserved across diverse platforms, systems, and services.

The following subsections will examine how some of these factors apply to the OA books published by the Institute.

METADATA STANDARDISATION

As previously noted, the books listed under the “Digital Editions” section on the Institute’s website are accompanied by a relatively limited set of metadata, typically including only the author, publisher, year of publication, and price. In contrast, the books deposited in the institutional repository use the Dublin Core standard, ensuring the level of metadata standardisation necessary for interoperability.

A practical solution to the limited metadata on the website would be to link each book, not to the PDF currently hosted there, but to the repository record. This would require uploading the full texts to the repository and providing comprehensive metadata, including information such as the language of the full text. Ensuring that metadata and abstracts are available in English would significantly increase the books’ visibility and accessibility to an international audience.

PERSISTENT IDENTIFIERS

In the context of OA publishing, the central persistent identifier is the digital object identifier (DOI), which ensures that works can be reliably cited and consistently linked. Ideally, DOIs should be assigned to both entire books and, for edited collections, to individual chapters. In Croatia, DOIs are issued by the Croatian DOI Office, which acts as an intermediary between publishers and the DOI registration agency, Crossref. Currently, however, DOI assignment is limited to journal publications. Institutions wishing to register DOIs for books or book chapters must become members of Crossref and pay the associated membership fee. One example of such an arrangement in the local context is the Press of the Faculty of Humanities and Social Sciences at the University of Zagreb. The Institute has not yet explored this possibility.

Another key identifier is the Open Researcher and Contributor ID (ORCID iD), which ensures accurate author attribution, particularly in cases where researchers have identical or similar names. While not yet required by the Institute, most researchers have obtained one independently.

LICENSING RIGHTS

Clearly defined licensing information anchors a publication more securely within the OA landscape. It articulates the legal terms under which a book can be accessed, shared, reused, and redistributed. The most widely used and recognised form of such licensing is the CC framework. These licences are machine-readable, incorporating code that enables platforms such as DOAB and Google Scholar to interpret and process licence terms automatically and, as a result, to index and retrieve OA books more efficiently.

Recent European recommendations (Science Europe 2019; Bandura-Morgan et al. 2024) advocate for open licensing by default, ideally CC BY, and emphasise the rights retention by authors and institutions. The PALOMERA project is very clear about this:

RFOs, RPOs, and policymakers should require researchers, and their institutions, to hold copyright over an openly licensed book, chapter or long-form publication OA by not transferring those rights or (indefinite) exclusive publishing or permission rights to the publisher. This requirement can be supported by means of an institutional rights retention policy where feasible.

When publishing OA, researchers and institutions should only sign non-exclusive publishing agreements. (...) Institutional OA policies should encourage staff to reserve the right to secondary publication when signing a publishing contract and to archive a version of their books in institutional repositories after the legally prescribed period has expired (Bandura-Morgan et al. 2024: 21–22).

Among researchers at the Institute, and likely among many researchers across the humanities and social sciences, awareness of the benefits and implications of open licensing remains limited. It is often accompanied by concerns about losing control over how one's work is used, adapted, or cited. This is understandable, as in these fields intellectual

property is closely tied to scholarly identity and reputation. However, as highlighted in the OAPEN OA Books Toolkit and related resources (OAPEN 2024), the fear that licensing one's work means that "anyone can do anything with my work" is unfounded: CC licences allow authors to retain significant rights while making their work accessible under clearly defined conditions.

DISSEMINATION

In the context of OA books, dissemination refers to ensuring broad availability and accessibility across multiple platforms. A crucial aspect of this process is depositing books in trusted repositories, which also supports long-term digital preservation. The initial step typically involves depositing the work in an institutional repository. In Croatia, deposit into the national repository system, Digital Academic Archives and Repositories (DABAR), is strongly encouraged and will be discussed in more detail later. Following this, dissemination can be expanded through various international third-party platforms, which either index or directly host the books. Some are freely available to publishers, while others operate on a low-cost, fee-based model.

OAPEN (OAPEN n.d.b) is an open infrastructure service dedicated exclusively to OA books. Operated by the non-profit OAPEN Foundation, it manages three main platforms:

- OAPEN Library – a central repository for hosting and disseminating OA books;
- OAPEN Open Books Toolkit – a resource designed to help authors better understand the OA book publishing process;
- Directory of Open Access Books (DOAB) – a discovery service that indexes peer-reviewed OA books, developed in partnership with OpenEdition.

To participate in OAPEN, publishers must undergo a review process to demonstrate that their publications meet academic peer-review standards and are released under an open licence. Once approved, books and book chapters can be deposited into the OAPEN Library. Publishers are required to pay a participation fee. For frontlist publications,

a one-time fee of EUR 10 per book or book chapter is charged. For backlist publications, a recurring fee of EUR 2 per book or chapter applies. An annual minimum fee of EUR 175 is set, which generally exceeds the publishing output of most small- and medium-sized research institutes in Croatia. However, publishers affiliated with a library or an institution with an active OAPEN membership are exempt from this fee. Active OAPEN support is available through four support packages, each priced differently. For example, a funding body such as the Croatian Science Foundation would pay an annual fee of EUR 8,000. Institutions from low- and middle-income countries, such as the Institute, have the option to pay EUR 500 per year to support OAPEN alone, or EUR 1,000 to support both OAPEN and DOAB. A 25% discount is available for consortia with ten or more participating organisations.

DOAB (DOAB n.d.a), a discovery service provided by the DOAB Foundation and closely connected with OAPEN, is a key discovery index for OA books. Its services are offered free of charge. To be indexed, a publisher must ensure that works undergo independent, external peer review before publication and are released under an open licence. In addition to these two main criteria, other requirements must also be met before the publisher can submit metadata for inclusion in the DOAB catalogue. DOAB does not host full texts; it provides metadata that can be integrated into library catalogues and discovery systems. Crucially, DOAB only includes books that are freely shareable (i.e., under an open licence); books that are only free to read but do not allow reuse are not eligible. In contrast, the OAPEN library hosts books that can be freely read as well as those that can be freely shared under open licences. To streamline the process for publishers and enhance discoverability, DOAB collaborates with several other platforms, such as OAPEN Library, OpenEdition, Project MUSE, JSTOR, and others, through the DOAB Trusted Platform Network (DOAB n.d.b). This network allows verified OA books to be automatically listed in the DOAB catalogue.

Project MUSE (Project MUSE n.d.), operated by Johns Hopkins University, is another platform that supports OA content and not-for-profit publishing. It aggregates journals and books from university presses and non-profit publishers, primarily in the humanities and social sciences, and ensures their discoverability in global library systems. Through its Open Access Books programme, publishers can

make their books available on the platform. While the service is not free, costs are significantly lower than commercial platforms, with a one-time hosting fee of USD 100 per title.

Zenodo, the EU's Open Research Repository, is designed to share and preserve outputs from EU-funded projects, such as Horizon Europe, the European Atomic Energy Community (EURATOM), and previous framework programmes, across all disciplines. Accepted content includes datasets, reports, project deliverables, journal articles, book chapters, and more. Each uploaded item is assigned a DOI.

Hosting or indexing through these platforms substantially increases the likelihood of OA books being indexed in databases such as Google Scholar, as well as their inclusion in library catalogues. While some steps, like improving metadata and standardising licensing, can and should be implemented at the institutional level, sustainable dissemination and visibility ultimately require national coordination and participation in European infrastructures. The next section, therefore, broadens the scope to consider institutional scholarly publishing in Croatia more generally, situating the Institute's efforts within a national context marked by uneven OA practices and limited policy support.

INSTITUTIONAL SCHOLARLY BOOK PUBLISHING IN CROATIA

Iva Melinščak Zlodi's overview of the scholarly book publishing landscape in Croatia (2023) has shown that the majority of scholarly publishing takes place in the private sector. Most of this publishing is carried out by small- or medium-sized companies, which tend to lack both the motivation to seriously consider a transition to OA and the practical knowledge to implement it. Although the public sector remains cautious about OA, institutional publishing has taken a measured step forward. The "Developing Institutional Open Access Publishing Models to Advance Scholarly Communication" (DIAMAS) project defines institutional publishing as scholarly publishing "by an institution, unit, or team that is part of an institution" (DIAMAS n.d.). Examples of such institutions in Croatia include research-performing organisations like the Institute, as well as learned societies, such as the Croatian Academy of Sciences and Arts, and university presses.

In Croatia, as in other countries, institutional publishing is typically non-profit and supported by state funding through various mechanisms. At the Institute, for instance, several book titles are submitted each year for subsidies provided by the Ministry of Science, Education and Youth of the Republic of Croatia. These subsidies usually cover proofreading and printing costs, while typesetting, design (at least partially), and promotion are carried out by the Institute's staff and the authors as part of their regular responsibilities. Any revenue generated from book sales goes back to the institution and is reinvested. Notably, the Ministry of Science, Education and Youth does not require that subsidised books be made OA; the decision is left entirely to the institution and the authors. At the Institute, making books OA is standard practice, but this is not always the case at other institutions. Since openness is neither a requirement for receiving subsidies nor a factor in academic promotion, many authors and institutions choose not to pursue it. It would not be an exaggeration to say that in Croatia, there is still a significant lack of awareness and understanding of OA and the opportunities it offers. This gap in knowledge affects all parties involved – authors, publishers, and funders alike.

OA PUBLISHING IN HUMANITIES AND SOCIAL SCIENCES INSTITUTES

According to the Ministry of Science, Education and Youth (Ministry of Science, Education and Youth 2025a), there are twenty-five public research institutes in Croatia, fourteen of which operate within the humanities and social sciences. As part of the research conducted for this paper, the Institute's OA publishing output was compared with that of these fourteen institutes, all of which are small or medium-sized organisations that, with one exception, maintain their own publishing programmes.

The institutes' websites served as the primary sources of information about their publishing activities and policies. The websites' publishing sections were examined twice, first in September 2023 and again in April 2025. The listed publishing output was analysed using one main criterion: whether the books were OA or not. The OA titles

were then further examined in terms of metadata standards, storage platforms, the use of DOI, and licensing practices. The overall situation changed so little between 2023 and 2025 that the difference is negligible. Four of the fourteen institutes keep their entire publishing output behind a paywall. The remaining ten make at least part of their publications openly accessible, typically newer titles or those published as part of European Research Council-funded projects. The analysis further showed that no publicly available OA policies, whether for research outputs in general or for books in particular, were found on the fourteen examined websites. This, however, may change in the near future, since the recently published “The Croatian Open Science Plan” (Ministry of Science, Education and Youth 2025b) encourages public institutes to develop and adopt their own institutional open science policies. At present, only one surveyed institute, the Institute of Art History, has a general open science statement published on its website, under the “Library” section (Institute of Art History n.d.). It begins by expressing the organisation’s general support for open science principles, followed by a brief overview of the online resources where information about its publishing output, library and archival holdings, and other freely available content can be found.

The Institute of Social Sciences Ivo Pilar, a prolific publisher that makes part of its output (primarily edited collections) available online, practices a form of OA that aligns more closely with the *gratis* rather than the *libre* model. This is made clear in the accompanying disclaimer, which states: “The full texts of these publications may be used free of charge for personal or educational purposes, provided that the authors’ and publishers’ copyrights are respected” (The Institute of Social Sciences Ivo Pilar n.d.).

OA or digitally published books by the institutes surveyed are most often made available as PDF files stored in three ways: most commonly on institutional websites, less frequently in institutional repositories, and, in two cases, in the national repository system DABAR. For example, the Institute of Philosophy deposits its digital books in DABAR. However, access is restricted to institute employees, while external users need to request permission. Another institute that deposits its OA books in DABAR is the Institute of Art History, where the books are freely accessible to all users.

Metadata practices are generally inconsistent and often inadequate. They range from moderately comprehensive records – including title, author/editor, publisher, place and year of publication, number of pages, and occasionally ISBN – to minimal entries including only the title and author. Explicit CC licences and DOIs are so rare that they are practically non-existent. The only consistent pattern that emerges from this niche case study is, paradoxically, the absence of consistency, highlighting the lack of national policy frameworks that would mandate OA for state-funded publications, a situation that persisted until the recent publication of the “Croatian Open Science Plan” (2025).

OA BOOK POLICIES IN CROATIA

At present, there is still no national OA policy for books in Croatia. As the main policymaker in the field of science and research, the Ministry of Science, Education and Youth has yet to produce such a policy. Similarly, the Croatian Science Foundation, the country's primary research-funding body, does not currently have a dedicated OA policy for books. However, a “Croatian Open Access Declaration” (Croatian Open Access Initiative 2012) is a foundational document that emphasises the importance of OA to publicly funded research and its outputs, and calls for the development of sustainable e-infrastructure to support it. More recently, in 2023, the Ministry of Science, Education and Youth appointed the Croatian Open Science Cloud Initiative (HR-OOZ) to draft the “Croatian Open Science Plan”. The Plan referred to OA books in the context of ensuring that all books, fully or partially funded by public sources, are made openly accessible, with rights retention and under open licences. Under the name “Croatian Open Science Plan”, the Plan was approved by the Initiative's Council and adopted by the Ministry of Science, Education and Youth in May 2025 to provide a national framework for open science implementation (OpenAIRE 2025).

If there was any hope that the Plan would introduce a dedicated OA book policy – by proposing, for example, the creation of a national OA book platform equivalent to the Portal of Croatian Scientific and Professional Journals (HRČAK), or perhaps a separate OA book funding scheme – this unfortunately did not come true. What the Plan

does do, however, is encourage public higher education institutions and research institutes to adopt institutional OA policies and the corresponding action plans. These policies require authors to deposit all publicly-funded research outputs in open repositories under open licences, either immediately after publication or following a short embargo period. Authors are also encouraged, though not mandated, to publish in OA venues and under open licences. The Plan notably strengthens the role of institutional repositories and the national repository infrastructure DABAR as the primary infrastructure for OA.

Although the Plan does not explicitly mention books, its policy wording is broad enough to implicitly include OA books. This means that the Plan's main recommendations – namely, the adoption of institutional policies, the deposit of research outputs in open repositories, and the encouragement of open licences and no-fee access – also apply to them. Building on this framework, individual institutional policies can be more specific, for example, by introducing tailored provisions for different types of research outputs, such as research data, theses, journals, and books. Even before the Plan was formally approved by the Ministry of Science, Education and Youth, most major Croatian universities, including those in Zagreb, Split, Rijeka, Osijek, Zadar, and Slavonski Brod, had already adopted their own institutional open science policies. These policies aim to make all research publications produced by their staff and students, as well as institutional publications, available in OA. Public research institutes are now expected to follow suit, and at the Institute, this work has already begun.

E-INFRASTRUCTURE FOR OA BOOK PUBLISHING

In advancing OA for scholarly books, universities can rely on the technical infrastructure developed and maintained by the University Computing Centre (SRCE), particularly through platforms like DABAR and the open-source publishing system Open Monograph Press (OMP). Together, these systems enable institutions to establish sustainable, locally managed publishing workflows, reduce dependence on commercial platforms, and strengthen the visibility and accessibility of their scholarly publications.

SRCE has implemented OMP, an open-source press management and publishing platform available for use by any academic or research institution in Croatia. OMP is specifically designed for managing and publishing scholarly books, including monographs, edited volumes, and conference proceedings. It provides a comprehensive, end-to-end solution that supports the entire publishing workflow, from manuscript submission to final publication, and is tailored to meet the needs of academic and university presses.

OMP supports standard metadata formats and aligns with OA initiatives, while also enabling the assignment of DOIs at both the book and chapter level, provided that each chapter has a dedicated landing page. Although the current Croatian implementation does not yet offer individual landing pages for chapters, this feature is planned for future development. The platform allows the organisation of various book series or serial publications, such as conference proceedings, into distinct collections. Each series can have its own webpage that displays all related volumes, along with key details such as the series description, editorial board, international standard serial number (ISSN), and more. At present, publishing is only available in PDF format, though the ePub format may be offered in the future. So far, three university presses in Croatia have been using this programme: FF Open Press (Faculty of Humanities and Social Sciences, University of Zagreb), Morepress (University of Zadar), and FFOS e-naklada (Faculty of Humanities and Social Sciences, University of Osijek). As noted by Melinščak Zlodi of the FF Open Press, this model can be described as “zero-budget”, as the development of the platform has been carried out entirely by the Faculty’s IT and library staff within the scope of their regular duties (Melinščak Zlodi et al. 2019).

Another e-infrastructure, originally not designed as a platform for e-books but increasingly taking on that role in an “unexpected but welcome” (Melinščak Zlodi 2024) turn of events, is DABAR – the national infrastructure for institutional repositories. There is a modest trend of using institutional repositories as the primary publication platform for OA books (Melinščak Zlodi 2024), which aligns with the statement on Croatia’s official national open science website that institutional repositories play a key role in enabling OA by supporting the storage and

dissemination of research outputs (Centar za znanstvene informacije n.d.). In this context, DABAR could play a key role in the future as it may become the national access point for scholarly books, much like HRČAK is for journals. DABAR appears to address many of the challenges faced by institutional OA book publishers: it uses standardised metadata, ensures digital preservation, and offers much better visibility in Google Scholar compared to OMP presses. For this reason, Melinščak Zlodi speculates about the possibility of creating a “common access point for books based on repositories – like an overlay repository consisting only of open access books” (PALOMERA 2023). However, challenges remain regarding the use of DOIs and licensing, as the vast majority of OA publications in DABAR lack both a DOI and a clearly defined licensing. At present, DABAR hosts 185 institutional repositories.

CROATIAN INITIATIVE FOR OPEN SCHOLARLY BOOKS

The three university presses using the OMP platform are also among the five founding institutions of the Croatian Initiative for Open Scholarly Books, the other two being the Centre for Electronic Publishing (CEN) at the University of Rijeka and the e-Leks platform of the Miroslav Krleža Institute of Lexicography. Launched in 2023, the initiative aims to establish a shared national infrastructure and access point for OA books – designed to be open, non-profit, interoperable, and financially sustainable (Croatian Initiative for Open Scholarly Books n.d.). This infrastructure would be overseen by the academic community and open to all stakeholders from both the public and private publishing sectors. Another key objective is the long-term preservation of scholarly books, regardless of publisher, an essential component of the broader OA books ecosystem.

All five institutions already operate fully developed OA book publishing systems. While the FF Open Press, Morepress, and FFOS e-naklada use the OMP platform, a contrasting example is provided by CEN. Their website hosts links to OA books published by various university faculties, which are deposited in institutional repositories that are part of the national repository network, DABAR. As noted on the CEN’s website, this has been achieved using tools already available within the uni-

versity. The Miroslav Krleža Institute of Lexicography, in turn, operates its own OA publishing platform, e-Leks: online izdanja. It caters to its specific publishing focus: encyclopaedias, encyclopaedic monographs, lexicons, dictionaries, and related formats.

The OA publishing activities carried out by the Initiative's founders can serve as both a model and a source of inspiration for other institutions seeking to launch or advance their own OA publishing efforts. The Initiative also welcomes support from institutions and individuals through the addition of their signatures. The progress made by the members of the Initiative mirrors the broader developments within the ERA, where OA scholarly book publishing has been steadily expanding since 2017.

FURTHER ACTIONS

The analysis of OA book publishing at the Institute provides a concrete institutional perspective on broader structural issues shaping scholarly book publishing in Croatia. While important progress has been made, particularly in making a growing number of titles freely available online, further action is required at multiple levels to ensure that OA books achieve meaningful visibility, interoperability, and long-term impact.

FURTHER ACTIONS AT THE INSTITUTIONAL LEVEL

At the Institute, the foundation for OA book publishing is already in place. The steady growth of OA titles demonstrates both institutional commitment and author support. However, several targeted improvements are necessary for these publications to achieve broader impact. First, the systematic assignment of persistent identifiers, particularly DOIs, should be addressed at the institutional level. Although DOI registration for books is not yet widespread in Croatia, joining Crossref – either independently or through a consortium – would significantly improve citation, tracking, and integration into global scholarly infrastructures. Second, licensing practices should be clarified and standardised. While the current approach reflects a pragmatic compromise between openness and traditional copyright concerns, shifting

towards the routine use of CC licences would provide legal clarity and enable reuse, indexing, and automatic discovery. Institutional guidance and author education will be crucial in addressing persistent concerns around loss of control and misuse. Third, the metadata quality and consistency require improvement. Linking the Institute's website directly to repository records, rather than standalone PDFs, would allow richer, standardised metadata to be exposed to harvesting services. Providing English-language metadata and abstracts would further increase international visibility. Finally, while depositing books in the Institute's repository is a necessary first step, inclusion in the national repository system DABAR should be prioritised. This would ensure standardised metadata, long-term preservation, and greater visibility in discovery services such as Google Scholar. Indexing in DOAB represents an important additional goal. Although DOAB indexing is free of charge, it requires publishers to meet certain criteria. Meeting these criteria, if not already fulfilled, would, among other benefits, ensure a clearly defined quality-control process (e.g. peer review) and help resolve licensing and copyright issues.

FURTHER ACTIONS AT THE NATIONAL LEVEL IN CROATIA

Many of the challenges identified at the Institute are shared by institutional publishers across Croatia. The absence of a dedicated national policy for OA scholarly books has resulted in fragmented practices, inconsistent metadata standards, and limited engagement with international infrastructures. The recent adoption of the "Croatian Open Science Plan" marks an important turning point. Although the Plan does not explicitly single out books, its broad recommendations – repository deposit, encouragement of open licensing, and the development of institutional OA policies – create a framework within which OA book publishing can be strengthened. Public research institutes now have an opportunity to develop more explicit internal policies addressing books as distinct scholarly outputs. At the same time, national funders and ministries should take a more active role. Financial and organisational support for participation in international infrastructures such as OAPEN would enable smaller publishers to overcome cost barriers. Coordinated national support, be it through consortium membership,

targeted funding schemes, or shared services, would significantly enhance the sustainability and visibility of Croatian OA books. Equally important is the continued development and promotion of the national e-infrastructure. Platforms such as DABAR and OMP, supported by SRCE, already provide the technical backbone for institutional OA publishing. Strengthening licensing practices, DOI implementation, and metadata enrichment within these systems would allow them to function not only as repositories but as fully integrated components of the European OA books ecosystem.

CROATIA WITHIN THE WIDER EUROPEAN OPEN ACCESS LANDSCAPE

Croatia's current position reflects a broader pattern observed across Europe before recent policy interventions: strong technical capacity at the institutional level, but limited coordination and policy support for OA books. European initiatives, such as cOAlition S, Science Europe, and PALOMERA, demonstrate that there is no single model for OA book publishing, but rather a shared set of principles – open licensing, quality assurance, interoperability, and sustainability – adapted to national contexts. By aligning institutional and national practices with these principles, Croatia has the opportunity to integrate more fully into the ERA's OA infrastructure. Participation in platforms such as DOAB and OAPEN, engagement with policy forums coordinated by OAPEN, and adoption of rights retention and open licensing policies would allow Croatian scholarly books to circulate more widely beyond national boundaries. Importantly, much of the necessary infrastructure is already in place. What remains is the strategic alignment of institutional practices, national policies, and European frameworks. In this sense, Croatia is in a good position to move from isolated examples of good practice towards a more coherent and sustainable OA book publishing system.

CONCLUSION

This paper shows that increasing the visibility and impact of OA scholarly books requires more than simply making them freely available on-

line. The case of the Institute illustrates how institutional commitment, when combined with improved metadata, licensing, and dissemination practices, can significantly enhance discoverability. At the national level, the adoption of the “Croatian Open Science Plan” provides a crucial policy framework, even as dedicated support for OA books remains underdeveloped. Within the wider European landscape, the Croatian experience mirrors earlier stages of OA book policy development, suggesting that alignment with existing European infrastructures and recommendations offers a realistic and effective path forward. Together, these findings underscore that the success of OA scholarly book publishing depends on coordinated action across institutional, national, and European levels.

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Linnaeus University, Faculty of Arts and Humanities, Department of
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Institute of Ethnology and Folklore Research, DARIAH-HR, Croatia

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Librarianship, Italy

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University of Zadar, Department of Information Sciences, Centre for
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University of Applied Sciences Potsdam, Germany

Tihomir Živić

Josip Juraj Strossmayer University of Osijek, Faculty of
Agrobiotechnical Sciences Osijek, Croatia

Anamarija Žugić Borić

Institute of Ethnology and Folklore Research, DARIAH-HR, Croatia

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The volume makes a significant contribution by bringing together diverse perspectives on digital humanities and demonstrating the interplay between theory, methodology, and practice. A key contribution lies in the critical reflection on emerging technologies. Jovanović's discussion of LLMs, for instance, raises important epistemological questions regarding the outsourcing of interpretation and the potential transformation of scholarly work. At the same time, applied studies such as "Preserving the Past, Shaping the Future: Heritage-Based STEM Workshops in Ivanić-Grad, Croatia" show how digital humanities methodologies can be implemented in educational and community contexts. The volume thus contributes both to theoretical debates and to practical innovation within the field.

Iva Rosanda Žigo

University North, Croatia

The volume will be of interest for national as well as for international audiences. Firstly, it would be highly relevant to digital humanities researchers seeking to understand how computational methods are transforming traditional disciplines, from philology to heritage studies. (...) By integrating traditional inquiry with modern computational approaches, the collected work demonstrates how digital methods can preserve cultural heritage, broaden access to knowledge, and critically engage with the social and ethical implications of technology. Collectively, the papers illuminate methodological innovations and theoretical insights that advance the discipline and its role within the humanities, making this volume a meaningful and influential scholarly contribution.

Dimitar Iliev

Sofia University "St. Kliment Ohridski", Bulgaria