



Cost Action CA 21161
DOI: 10.5281/zenodo.17540237

A New Ecosystem of
Early Music Studies



CESR-RicercarLab
ISBN: 979-10-981515-07



MUSICOLOGY AS DATA SCIENCE AND HERITAGE SCIENCE

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How to quote: Philippe Vendrix and Rebekah Ahrendt, eds, *et al.*, *Musicology as Data Science and Heritage Science*,
Tours, CESR, 2025.

This publication is based upon work from COST Action Earlymusic CA21161, supported by COST (European Cooperation in Science and Technology)".

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Abstract:

This collective guide explores the transformative intersections of musicology with data science and heritage science in the European context. It positions musicological research as both a model for and contributor to broader cultural heritage, analyzing its tangible and intangible dimensions. The report reviews advances in research infrastructures, including the European Open Science Cloud, ECHOES, and E-RIHS, highlighting challenges and opportunities for integrating music into transnational heritage frameworks. It surveys the complexity of music data—notation, audio, metadata, and visual sources—and emphasizes standardised methods for cataloguing and preservation. The text critically assesses legal, policy, and technical barriers to digitising and reusing musical materials, advocating for legal reforms and open science principles. New publication paradigms are proposed, leveraging digital tools to expand access and impact. The role of musicologists in public engagement, education, and fostering research communities is underscored as crucial for sustainability. Best practices and collaborative models link musicological data to broader digital humanities and preservation strategies. Ultimately, the guide calls for active participation in European policy and research networks to enhance musicology’s role in shaping and disseminating cultural heritage for future generations.

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Introduction

The European Commission considers the music sector vital to safeguarding Europe's cultural diversity and to strengthening its competitiveness. Music is the universal language of humankind and holds a unique, creative and cohesive power for both society and the individual. It also has great economic importance. The music sector is the third largest employer within the cultural and creative industries in the EU. Based on small and medium businesses, the European music sector is very dynamic and innovative, and it has an important growth potential.¹

Cultural heritage encompasses both the tangible and intangible, and is a vital component of Europe's cultural landscape and a key term for many funding agencies. Musical heritage, including both its material and sonic aspects, is an essential part of European cultural objectives. As both tangible and intangible heritage, music and its related products and systems of knowledge—most notably, musicology—can serve as both test cases and models for other branches of heritage. Yet, music remains underrepresented in both policy and heritage science infrastructures.

Musicology and musical heritage are deeply interconnected. Musicologists not only study the history, theory, and cultural contexts of music, but they also actively shape how musical heritage is preserved, understood, and experienced today. Their work extends far beyond academic research: it informs and constructs editions of musical works, performances, recordings, audiovisual productions, heritage site programming, and public education initiatives, providing essential historical, analytical, and interpretive context. The work of musicologists has also enabled large-scale data projects on musical corpora and created innovative digital tools for the optical recognition of musical notation and analysis of musical structures, among others. Musicologists are involved in every step of these processes, often through publicly-funded research that ensures Europe's rich musical past remains part of its present and future.

But how can musical scholarship fit into 'cultural heritage' as it is currently used? The tools we employ for musicology shape our understanding of the past, and many musicologists continue to engage directly with materials from historical manuscripts, early prints, or physical archives,

1 [Music](#),¹ European Commission.

employing traditional critical practices. These approaches cultivate a profound sense of connection and attention. Yet, as our musicological heritage grows increasingly vulnerable with the passing of time, new approaches and tools are emerging that allow us to ask new questions and visualise new answers: for instance, we can preserve musical archives while simultaneously making them available to a wider audience through facilitating performances or generating data for analysis.

How do we ‘make’ musicology into something that not only fits within but also contributes actively to cultural heritage? It requires a change of perspective, from that of a lone scholar working in a sharply defined field to a vibrant community which transforms scholarship into a living practice which attends to the past while looking toward the future.

Musicology has a long and strong record of developing skills and (digital) tools by which to study music. The field is also aware of methodologies developed by other sciences and is able to use them. The very versatility of musicology—a broad field of science that encompasses the history, theory, and practice of music across time and geographical space—means that it has the strength and flexibility to model approaches to cultural heritage for other fields.

Technologies of writing have always shaped the relationship between creators and users of text and media. Music is no exception. Throughout history, from early Western musical notation through the printing press, audio recording, and into today’s digital realm, emerging transcription technologies have provided mechanisms to regulate music’s impact and function, while simultaneously establishing it as a form of intellectual property. These innovations each represented the ‘new media’ of their era, creating fresh opportunities for interaction among composers, performers, and audiences centered on musical concepts.

Developing musicology for the digital era demands careful consideration of musical texts in their full complexity, spanning from primary sources to digital displays, and encompassing written documents through to recorded interpretations. Beyond this, we must embrace novel approaches to conceptualizing music as data (via stratified, coded scores) alongside data concerning music (the extensively layered metadata contextualizing music within its creation and reception history). We want to think of our **Musical Heritage as Data**. But we need to think of **Musicological Data as Heritage**, too.

This document aims to accompany any musicologist in their desire to undertake research that positions the musical object as data science or heritage science. It brings together diverse resources, recommendations, suggestions for further exploration, and guidance. It attempts to account for the changing context in which musicology evolves, from its essential links with musical practice to its role in the cultural production chain. The collective text that follows claims nothing more than to serve as a guide to any musicological researcher wishing to position their work in relation to the complex fields that are data science and heritage science.²

The reader will therefore encounter a journey that moves from a description of European frameworks to the legal constraints that govern scientific production and artistic creation. The consequences of working with musicological data are felt in the way results are presented via new modes of publication, but also in how researchers experience their daily activities. This gives rise to new community spaces around contributors, the institutions in which they conduct their projects, and end users. The combination of these communities reconfigures the research space in which we operate. And this combination invites us to rethink the way in which a historical discipline, musicology, expresses itself in public spaces.

The reader should not expect to learn recipes, because there are none. Nor should they hope to read an exposition of a consolidated methodology assuming a firmly structured epistemological perspective. The innovations that punctuate our daily lives require constant questioning. We acknowledge that it is impossible to claim exhaustiveness, impossible to escape the risk of obsolescence, impossible to cover in detail each of the challenges, each of the concepts, each of the technological innovations, but we hope that this guide will encourage readers to find their own paths toward the musicological future.

2 The themes discussed in this document were addressed during meetings and a collective Short Term Scientific Mission in 2023, 2024, and 2025. Meetings took place in Lisbon in March 2023 hosted by João Pedro d'Alvarenga, in Malaga in September 2024 hosted by María José de la Torre Molina, in Zagreb in February 2024 hosted by Ivan Curković, in Wrocław in May 2024 hosted by Grzegorz Joachimiak, in Ljubljana in March 2025 hosted by Metoda Kokole, in Bratislava in March 2025 hosted by Eva Veselovská, and in Brussels in September 2025 hosted by Christophe Levaux and Marie Cornaz.

1. Infrastructures

In recent years, there have been a number of initiatives to network European research and knowledge around data science and heritage science. The way we approach and deal with cultural heritage is evolving rapidly thanks to digital technologies, and it is important to bring these developments into the next digital decades. The strategic approaches of the European Commission and the Member States of the European Union to the digitisation of cultural heritage can be identified in a number of national and supranational documents, platforms, frameworks, and EU projects ([ECHOES/ECCCH](#), [INCEPTION](#), [DARIAH-EU](#), [SCRIBEMUS](#), [MusicAIRE](#), [eKultura](#), etc.).

There are two primary challenges to the integration of musicology in such infrastructures and projects. The first is a lack of awareness amongst musicologists of the need to respond to these projects even when music is not specifically mentioned, or perhaps insecurity about what projects might best fit. We will address this challenge further below. A more pressing challenge is the need to address basic legal and policy issues and to begin to develop the standards and tools that will enable music heritage and musicology to fully participate in such initiatives.

Participation and incorporation of musicology into existing or developing infrastructures can be facilitated by data sharing and data interoperability. Here we can distinguish two main types of data resources that need to be attended to. Firstly, we have numerous databases and resources that musicologists have been developing and populating through decades of research. Integration of these pre-existing resources will be possible through promoting the adoption of linked open data (LOD) models and technologies. Many actions have already been undertaken, including the international [LinkedMusic](#) project, but there is still much to be done. Here we can distinguish two directions. On the one hand, fostering the use of reference data models that have been developed and adopted widely by cultural heritage institutions, such as [CIDOC-CRM](#) or IFLA LRM (see below). On the other hand, database integration into larger datasets will require music domain-specific authority resources to be put in place and curated. For instance, authorities for music personal names, musical instruments or musical works are all resources to which musicological research can contribute. The [Répertoire International des Sources Musicales](#) (RISM) project has assumed a central role in authority resources, particularly through its international and cross-border structure. Scoping and sharing such authority

datasets properly will allow for musicological research to be better connected to institutions dealing with iconography, art history, or sound archival documents, to name a few.

More generally, the compliance with [FAIR data](#) (Findable, Accessible, Interoperable, and Reusable) principles and the adoption of related practices is a key recommendation for structuring and publishing musicological data (e.g., audio recordings, sheet music, metadata), including data related to the [music industry](#). This includes using standardised formats for interoperability and embedding descriptive metadata for reusability across disciplines.

In the next sections, we will introduce four large-scale infrastructure projects in which musicology could play a vital role.

1.1. European Open Science Cloud: EOSC

The [European Open Science Cloud](#) (EOSC) is an initiative to provide a federated and open environment for scientific data sharing and research. It connects existing data infrastructures and services across disciplines and countries and promotes the adoption of the FAIR principles. Its goal is to support open science and accelerate scientific discovery in Europe.

EOSC provides multiple pathways for musicology to integrate into its open science ecosystem, leveraging both technical infrastructure and community-driven initiatives. Here are some examples of how the field of musicology could engage.

Utilization of [EOSC core services](#): The EOSC Portal offers tools for data storage, analysis, and sharing. Musicology projects could:

- Deposit multimedia content (recordings, scores) in federated repositories.
- Apply text/audio analysis, pattern-finding tools for computational musicology.
- Collaborate via EOSC's virtual research environments.

Domain-specific guidelines and communities: The **Open Science for Arts, Design and Music ([OS-ADM](#))** initiative provides tailored recommendations for integrating creative fields into open science frameworks like EOSC. Key actions include:

- Addressing copyright challenges in musical works through [Creative Commons licensing](#).
- Developing metadata schemes for multimedia artifacts.

- Creating workflows for ethical sharing of culturally sensitive materials.

A musicology project could:

- Publish annotated opera recordings in an EOSC-aligned repository using [CC-BY-SA](#) licenses.
- Link analyses to interdisciplinary datasets (e.g., historical context from humanities, acoustic measurements from physics).
- Use EOSC compute resources for large-scale audio pattern recognition.

Funding and Governance Pathways: The EOSC Partnership allocated €126.5M (2021-2022) for developing domain-specific services.

Musicology consortia could propose tools for:

- Digital preservation of musical heritage.
- Cross-modal data linking (e.g., connecting musical motifs to literary texts).

Joining the EOSC Association allows musicology organizations to:

- Shape technical specifications through the Strategic Research & Innovation Agenda.
- Access training resources for open science adoption.

By leveraging these mechanisms, musicology can both contribute to and benefit from EOSC’s vision of a pan-European web of FAIR research data. Early adopters may focus on pilot projects demonstrating cross-domain value, such as linking musical analysis to cultural analytics datasets.

1.2. European Cloud for Cultural Heritage: ECCCH-ECHOES

A very significant recent development which has much promise for musical heritage science is the [ECHOES project](#) (European Cloud for Cultural Heritage OpEn Science), funded by the Horizon Europe programme for the period 2024-2029. ECHOES is conceived as an initiative aimed at creating the [European Collaborative Cloud for Cultural Heritage](#) (ECCCH), a pan-European reference platform for professionals operating within the domain of cultural heritage, both tangible and intangible.

ECHOES aims to develop the infrastructure and legal entity of the Cloud in close collaboration with cultural heritage communities, promoting a holistic approach to digital transformation and fostering collaborative knowledge construction. Through the adoption of a transparent governance model and

the application of FAIR principles, ECHOES seeks to facilitate the integration of European and national projects within the cloud infrastructure.

ECHOES offers many opportunities for involving scientists and communities. For example, a recently launched [ECHOES Questionnaire](#) (participation until the end of April 2025) specifically aims to engage the community of researchers in cultural heritage to help shape the future paths of the project and ECCCH. ECHOES has also launched a series of [Cascading grants](#) designed to stimulate use and development of the Cloud. The first data-focused call ended in February 2025. The second call was focused on Engagement and Collaboration (September 2025), and Call 3 is specified for Data and Vertical Applications (January 2027).

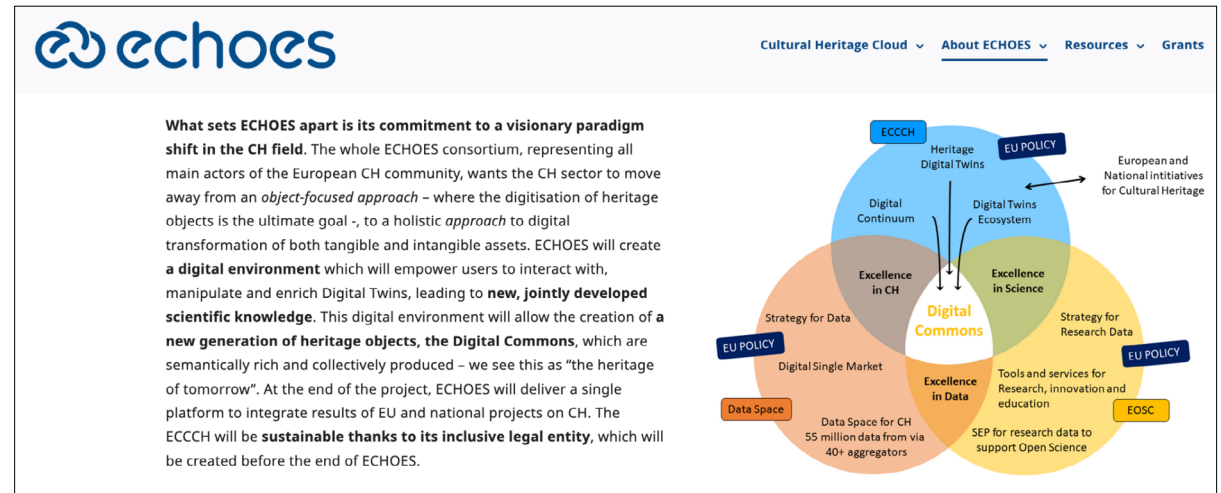
Musicology could be significantly involved in the European Collaborative Cloud for Cultural Heritage (ECCCH) in several ways:

Digital Preservation and Analysis

- Contribute to the digitisation of musical artifacts, including scores, recordings, and instruments.
- Develop specialised tools for analysing and studying musical heritage, such as advanced audio processing algorithms or notation recognition software.

Collaborative Research

- Participate in multidisciplinary projects that connect music to other cultural heritage domains, leveraging the ECCCH's ability to link different data types.
- Use the cloud infrastructure to collaborate on large-scale musicological studies across European institutions.



Interactive Content Creation

- Design interactive experiences for visitors to engage with musical heritage, utilising the ECCCH's tools for high-quality interactions.
- Create virtual exhibitions or augmented reality experiences that bring historical music to life.

Data enrichment and interlinking

- Develop methods for documenting and interlinking various aspects of musical heritage, such as connecting compositions to historical contexts or performance practices, thus operationalising the crucial relation between 'music as data' and 'data about music'.
- Contribute to the creation of semantic-rich digital twins³ of musical objects and phenomena.

Monitoring and conservation

- Implement tools for tracking the condition of physical musical artifacts over time.
- Develop preservation strategies for both tangible (e.g., instruments, manuscripts) and intangible (e.g., performance traditions) musical heritage.

Training and knowledge sharing

- Participate in creating targeted training modules for musicologists and other professionals on using the ECCCH's innovative tools.
- Share best practices and methodologies for digital musicology through the cloud platform.

By engaging with the ECCCH, musicologists can contribute to and benefit from a unified European platform for cultural heritage research, preservation, and dissemination, while also ensuring that music's unique aspects are well-represented in this digital ecosystem. Engaging with ECCCH would also reduce environmental impacts necessitated by musicological research. Relative to other historical or cultural research areas, the current lacking state of digital accessibility for sources relevant to musicologists has necessitated more travel (often short-haul flights) for research that could be

3 A digital twin is a digital model of an intended or actual real-world product, system or process that serves as a digital counterpart of it for purposes such as simulation, integration, testing, monitoring, and maintenance. See, for instance, Concetta Semeraro, Mario Lezoche, Hervé Panetto, and Michele Dassisti (2021), '[Digital twin paradigm: A systematic literature review](#)'.

accomplished via access to high quality images, digital descriptions of objects, and other important metadata often otherwise only discoverable in situ.

1.3. European Research Infrastructure for Heritage Science: E-RIHS

The [European Research Infrastructure for Heritage Science](#) (E-RIHS) was created to support documentation, interpretation, and preservation initiatives by providing tools, interpretive digital spaces, and data networking possibilities. A pan-European distributed and interoperable research infrastructure, E-RIHS demonstrates the benefits of interlinked projects that dynamise past research results and pave the way for the future of heritage science.

E-RIHS is part of the [Social Science and Humanities Open Cluster](#) (SSHOC), one of the five science clusters in the context of the [European Open Science Cloud](#) (EOSC). E-RIHS also collaborates closely with European cultural heritage initiatives like the [Joint Programming Initiative on Cultural Heritage](#) (JPI CH) and contributes to discussions on the EU Partnership Resilient Cultural Heritage via the [Alliance for Research on Cultural Heritage in Europe](#) (ARCHE). To strengthen collaboration, E-RIHS, ARCHE, and JPI CH signed a [Memorandum of Understanding](#) in 2024. Joint activities include enhancing E-RIHS's user strategy, promoting access to facility use in transnational projects, organising training through the HS Academy, and capacity-building for cultural heritage practitioners.

The services offered by E-RIHS are organised around four services, namely:

- [ARCHLAB](#), providing access to scientific information from archives of European museums, galleries and research institution,
- [FIXLAB](#), with a focus on state-of-the-art instrumentation for advanced diagnostics and archaeometry,
- [MOLAB](#) (MOBILE LABoratory), providing access to state of the art mobile equipment and related competencies,
- DIGILAB, the new platform of data and digital tools for creating new heritage science knowledge to be available soon.

There is currently no project, service, or space within E-RIHS that serves musical heritage. This gap deserves to be filled, especially considering the vital and complex nature of musical heritage, which interacts with, is created by, and creates acoustic and sonic spaces, heritage sites, and public

experience.⁴ We can imagine that future contributions to E-RIHS ought to include data on acoustic spaces derived from built heritage or the natural environment, as well as other data sources that are relevant not just to musicology or musical heritage, but to other forms of cultural heritage as well.

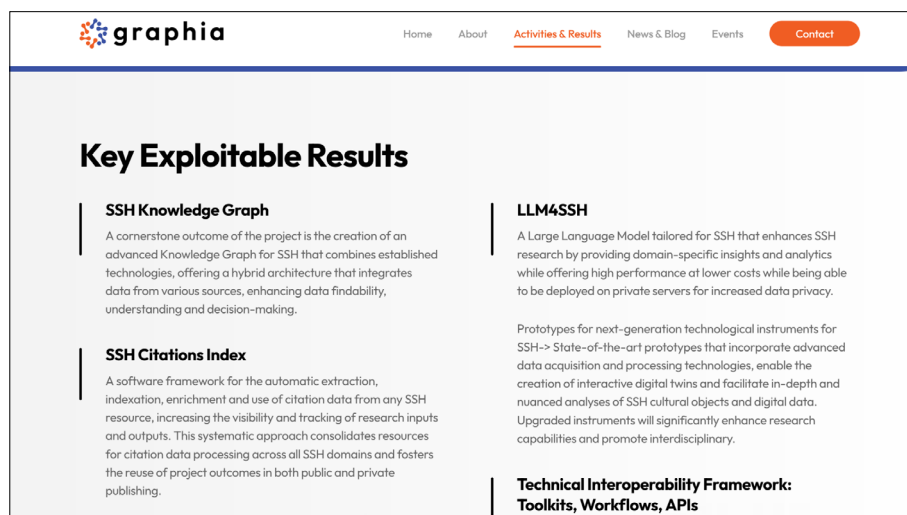
1.4. Europeana Pro and the Common European Data Space for Heritage

[Europeana Pro](#) serves as Europeana’s dedicated platform for cultural heritage professionals, offering tailored resources, expert guidance, and practical tools to advance Europe’s digital transformation through digitisation, standards adoption, and collaborative sector initiatives. Europeana Pro is intended to assist museum, library, archive, and gallery professionals by granting targeted access to network-wide activities, sector best practices, funding information, project updates, and relevant policy developments. The portal is instrumental in equipping institutions with the means to implement digital strategies, exchange expertise, and foster innovation across fields such as digitisation and digital storytelling.

To engage with Europeana Pro in a way that mirrors the EOSC initiative, musicology can play a central role across several activities. By contributing to projects such as [Europeana Sounds](#)—the domain aggregator for audio and music-related materials within Europeana—musicologists help enrich and make accessible Europe’s vast audio heritage. This involves providing structured metadata for audio recordings and music-related content (typically in XML or CSV), ensuring that digital media, including audio, images, text, and video, are published online with direct links. It also involves clearing usage rights so that content is freely available globally and consistently labeled for accessibility.

Active participation in innovative digital platforms is another avenue for musicological engagement. Musicological projects have contributed significantly to Europeana Pro and can continue to do so. Examples of musicological projects that have seeded Europeana Pro include [Polifonia](#), which leverages Linked Open Data and Knowledge Graphs to enhance the search and discovery of European musical heritage. Musicologists have participated in the [TUNE](#) Online Platform for Learning, facilitating teaching and musical exchange, and in the [European Music Archaeology Project](#) (EMAP), which investigated the interconnected musical histories of Europe. Beyond platform building, musicology communities may

4 See, for example, the June 2025 issue of *The Journal of the Acoustical Society of America*, ‘[Advances in soundscape: Emerging trends and challenges in research and practice](#)’ dedicated to soundscapes.



The screenshot shows the GRAPHIA website with a navigation bar at the top containing links for Home, About, Activities & Results (highlighted), News & Blog, Events, and a Contact button. The main content area is titled 'Key Exploitable Results' and is divided into four columns:

- SSH Knowledge Graph**: A cornerstone outcome of the project is the creation of an advanced Knowledge Graph for SSH that combines established technologies, offering a hybrid architecture that integrates data from various sources, enhancing data findability, understanding and decision-making.
- SSH Citations Index**: A software framework for the automatic extraction, indexing, enrichment and use of citation data from any SSH resource, increasing the visibility and tracking of research inputs and outputs. This systematic approach consolidates resources for citation data processing across all SSH domains and fosters the reuse of project outcomes in both public and private publishing.
- LLM4SSH**: A Large Language Model tailored for SSH that enhances SSH research by providing domain-specific insights and analytics while offering high performance at lower costs while being able to be deployed on private servers for increased data privacy. Below this, it mentions: 'Prototypes for next-generation technological instruments for SSH-> State-of-the-art prototypes that incorporate advanced data acquisition and processing technologies, enable the creation of interactive digital twins and facilitate in-depth and nuanced analyses of SSH cultural objects and digital data. Upgraded instruments will significantly enhance research capabilities and promote interdisciplinary.'
- Technical Interoperability Framework: Toolkits, Workflows, APIs**

[GRAPHIA](#) aims to significantly improve data quality, actionability, interoperability, and visualization in SSH by converting unstructured data into actionable insights with AI, facilitating advanced analysis and discovery of complex patterns and connections within SSH fields.

signing standardised metadata schemas and interoperability standards is essential to improving data sharing across diverse music collections, ensuring that resources are compatible, discoverable, and useful to a global community.

Ultimately, these initiatives contribute to the [Common European Data Space for Heritage](#). This is a major European Union initiative designed to accelerate the digital transformation of the cultural heritage sector by providing a secure, interoperable infrastructure for sharing, accessing, and reusing digitised cultural heritage data throughout Europe. The project aims to digitise monuments, sites, objects, and artefacts, making high-quality 2D and 3D data widely available to safeguard at-risk heritage and support reuse in areas like education, tourism, and the creative industries. It is a flagship action built on the Europeana platform, which already offers access to millions of digitised cultural assets. Member States are encouraged to digitise all monuments and sites at risk of degradation and at least half of the most-visited locations by 2030.

develop and openly share software tools, datasets, and ontologies designed to foster new research and spur innovation in both musicology and digital humanities.

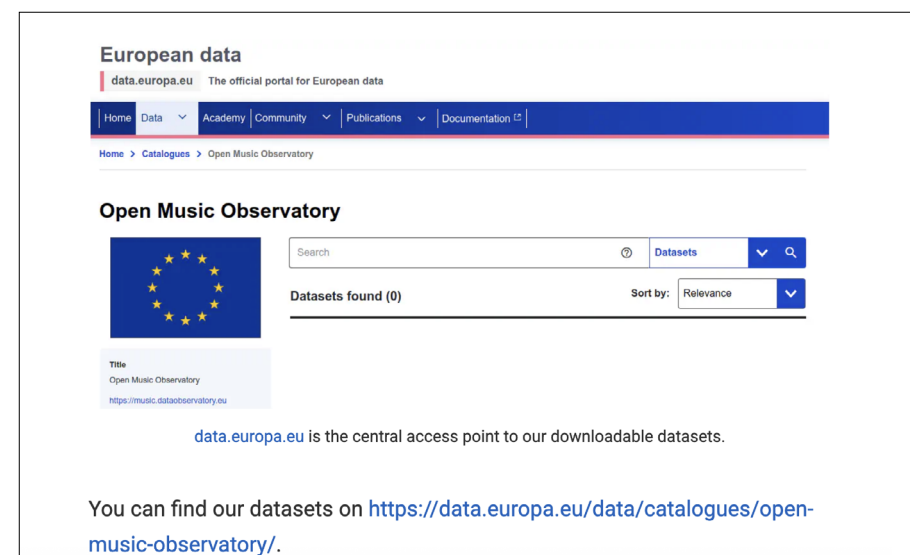
Ongoing professional development is also key. Musicologists can contribute to webinars, conferences, and workshops organised by Europeana Pro, sharing expertise around data workflows, Linked Open Data, AI, and 3D technologies in cultural heritage. Collaboration on de-

In the Data Space, music occupies a significant place, although its representation is still developing compared to images or texts. Music is part of the vast body of digital heritage resources that are aggregated and made accessible through the Data Space, mainly via initiatives such as Europeana Sounds and specialised portals like Polifonia or the [Open Music Observatory](#). Europeana, which serves as the backbone of the infrastructure, currently offers more than 59 million digital objects, including millions of recordings and sound archives, which can be consulted and reused in educational, scientific, or creative projects. The Open Music Observatory embodies a decentralised approach to aggregation, enabling federated sharing and the exploration of musical metadata according to European data space standards, while also encouraging interdisciplinary connections with other heritage domains.

1.5. Digital Research Infrastructure for the Arts and Humanities (DARIAH)

DARIAH is the [Digital Research Infrastructure for the Arts and Humanities](#), a European consortium that enhances and supports digitally-enabled research and teaching across the arts and humanities by providing tools, services, data, and expertise for researchers and educators. DARIAH is structured as a European Research Infrastructure Consortium (ERIC). Its primary aim is to foster collaboration, preserve and disseminate research outputs, and develop technologically advanced infrastructure for research practices in the digital arts and humanities. Through its national branches, DARIAH has funded a wide range of music-related projects, spanning artistic practice, music technology, and digital heritage.

Among the many initiatives supported by DARIAH, it is worth mentioning [MusicPUT](#). MusicPUT is a specialised digital musicology initiative operating within DARIAH-PL, which is the largest humanities consortium in Poland. The team based at the Institute of Computer Science at Poznan University of Technology focuses on creating innovative computational tools for music research and analysis. The

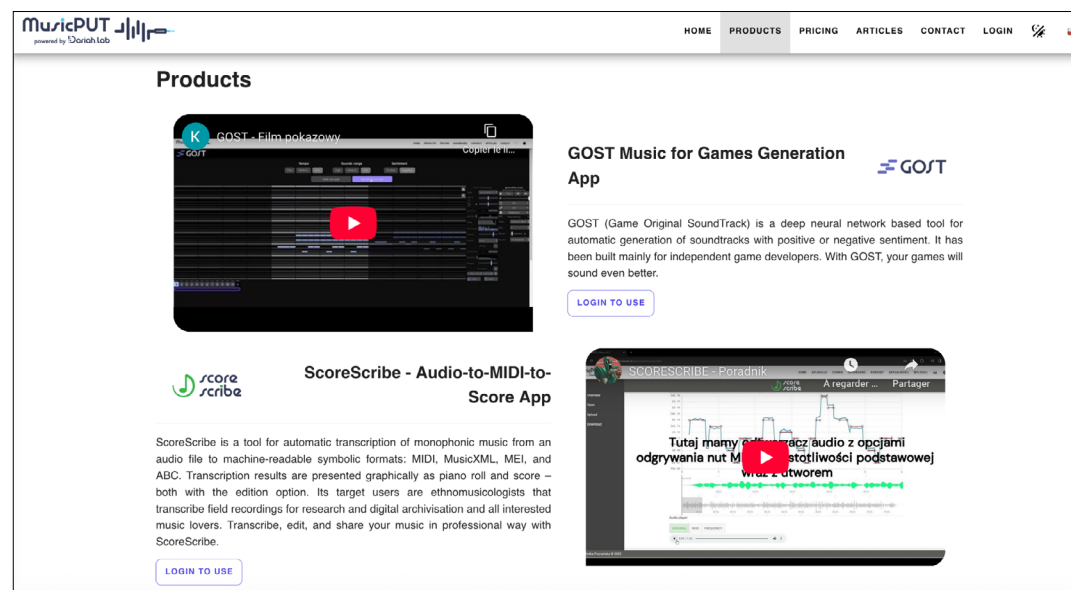


MusicPUT platform represents a significant contribution to digital musicology by providing specialised tools that bridge computer science and music research. Their products serve various musicological needs:

- [ScoreScribe](#): Automatic transcription from audio to symbolic formats (MIDI, MusicXML, MEI, ABC), particularly valuable for ethnomusicologists working with field recordings.
- **OMRAT**: Optical music recognition for automatic annotation of sheet music, enabling content extraction and indexing for music libraries.
- [Timbra](#): Timbre analysis and visualization for specialists studying sound characteristics.
- **MEIConvert**: Batch conversion between symbolic music formats.

The platform specifically addresses musicologists, music librarians, ethnomusicologists, sound engineers, musicians, and educators who lack programming expertise, democratising access to advanced computational musicology tools. The platform's integration within DARIAH-PL ensures sustainability and connection to the broader European digital humanities infrastructure, facilitating international collaboration and resource sharing.

The MusicPUT project exemplifies how national digital humanities consortiums can develop specialised disciplinary tools while contributing to the larger European research infrastructure ecosystem.



1.6. Open Scholarly Communication in the European Research Area for Social Sciences and Humanities (OPERAS)

[Open Scholarly Communication in the European Research Area for Social Sciences and Humanities](#) (OPERAS) is a research infrastructure specifically geared toward open scholarly communication in

SSH fields in the European Research Area. Its mission is to coordinate and federate resources across Europe in order to facilitate accessing, creation, edition, dissemination, and validation of SSH research outputs. It aims to operate efficiently and openly, without barriers for researchers, students, or the public.

- OPERAS is designed as a distributed infrastructure, involving a broad network of partners and nodes throughout Europe.
- Key services developed under OPERAS include the [Directory of Open Access Books](#) (DOAB), authentication and authorization solutions for research resources, and technical as well as social innovation labs to support new communication practices and governance models in SSH.

OPERAS intends to overcome the fragmentation and underfunding in the SSH scholarly communication landscape—especially challenges like multilingualism, diverse (open) publication formats, and the need for specialised scholarly outputs (monographs, critical editions, etc.). OPERAS provides a service portal and a set of innovative tools to facilitate open access publishing, discoverability, certification, and research metrics in SSH.

The infrastructure is supported by EU-funded projects such as OPERAS-D (Design), OPERAS-P (Preparation), and OPERAS-PLUS, which further its development.

1.7. Cultural and Creative Sectors/Industries (CCS/CCI)

European heritage and industrial strategies identify music as a key component. As part of the [Cultural and Creative Sectors](#), music-related initiatives are supported by [Creative Europe](#) and by the specifically-targeted music sector framework [Music Moves Europe](#). Music is also an unmissable industry within the [Cultural and Creative Industries](#), one that has received a great deal of [policy](#) attention from the European Commission in recent years.

Responding to calls for proposals linked to the CCS or CCI strategies requires a threefold reflection: firstly, on the role of musicology in industrial development; secondly, on the benefits that each party (research and industry) can expect from it; and thirdly, on the actions to be taken.⁵

5 See '[How do UK research funders foster completion, collaboration, and impact \(CCI\) in international development research calls and programmes?](#)'

1.7.1. The role of musicology in industrial development

Tapping heritage for modern audiences: The Cultural and Creative Industries' and society's understanding of European musical heritage remains limited and often tied to outdated, rigid ideas of European identity. As a consequence, the substantial potential of this heritage that could directly inform creative and cultural products remains untapped. Engaging contemporary, diverse audiences in innovative ways and addressing their concerns and lived experiences while fostering a sense of cohesion and identity is a task musicologists are equipped for.

Seizing opportunities for sustainable integration: The specialist expertise of musicologists and the evidence base their work could provide are often not fully integrated into the Cultural and Creative Industries sector. This leads to missed opportunities in creating a sustainable knowledge economy where research and musical understanding are accessible to benefit a wide range of cultural and creative industries, as well as tourism, built heritage and territorial development.

Realising potential in cultural development: The European Cultural and Creative industries are a major economic output from the region, but there is significant unrealised potential for musicologists to contribute to evidence-based and data-driven strategies in cultural development. By enabling mutual benefits for musicologists and the Creative and Cultural industries, there is scope to drive innovation in cultural heritage and development that are grounded in recognised specialist world-leading scholarship.

1.7.2. The benefits

Empowering Cultural and Creative Industries with accessible knowledge: The Cultural and Creative Industries will be able to quickly and efficiently tap into a range of knowledge, data and resources that will improve their capacity to respond to the needs of local and international societies, creating innovative and relevant cultural products and services.

Fostering sustainable careers for musicians: Musicians and other agents in the musical and cultural ecosystem will be able to develop more stable and sustainable careers and be empowered by wider access to heritage resources to shape their own creativity.

Linking heritage and Cultural and Creative Industries: Heritage organisations will develop stronger connections with the cultural and creative industries, increasing their capacity for innovation and allowing heritage to be reimagined in ways that resonate with contemporary audiences, creating new opportunities for research, preservation and commercial development within the creative sector.

Promoting European development through music: European territories (e.g. towns, cities, regions) will be able to strengthen the links between Europe’s musical heritage and their own role in boosting and revitalising territories—for example, by offering more sustainable and resilient tourism products/ services.

Enhancing access and well-being through culture: The users of the cultural and creative industries, as well as the broader society, will have access to an increased, more relevant offer, leading to increased wellbeing, greater awareness of the diversity of European identities and greater social cohesion.

1.7.3. Types of actions to be taken with the cultural and creative industries

Clearly define ‘musicologist’ as an official job category: By recognising musicologists as specialised professionals (e.g., within OECD categories), policymakers can more easily quantify the contribution of musicology to evidence-based policymaking. Musicologists provide essential data-driven insights that can assist policymakers in understanding the specific impacts and benefits of musical research on the wider cultural and creative industries. This recognition ultimately supports the development of more effective policies for the sector.

Support nomination of musicologists in advisory boards: When creating policies, consider including musical heritage and its manifestations as vital components in promoting diversity and territorial development. Musicologists bring essential expertise and insights that can inform decision-making, ensuring that cultural policies are rooted in a comprehensive understanding of musical traditions and manifestations, and their impact on communities.

Develop a user-friendly data gateway: To enhance the music sector and public engagement, a user-friendly gateway providing access to high-quality, open-access musicological data is essential. This gateway would serve as a comprehensive resource, sparking innovation and enabling the use of valuable music data in new ways to future-proof information within a European context. The creation

of an interdisciplinary network of musicologists, musicians, web designers, and developers would be fundamental. This team would collaborate to ensure the gateway's technical and artistic quality.

Create micro-grants for knowledge exchange: Establish micro-grants to support and incubate knowledge exchange in scholarly-creative partnerships. These initiatives could contribute to a repository of best practices and may also include an innovation/technology priority, such as proposing different ways to integrate AI into projects related to making musicological data available.

1.8. National and transnational initiatives

Building on and contributing to the models and data of significant national and transnational initiatives will help move our work into the musicological future. Here we would like to highlight a few representative examples regarding data science and cultural heritage.

In **Germany**, the National Research Data Infrastructure ([NFDI](#)) is the umbrella structure of sub-discipline consortia for data preservation. The branch dealing with heritage is [NFDI4Culture](#) - Consortium for Research Data on Material and Immaterial Cultural Heritage, coordinated by the Mainz Academy of Sciences and Literature. [Musicology](#) is an important community within this consortium, and a [recent report](#) shows music is playing a central role in this context.

The purpose of the consortium is to develop services, standards, and training for managing, preserving, and sharing both material and immaterial cultural assets, with musicology as a central community. For music researchers, it provides infrastructures for complex data types (scores, audio, video, 3D models), promotes FAIR principles, supports standards like MEI, and offers legal guidance on copyright and performer rights.

Major musicological initiatives co-ordinated and supported by NFDI4Culture include the Centre for Digital Music Documentation ([CDMD](#)) which itself acts as a clearinghouse for digital initiatives within the musicological projects funded by the German Academies of Sciences.

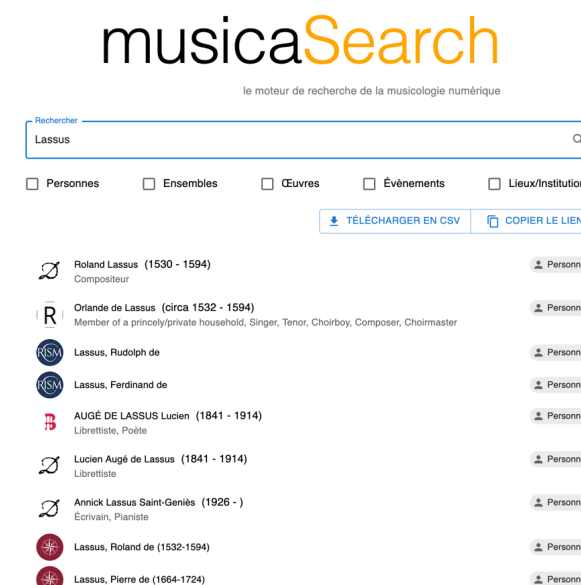
In the **United Kingdom** there is no official national research data infrastructure, but [JISC](#) (Joint Information Systems Committee), jointly sponsored by the government and participating institutions, acts as a de facto national provider of digital research infrastructure, including eduroam, a consolidated national library catalogue (formerly COPAC) and [JANET](#) as the national research data network for research and education.

In **France**, [Huma-Num](#) is a national research infrastructure dedicated to the humanities and social sciences (HSS) and to digital humanities. It supports researchers in the management, storage, sharing, and preservation of digital data related to their HSS projects. Huma-Num provides digital tools and services throughout the entire research data lifecycle: secure storage (ShareDocs, Huma-Num Box), long-term archiving, dissemination (virtual machines, Nakala), indexing (Isidore), and interoperability. It promotes the principles of open science and FAIR data management.

Within Huma-Num, [MUSICA2](#) is a consortium specialised in digital musicology that brings together researchers and engineers around issues related to the management and modeling of musical and musicological data. The consortium’s main objective is to open up the discipline to interoperable and shareable approaches, while developing tools and standards suited to the specificities of musical sources (manuscripts, scores, archives, corpora, etc.). MUSICA2 has developed a cross-disciplinary search tool, [MusicaSearch](#), and publishes best practice guidelines.

Spotlight: [MUSICASEARCH](#)

The [Musica2 consortium](#) has developed MusicaSearch, a search engine for digital musicology, to give greater visibility to digital projects and corpora scattered across France and abroad, attached to multiple, disconnected research units and organizations. To this end, MusicaSearch facilitates cross-searching in various Musica2 partner corpora, by displaying the results of a query in the form of an interactive list. MusicaSearch also invites you to create links between projects, by building active gateways from the data itself (partner site widget). MusicaSearch queries the data (people, ensembles, works, events) displayed on the various partner sites, or even the music data on generalist sites, offering an access point (API, OAI-PMH, Sparql endpoint). MusicaSearch aims to provide users - whether students, researchers, teachers, music lovers, musicians or the simply curious - with a centralised search tool for consulting data available in the field of digital musicology.



musicaSearch
le moteur de recherche de la musicologie numérique

Rechercher
Lassus

☐ Personnes ☐ Ensembles ☐ Œuvres ☐ Événements ☐ Lieux/Institutions

[TÉLÉCHARGER EN CSV](#) [COPIER LE LIEN](#)

	Roland Lassus (1530 - 1594) Compositeur	Personne
	Orlande de Lassus (circa 1532 - 1594) Member of a princely/private household, Singer, Tenor, Choirboy, Composer, Choirmaster	Personne
	Lassus, Rudolph de	Personne
	Lassus, Ferdinand de	Personne
	AUGÉ DE LASSUS Lucien (1841 - 1914) Librettiste, Poète	Personne
	Lucien Augé de Lassus (1841 - 1914) Librettiste	Personne
	Annick Lassus Saint-Genies (1926 -) Écrivain, Pianiste	Personne
	Lassus, Roland de (1532-1594)	Personne
	Lassus, Pierre de (1664-1724)	Personne

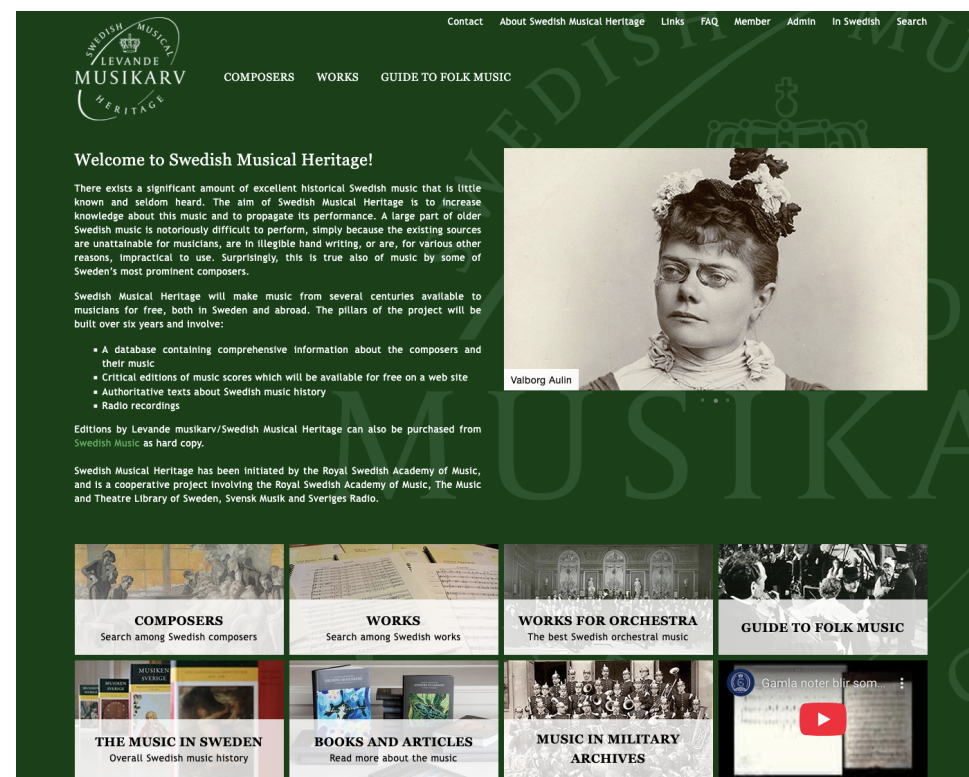
The [PEPR ICCARE](#) is a priority research program and facility launched in June 2024, dedicated to cultural and creative industries (CCI) in France. ICCARE aims to support the CCI sector (visual arts, audiovisual, music, performing arts, design, architecture, heritage, video games, publishing, arts and fashion crafts, etc.) in its transformation in response to digital, ecological, and economic challenges. It forms the research component of the national CCI acceleration strategy, aligned with France 2030.

Music holds a central place in ICCARE, both in strategic orientations and in concrete initiatives supported by the program. The Cultural and Creative Industries sector explicitly includes music, along with audiovisual, visual arts, publishing, and performing arts. ICCARE aims to bring together musicologists, music professionals, technicians, creators, and institutions for reflection and co-construction on contemporary issues in music.

In **Sweden**, the [Royal Swedish Academy of Music](#) maintains an extensive website on [Swedish musical heritage](#) (Levande musikarv—living musical heritage), containing a database, downloadable sheet music, and scholarly publications with the aim of safeguarding, highlighting and popularising Swedish music heritage (both art and folk music).

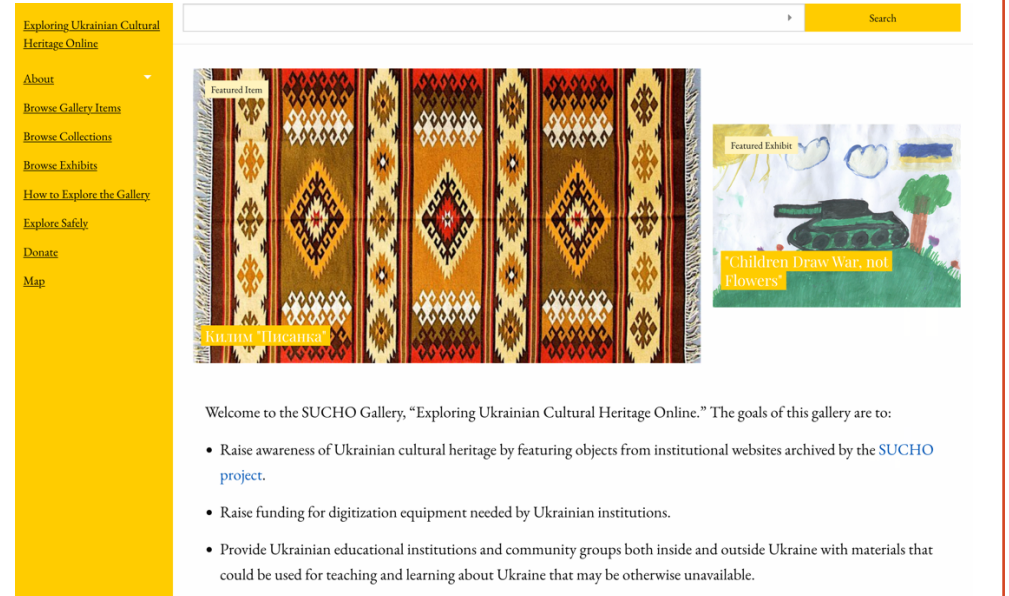
Similarly, The Fryderyk Chopin Institute in Warszawa, **Poland**, developed (with the support of EU funds) [Polish Music Heritage](#) and [Polish Scores](#) portals with the aim of making available metadata, scans, and digital transcriptions of musical sources held by several institutions.

On a transnational level, [Saving Ukrainian Cultural Heritage Online \(SUCHO\)](#) is a multi-institution initiative to safeguard the digital cultural heritage of **Ukraine**.



Spotlight: [Saving Ukrainian Cultural Heritage Online \(SUCHO\)](#)

SUCHO holds valuable lessons for cultural heritage preservation efforts, particularly in highlighting how digital resources are also at risk of damage or destruction. The project relied on word-of-mouth through the digital humanities community to identify Ukrainian collections accessible online. Volunteers suggested collections to target for preservation, then project facilitators evaluated those collections according to their cultural importance and risk level. The shock and enormity of war in Europe managed to mobilise a large number of volunteers in a very short period. As an independent collective, SUCHO was able to set up its own servers and get started archiving right away—a much quicker process than going through institutional channels. Once the process was underway, the archiving process itself revealed additional candidates for archiving, including new domains to explore. This case illustrates the need to begin conservation conversations now, as well as the role to be played by informal, self-sustaining networks in identifying and archiving materials.



2. Materiality: Data for Musicology

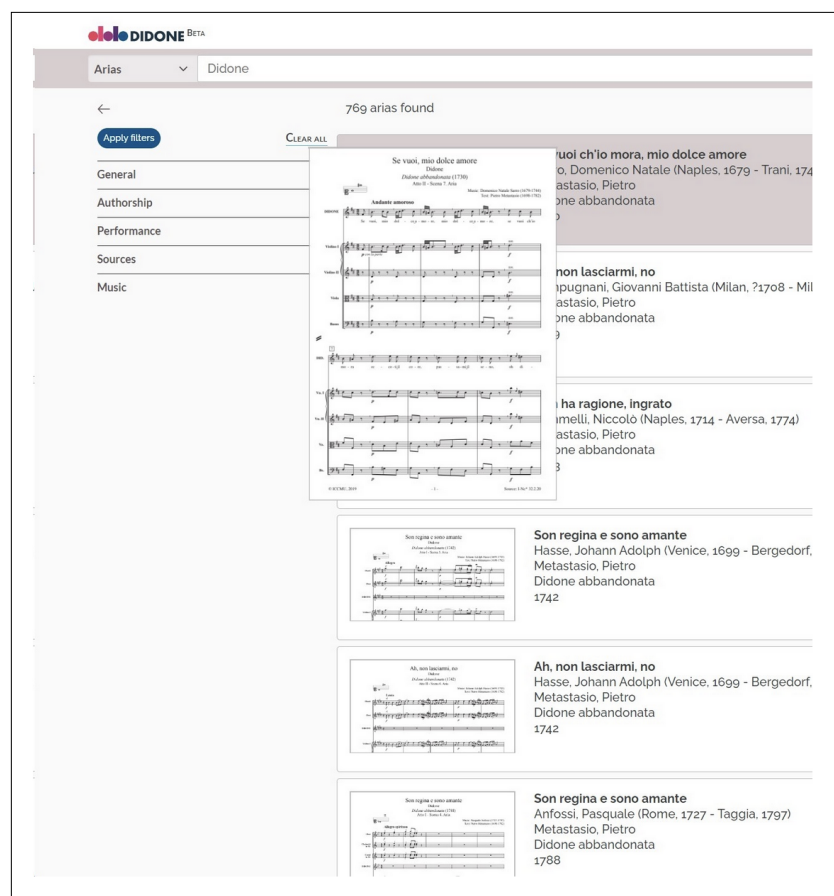
Unlike many kinds of data, music data is never 'raw'. Sound being ephemeral, all music data we engage with is an encoding of a temporal physical experience in a defined space, whether it be notated music, a song text, a musical instrument, or choreographic instructions. Therefore, all music data is always inherently mediated, by humans or machines. This section is therefore concerned with when and how musical heritage becomes data. Terminology in this document is generally in line with the [DIKW pyramid](#), explaining relations between data, information, knowledge and wisdom.

2.1. Recognising data for musicology

Musical heritage sources represent the entirety of human involvement with making organised sound – sources that can be discovered, explored and made accessible through digital versions, innovative analytical methods and techniques. They are preserved either in tangible, physical forms (written notation, musical instruments, information about music in archival documents, literature, visual arts

or historical material) or in intangible, non-physical forms (songs, chants and melodies transmitted aurally/orally independently of notation, improvised music). They can be centuries old or created yesterday, edited or pristine, in the public domain or locked behind private walls or legal barriers.

2.2. Sources of data



Tangible musical sources are mostly part of the collections of various libraries, museums or archival institutions, which are either privately (individuals, churches) or publicly owned.

Written (notated) sources are one of the most important sources for musicology. These include manuscripts surviving in complete or fragmentary form, historical musical prints and theoretical musical texts as well as writings explaining performance practice or compositional techniques. Scholarly editions of original sources that have been published (and may be under copyright restrictions) are also included here.

Music-related visual materials: images of music, musical materials, musicians, musical instruments, musical life, musical practice. The main sources for these images include paintings and drawings, sculptures and reliefs, autonomous graphics or illustrations included in manuscripts or prints, applied arts and design, photographs, as well as reproductions of these visual materials.

The [Didone Arias Data Base](#) offers detailed criteria for searching Metastasian opera arias, including composer, singer, theatre, source information, musical key, scoring, time signature, and easily showcases scores.



Verein | Association | Associazione | Association | Asociación
Répertoire International d'Iconographie Musicale

advanced search

switch advanced / simple

reset searchform

i creator / artist

i title

i institution

i Fiddle

i item type

i material, medium, technique

i nationality

i iconclass

i depicted persons

i musical works composer

i musical works title

i bibliographic references

RidIM record id

year from year to

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search

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Search sorting options ▾

Page 1 from 11
205 records

« 1 2 3 4 5 6 7 8 » →

RidIM record id: 7

Mary, Queen of Heaven
Master of the Saint Lucy Legend (fl. ca. 1475-1505)
National Gallery of Art (Washington, DC)
1952.2.13



[image link 1](#)

RidIM record id: 12

Vierge en Majesté entourée d'anges
Master of the Embroidered Foliage (fl. c. 1495-1500)
Musée du Louvre
RF1973-35



[image link 2](#)

RidIM record id: 17

Les arts libéraux, L'annonce aux bergers, détail du portail ouest, porte sud de la cathédrale de Chartres
Unknown (French)
Cathédrale de Chartres
[image link 1](#)

RidIM record id: 117

Madonna and Child with angels
Memling, Hans (born 1430-1440, died 1494)
National Gallery of Art (Washington, DC)
1937.1.41



[image link 1](#)

RidIM record id: 118

Madonna and Child with saints and angels
Daddi, Bernardo (active ca. 1280-1348)
National Gallery of Art (Washington, DC)
1952.5.61



[image link 1](#)

RidIM record id: 194

Peasant dance
Robert, Hubert (1733-1808)
National Gallery of Art (Washington, DC)
1963.15.26



[image link 1](#)

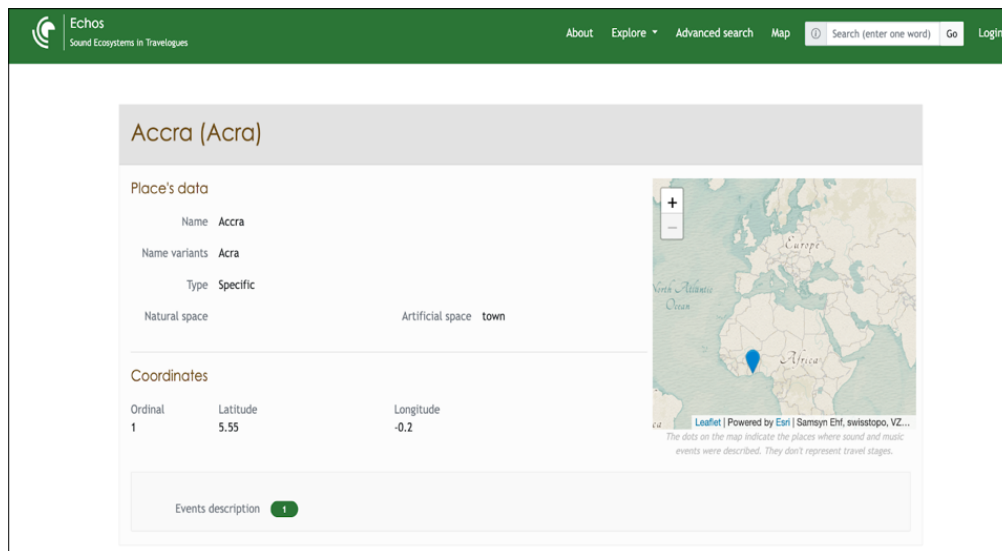
RidIM record id: 281

Group of musicians
Benson, Ambrosius (ca. 1495-before 1550)
Museo di Castelveccchio
no. 486
[image link 1](#)

RidIM record id: 374

Feast of the gods
Brueghel, Jan, the elder (1568-1625)
Balen, Hendrick van, I (1575-1632)
Musée du Louvre
D.L. 1973-21
[image link 1](#)
[image link 2](#)

The Répertoire International d'Iconographie Musicale ([RidIM](#)) offers a database of images of music, searchable by instrument, artist, location etc. The RidIM [Database](#) records contain descriptions and images of visual objects featuring music, dance, theatre and opera-related topics or content. (Sample search: fiddle)



The website [ECHOS – Sound Ecosystems in Travelogues](#) (University of Padova) is designed to collect, analyse, and reconstruct descriptions of musical events and soundscapes found in travelogues from the fourteenth to nineteenth centuries.



The [musicalLetters](#) project led by the consortium MUSICA of Huma-Num.

Music-related textual materials are found in literature (contemporary literature, biographies/vitae, legends etc.), in letters and diaries (correspondence between composers, performers, or patrons that provide insight into musical life, concert programmes, concert posters, newspapers, journals, etc.), or in archival and historical documents. These varied kinds of texts contain important information about musical practice, musicians, composers, musical life, etc. Music criticism and performance reviews are an example of this, but, crucially, musicological literature itself also belongs in this category.

Recordings (either audio or video) are a further important source for music heritage and its study. These include concert and festival live recordings, which reflect the actual presence of the music and the unique contribution of the performer(s) and the interaction with the audience. These are often held by the broadcasting or producing organizations or by libraries and archives. Contemporary studio recordings provide up-to-date reconstructions of musical sources based on the unique approach of

the music's performers, often in the context of detailed research into historical sources. Historical recording formats include wax cylinders, piano rolls, vinyl, compact discs, magnetic tapes, and other fragile or obsolete formats, which require urgent digitisation to prevent degradation and loss of sound quality over time.

Musical instruments provide concrete evidence of construction practices and sound production. They bear witness to regional or supra-regional customs and standards of musical production, practices, and instrument-making.





Guitar

Stringed instruments / Citterns / English guitar

MICHAEL RAUCHE

1757

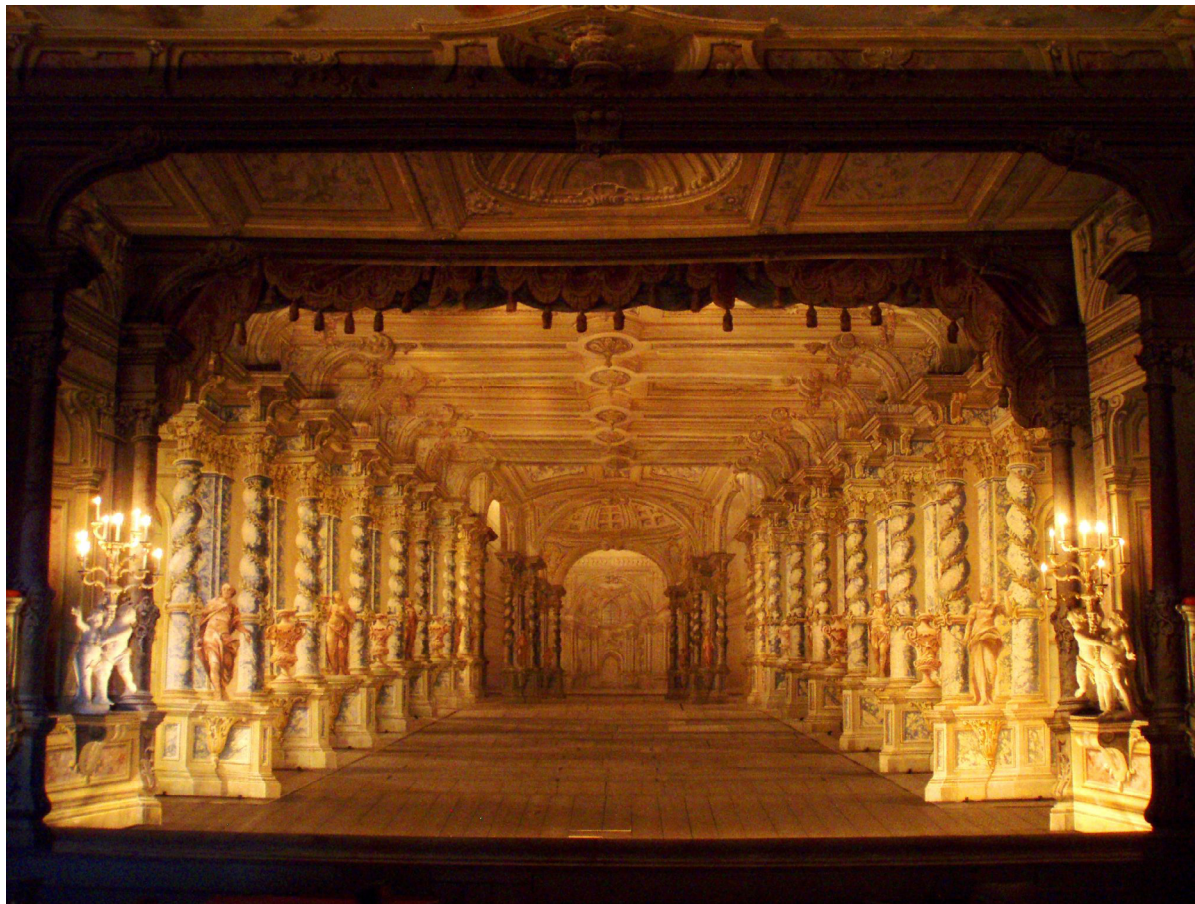
London (Timezone: Europe/London)

Inventory number :3.4565

See object description on : [MINIM-UK](#) 

The MiMO entry for a 1757 guitar.

Concert halls, opera houses or churches are also objects that can be directly related to cultural heritage and to performance history. They are often tightly bound to the music production and performance of a particular time in music history. Their study is directly connected to that of architecture and related arts.



The stage of the baroque opera theatre at Český Krumlov Castle, a UNESCO World Heritage site.

Source: https://en.wikipedia.org/wiki/%C4%8Cesk%C3%BD_Krumlov#/media/File:Ceskystage.jpg

For intangible musical sources, the [UNESCO Intangible Cultural Heritage List](#) represents the breadth and diversity of musical heritage. Intangible heritage refers to non-physical, immaterial aspects of music that are transmitted through oral tradition, live performance, memory, and cultural practice rather than written or recorded formats. These sources are essential for preserving and understanding musical heritage. They incorporate vital human traditions of religious and ritual music that play a crucial role in ceremonies, rituals, and spiritual practices, as well as performance practices and techniques that transmit the implicit knowledge of musical culture. Oral traditions and folk music include songs, chants, and instrumental tunes passed down independently of notation. Traditions of music and dance, Indigenous and folk music represent the oral history and cultural expressions of communities worldwide. Since many of these traditions are orally transmitted, they are at high risk of disappearing without proper documentation, and there is a long tradition within musicology of recording and preserving such oral traditions. Similarly, oral histories and interviews provide invaluable stories and insights from musicians, composers, and musicologists that help contextualise music's role in society and preserve intangible knowledge. Music, and the people who study it, also contributes to the preservation of languages and dialects, for many endangered languages have been used in musical compositions, mostly unwritten and transmitted with the help of oral tradition.

2.3. Types of data

From a data science perspective, we can distinguish *potential* data (for example music notation in a manuscript score, physical parameters of a music instrument, track numbers in a recording, that can be extracted and recorded/documentated by human or machine) and *actual* data (in machine-readable form that can be accessed, interpreted, and linked).

Data essential for musicological research vary greatly and cover virtually all data types. Actual data can be structured at different levels, from free text to partly structured (TEI, XML, a catalogue or critical edition) and fully structured formats according to recognised standards (e.g. MARC21).

Data exists in many forms and formats. There are images of scanned manuscript or printed scores, there are born-digital encodings in symbolic formats (e.g. composed in a music notation software), there are audio recordings of historical pieces, but there are also historical recordings testifying to early recording and performance practices. There is a host of textual data, encompassing all sorts

of texts from letters to concert programs to treatises or songbooks. There is cartographic data in research on music migrants and migration or on tracing musical traditions. There is also data created by librarians, archivists or museum professionals, in the form of handwritten inventories, card catalogues, printed catalogues, digital catalogues.

Following established data-related practices and expertise in the humanities and heritage science, in an effort to organise the described abundance and complexity, the following broad types were identified in data for musicology:

- Materiality
- Notation (notes, symbols, words)
- Audio data
- Visual data
- Personal data
- Paratexts
- Authority data
- Access data
- Bibliographical data

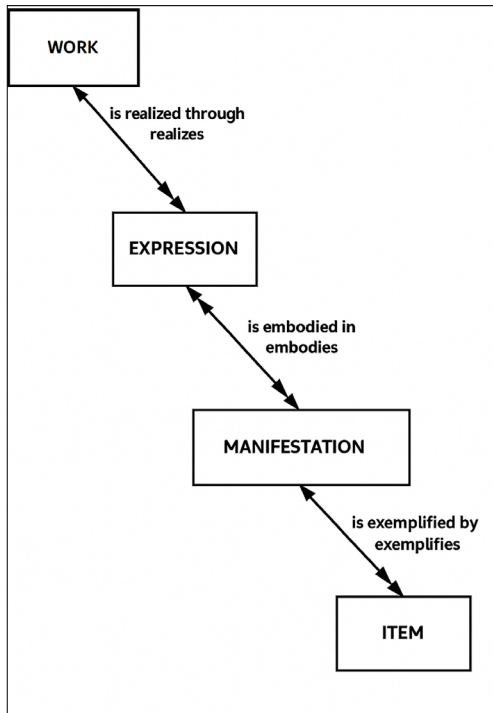
These categories are not inherently divisible between ‘potential’ or ‘actual’ data. For example, a RISM record for a source provides both potential data (e.g., which sources feature a certain song setting, to be discovered) and actual data that can be linked with other actual data points (e.g., how a certain song setting is transmitted in several sources). By understanding the scope of music data as comprising information pertaining to broad themes, types or subdomains, we can recognise the fluidity of music data, with data points interacting with each other often on multiple levels at the same time.

2.4. Structuring music data

Mapping and cataloguing sources is one of the fundamental tasks for both musicology and heritage science. Librarians, musicologists, and researchers have developed various models and standards for documenting sources, which ensure consistency, interoperability, and accessibility. Used for both

tangible and intangible musical sources, these standards ensure the preservation and accessibility of valuable musical artefacts.

2.4.1. Metadata for musicology



LRM modelling of the relationships between Work, Expression, Manifestation and Item.

Since the majority of music sources (written music sources, music-related textual materials, recordings) fall under the category of library collections, the library perspective of organising data will be outlined at the first place, with elaboration on museums, archives and galleries later in this subchapter. The [Library Reference Model](#) (LRM) propagated by the International Federation of Library Associations and Institutions (IFLA) replaced the earlier [Functional Requirements for Bibliographic Records](#) (FRBR) model. LRM alongside [Machine-Readable Cataloguing](#) (MARC) and [Bibliographic Framework](#) (BIBFRAME) standards provides structured methodologies for organising, cataloguing, and digitally preserving musical sources, facilitating their long-term accessibility and scholarly use.

The LRM model offers a conceptual structure for bibliographic data. It enables a nuanced understanding of the relationships between different manifestations of a musical work, which is crucial for the study and preservation of historical musical documents.

MARC (Machine-Readable Cataloguing) and BIBFRAME (Bibliographic Framework) are metadata standards used for documenting and preserving musical heritage. While MARC has traditionally been used for cataloguing library holdings, BIBFRAME introduces a more flexible, linked-data approach, enhancing accessibility and interoperability in digital environments

Despite its structured approach, MARC has limitations in handling complex historical relationships and linked data, prompting the shift towards BIBFRAME. BIBFRAME restructures bibliographic data into a linked-data model, offering improved capabilities for preserving and interconnecting musical heritage materials. Its three core classes align with LRM and historical musicology: Work, Instance (Manifestation in LRM) and Item. By leveraging linked data principles, BIBFRAME enhances the discoverability of musical sources across institutions, enabling researchers to access and compare materials from different collections seamlessly.

The formats discussed above that are used in libraries are mainly applicable when describing tangible material sources. In the case of intangible sources, it may be more relevant to use standards developed by archivists, museum professionals or ethnographers. Museums, galleries, and archives often use different metadata standards suited to their needs and ensure proper documentation, retrieval, and interoperability of cultural heritage materials including intangible musical sources through the use of standardised dataframes and/or *thesaurii*. Ontologies such as CIDOC CRM, the Conceptual Reference Model (CRM) created by the International Committee for Documentation (CIDOC) allow Linked Open Data and are favored for their innate interoperability

There is currently no widely recognised metadata standard for musical sources that is more specific than the established standards for libraries outlined above; higher level standards such as the [Dublin Core Metadata Initiative](#) (DCMI) general metadata standards for describing digital resources are not always sufficient.

Museums, unlike libraries, primarily use object-centred metadata standards for cataloguing artifacts, including musical instruments, recordings, and audiovisual materials. Common metadata standards include:

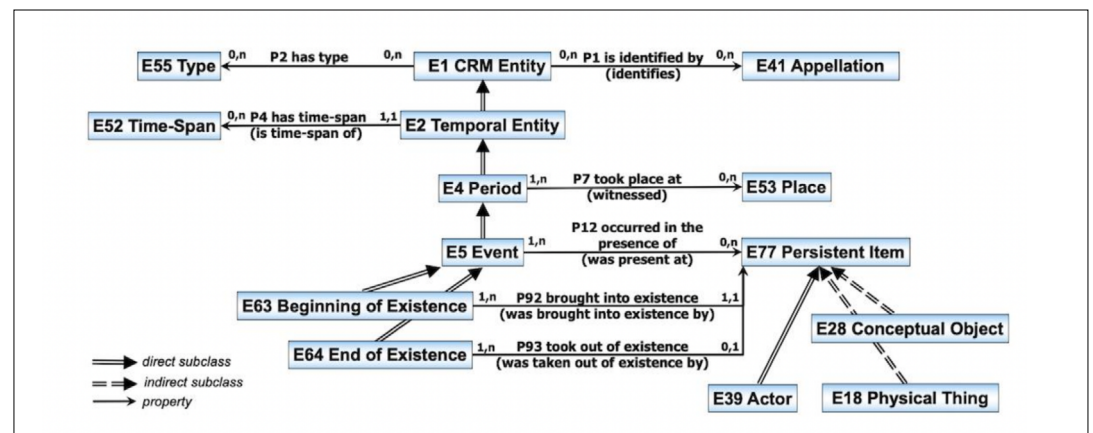
Record URI: <https://rism.online/sources/600033396>

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22 </datafield>
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25 </datafield>
26 <datafield tag="590" ind1=" " ind2=" " >
27   <subfield code="a">no further indication</subfield>
28   <subfield code="b"/>
29   <subfield code="8">01</subfield>
30 </datafield>
31 <datafield tag="593" ind1=" " ind2=" " >

```

RISM Online API response in MARCXML for source 600033396.



CIDOC CRM high level ontology for main concepts in cultural heritage.
Version 7.1.3, 2024. Licence CC BY 4.0.

- [CDWA](#) (Categories for the Description of Works of Art)—Used for describing artworks, including musical instruments.
- [IconClass](#) - Classification system for the content of images.
- [LIDO](#) (Lightweight Information Describing Objects)—A metadata format for exchanging museum data across institutions.

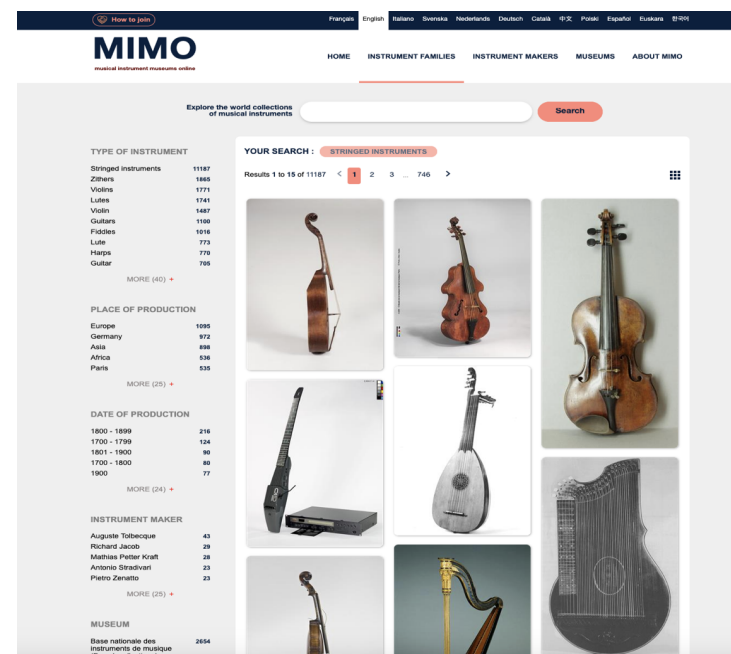
One of the major contributors working with musical instruments and using the above formats is [MIMO - Musical Instrument Museums Online](#). The consortium's current goal is to become the single point of access to information about public collections of musical instruments for the whole world and is used by musicologists working as much on acoustic instruments as on electronic instruments.

Galleries, especially those dealing with digital art and audio-visual materials, use metadata standards similar to museums:

- [VRA Core](#) (Visual Resources Association Core)—Used for describing images and multimedia, including performance documentation.

Archives manage both physical and digital records, often focusing on structured metadata for preservation and retrieval.

- [EAD](#) (Encoded Archival Description)—XML-based standard used to describe archival collections, including sound and music materials.
- [ISAD\(G\)](#) (General International Standard Archival Description)—A framework for structuring archival metadata.
- [ISAAR CPF](#) (International Standard Archival Authority Record for Corporate Bodies, Persons, and Families)—Provides authority control for describing entities related to musical archives.
- [MODS](#) (Metadata Object Description Schema)—XML format for describing digital collections in archives and libraries.
- [METS](#) (Metadata Encoding and Transmission Standard)—Used to store descriptive, administrative, and structural metadata for digital objects in archivers and libraries.



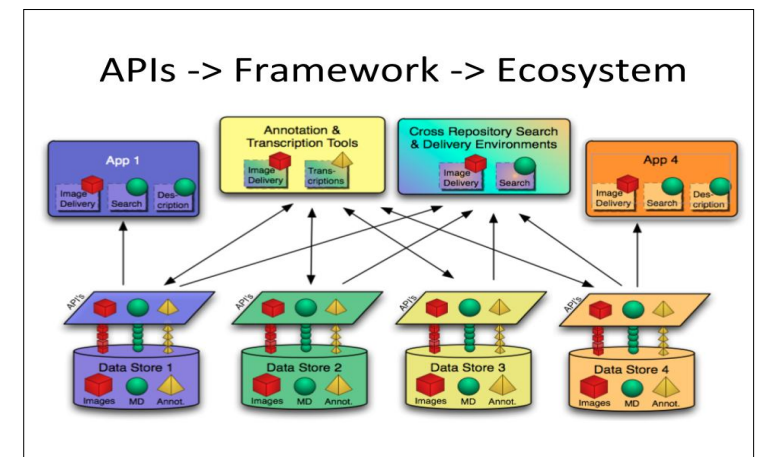
[MIMO: musical instruments museum online](#), catalogue search example.

Given that many museums and archives store intangible musical heritage, various specialised metadata standards for Audio-Visual and Musical Archives are used:

- [PBCore](#) (Public Broadcasting Metadata Dictionary Core)—Developed for audio and video materials in broadcast archives.
- [EBUCore](#)—provides a common set of metadata for describing radio & TV media assets.
- [AES57](#) (Audio Engineering Society Metadata Standard)—Describes audio recordings for professional and archival use.
- [IAML's UNIMARC for Music](#)—Used in specialised music archives for musical sources and sound recordings.

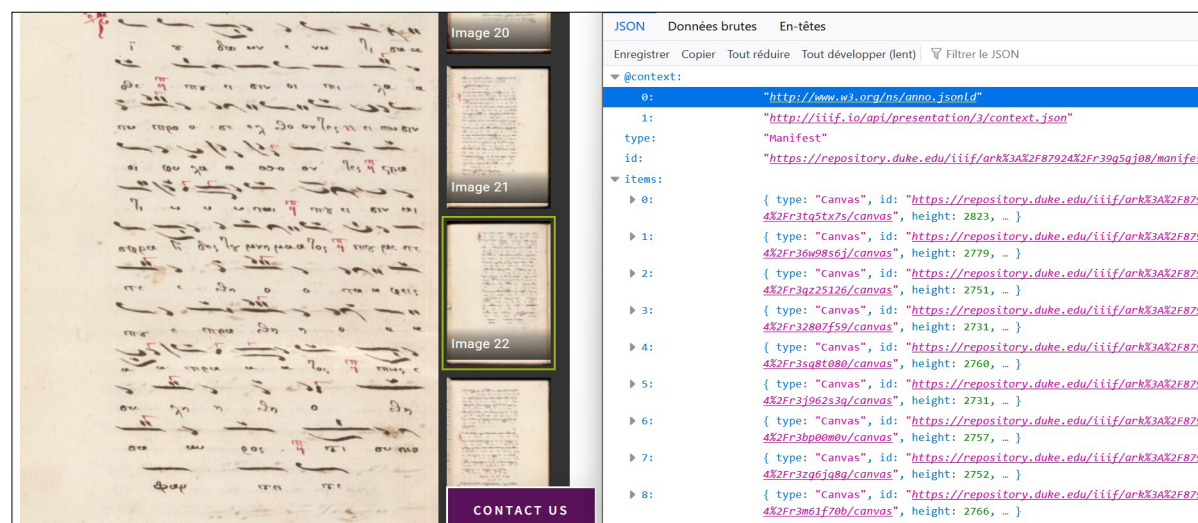
One of the most important and most successful recent initiatives for fostering data access and data reusing within cultural heritage institutions is undoubtedly [IIIF](#), the International Image Interoperability Framework. Its development has been a huge boost to data sharing and data re-use for libraries, museums and archives. In addition to that, its organization as a consortium with multiple contributing institutions is also a funding model that cannot be ignored. Of course, musicology is by far too small for considering setting up a specialised framework. Nonetheless, IIIF can serve as a model for making musicology data, and encoded music scores in particular, accessible and re-usable in similar ways. To some extent, the Music Encoding Initiative model (see below) already fulfils this purpose and it can certainly serve as the basis for such a model. However, it is still necessary to think through access protocols and develop reference implementations for it in the same way the IIIF community developed reference image viewer implementations.

Along the same lines as IIIF, another model from which we can draw inspiration from is the [Distributed Text Services](#) (DTS). DTS is in a way a IIIF for text. It is an open standard that defines a web-based API for accessing, querying, and retrieving digital texts in a structured and interoperable way. It is particularly useful in the humanities, enabling scholars, researchers, and developers to work with texts from different repositories without being tied to specific platforms or formats. DTS allows for navigation, citation, and metadata retrieval while supporting dynamic text collections and multilingual



Possibilities of data exchange and integration through the implementation of [IIIF](#) in various heritage institutions, source: <https://training.iiif.io/iiif-5-day-workshop/>.

content. Its goal is to enhance accessibility, interoperability, and reusability of textual data across digital libraries and research projects.



Anastasimatarion (Duke University, MS emsgk01019) displayed via IIIF manifest using Mirador.

In addition to the development of IIIF, [IIIF-AV](#), a sub-project community group, should also be followed. In this context, there is a huge potential for encoding music scores to become a new type of interaction layer for accessing and navigating sound archives and for integrating Music Information Retrieval⁶ (MIR) techniques into cultural institution portals.

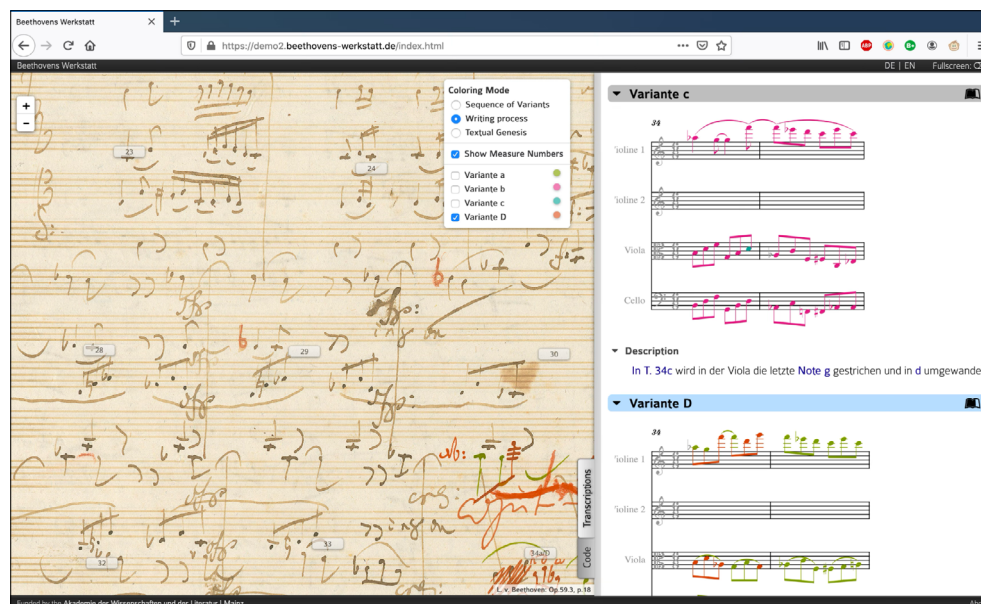
Finally, the development of text publishing frameworks such as the [TEI Publisher](#) should also serve as a potential model for advancing data publishing in musicology. TEI Publisher has made it significantly easier for researchers to create, share, and explore structured texts in a sustainable and interoperable way, and this is something that is still lacking for musicology.

⁶ Music information retrieval (MIR) is the interdisciplinary field focused on the extraction, analysis and retrieval of meaningful information from music data.

Demonstrating best practices and project models is also essential in the field of promoting musical heritage. From this perspective, it is important to build on work that could be recognised as model solutions in future EU programs. These include, for example, the examples set by [RISM](#), [MusicLabs](#), [Verovio](#), [Music-focused Transkribus OMR projects](#), [OMMR4all](#). By adopting standardised metadata structures (e.g., MEI or MusicXML), by improving digital tools such as Optical Music Recognition (OMR), and by investing in pilot projects focused on the preservation and dissemination of digital content, best practices can be developed and disseminated.

2.4.2. Encoding music scores

The XML-based [Music Encoding Initiative \(MEI\)](#) has established itself as the most advanced score encoding framework for digital musicology research and beyond. MEI has been adopted by dozens of musicology research projects, infrastructures and corpora. The use of MEI ranges from simple scores in common western music notation (CMWN) to very rich critical or genetic music encoding.



The screenshot displays the 'Beethovens Werkstatt' web application. The main area shows a musical score with handwritten sketches in brown ink on a light background. The score is for a piece by Beethoven, Op. 59.3, p. 18. The interface includes a 'Coloring Mode' sidebar with options for 'Sequence of Variants', 'Writing process', and 'Textual Genesis'. Below this, there are checkboxes for 'Show Measure Numbers' and 'Variant a', 'Variant b', 'Variant c', and 'Variant d'. The right sidebar shows 'Variante c' and 'Variante D' with their respective musical staves. The 'Description' section for 'Variante c' states: 'In T. 34c wird in der Viola die letzte Note g gestrichen und in d umgewandelt.' The bottom of the interface shows the 'Code' and 'Transcriptions' sections.

[Beethovens Werkstatt](#) project at the University of Paderborn and the Beethoven Haus in Bonn where MEI is being used for encoding the genetic process of Beethoven's sketches.

An important step to make for the MEI community will be clarification and consolidation, not primarily of the model itself, which is already extremely advanced and powerful, but of the encoding level and the encoded content. A recent publication by K  vin Roger summarises state-of-the art use cases and workflows in MEI.⁷

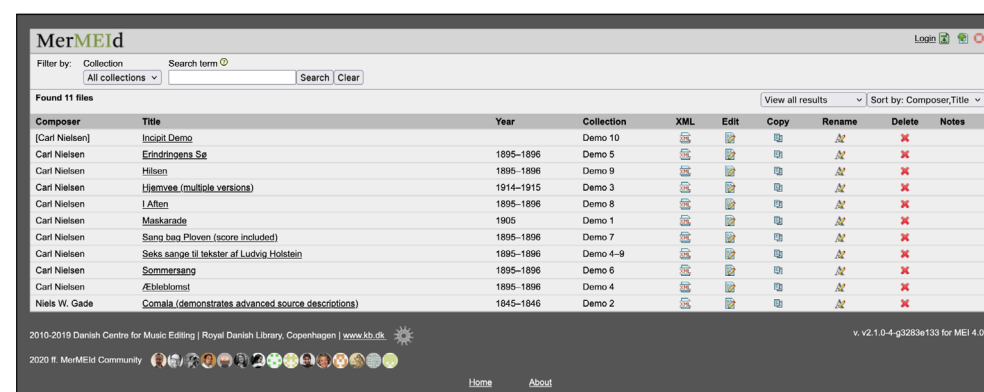
Further to this, music data can be formatted in a wide variety of ways, both digitally and physically. Formatting styles can be generally categorised as involving standards for formatting symbolic music notation, metadata, text, image, audio, and visual representation. Examples pertaining to these categories are provided below.

MEI can carry a great quantity of metadata related to the musical sources. An initiative aiming for standardisation is currently being undertaken by the [edirom](#) project based at the University of Paderborn through their MEI-based [MerMEId](#) editor—it is being adopted by various digitally-informed edition projects in Germany in particular, but it remains to be seen whether this will be widely accepted. The absence, for now, of a universally-accepted standard for music data means that some data pertaining to music-specific aspects risks being lost or captured in unsatisfactory ways. Other areas within the heritage sector have developed their own standards, beyond the general ones, which could in part serve as a model for musicology.

Another recent initiative is the publication of a Guide for digital musical editions⁸ published by the french

Symbolic music notation formatting standards

MEI	suited for critical editions
Humdrum	suited for statistical analysis
EsAC (Essen Associative Code)	suited for analysis and comparison of traditional music on Central Europe
MusicXML	suited for exchange between music editor software
Plaine & Easie Code	suited for easy manual encoding of music incipits



[MerMEId](#) is a tool for editing, handling, and displaying metadata based on the XML schema of the Music Encoding Initiative.

⁷ K  vin Roger (2025), '[The Music Encoding Initiative: Its Generation Workflows](#)'.

⁸ Philippe Vendrix, Augustin Braud (2025), '[Guide de l  dition musicale num  rique](#)'.

Consortium Huma-Num Musica2. It provides a structured survey of methods and standards for the digital editing of notated music, emphasising interoperability, sustainability, and FAIR principles.

The main topics include notation software and encoding formats (MusicXML, MEI, Humdrum), conversion and visualization processes, long-term archiving, and metadata integration to ensure traceability and scholarly citation. Situated in the context of European cultural policies and digital research infrastructures, the Guide combines technical guidance with institutional perspectives, offering a practical and research-oriented framework for digital music editing.

```
185 </measure>
186 <measure number="3">
187 <attributes>
188 </attributes>
189 <note>
190 <rest/>
191 <duration>240</duration>
192 <voice>1</voice>
193 <type>quarter</type>
194 <staff>1</staff>
195 </note>
196 <note>
197 <pitch>
198 <step>F</step>
199 <octave>4</octave>
200 </pitch>
201 <duration>240</duration>
202 <voice>1</voice>
203 <type>quarter</type>
204 <stem>up</stem>
205 <staff>1</staff>
206 <notations>
207 </notations>
208 </note>
209 <backup>
210 <duration>207</duration>
211 </backup>
```

Excerpt of a MusicXML score at *measure* 3 showing a quarter-rest followed by a quarter note F4 in voice 1 on staff 1.

2.5. Context of data management

Data science approaches to musicology highlight the overlaps between historical musicology, systematic musicology, and music theory and analysis, further drawing into question the dichotomies previously constructed between subfields. Data science approaches enable interrogation of past tendencies in musicology to emphasise the uniqueness of a source or work. Data science can also

provide reliable statistics about the background against which musicological claims can be made, so long as parameters are established to ensure accurate conclusions are drawn from the data analysis, as will be discussed in this section.

2.5.1. Collection and creation

In order to help musicologists work out the parameters for data collection in a given project, it is useful to have broader parameters for the fundamentals of data collection, in part to avoid entrenching hierarchies of data types. Previous broad parameters for music data collection have often relied on assumed inherent hierarchies regarding data types, and have often obfuscated the role of historical agents and communities that have - and continue to be - marginalised in society (e.g., women, ethnic, religious and other minorities, queer people, etc.). Given the importance of all kinds of agents and communities to music history, such marginalisation results in a skewed picture. To avoid inherent hierarchies, we have proposed a set of questions which musicologists should consider while establishing the context for data creation in their studies.

- What is the purpose for creating data (e.g., conservation, preservation, a specific study, facilitating future study)?
- What are the ethical and practical implications of the data creation?
- What historiographical approach does the study in question pursue? (e.g., book history, material history, religious history, organology, etc.)
- What role does chronology play in the study?
- What role does geography play in the study?
- What are the practical restrictions facing the researcher(s) in creating data?

Some examples of the context or motivation for data creation include:

- Digital preservation of tangible or intangible heritage
- Presentation and indexing
- Enabling content search
- Analysis and processing
- Constructing information and knowledge

- Editions
- Instruments
- Text-based scholarship (e.g., articles, monographs, library catalogues, museum descriptions)
- Recordings

Agents of data creation can include:

- Employees of the GLAM (Galleries, Libraries, Archives and Museums) sector
- Scholars (within and without the Academy)
- Editors
- Music industry professionals
- Non-professional music enthusiasts

The challenges as well as the opportunities of data creation by a multitude of actors operating independently from one another are well known. On the one hand, ‘crowdsourcing’ of data in the broadest sense of the word can be cost-efficient and create results very quickly, but it risks duplication of effort and lack of consistency and interoperability of data through lack of expertise and use of incompatible software or data standards. Further risks concern proprietary data (often behind paywalls), sustainability (where data from ‘boutique projects’ or private individuals is held on isolated computers or servers), lack of sustained funding (potentially leading to resources going offline) and lack of dissemination and communication. A current instance where the lack of data interoperability and resilience has resulted in a major free-standing resource going offline with no immediate prospect of recovery is the *Thesaurus Musicarum Latinarum* at the [Center for the History of Music Theory and Literature](#) at Indiana University Bloomington, one of the most important resources for research in early music.

Like other parts of the creative sector engaged with the creation and dissemination of data, musicology must address this tension between digitisation and metadata creation by domain experts vs. crowdsourcing. To expect all actors in this realm to conform to universally-accepted standards would solve this problem but is in reality a pipe dream, not least when it concerns legacy data. We need to explore how machine learning tools can be put into service to make data from potentially very

disparate sources interoperable, and what the best use of resources is in terms of usable, interpretable, accessible, linkable data, also in the context of data sustainability and constraints on data storage.

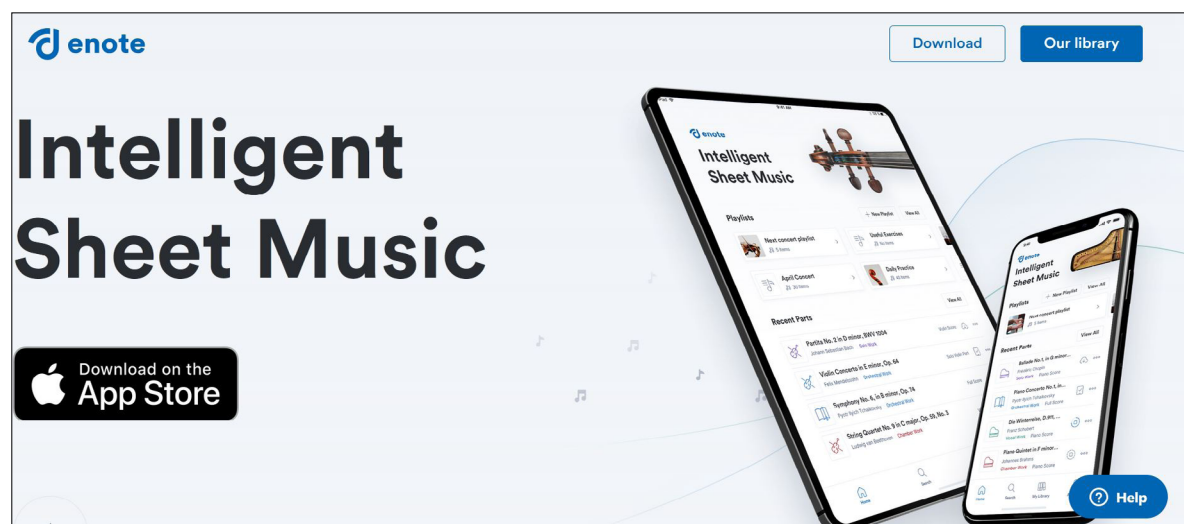
2.5.2. Usage

We propose that there are two possible uses of music data: 'passive' and 'active'. 'Passive' usage comprises finding relevant information, source(s), or resource(s). 'Active' usage comprises the creation or (re)articulation of relevant information about or representing the source(s) and/or resource(s), often on the basis of (initially) passive usage.

Examples of data usage:

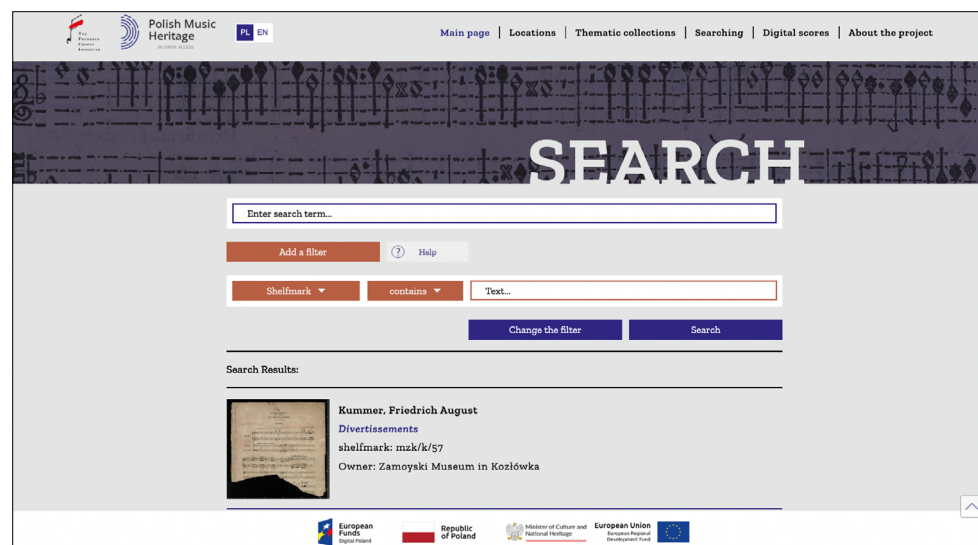
Passive Usage:

- Digital catalogues (metadata), such as [RISM](#)
- Digital repositories of music scores, such as [IMSLP](#) (public domain) or [Enote](#) (proprietary)



[enote](#): A subscription-based digital sheet music app.

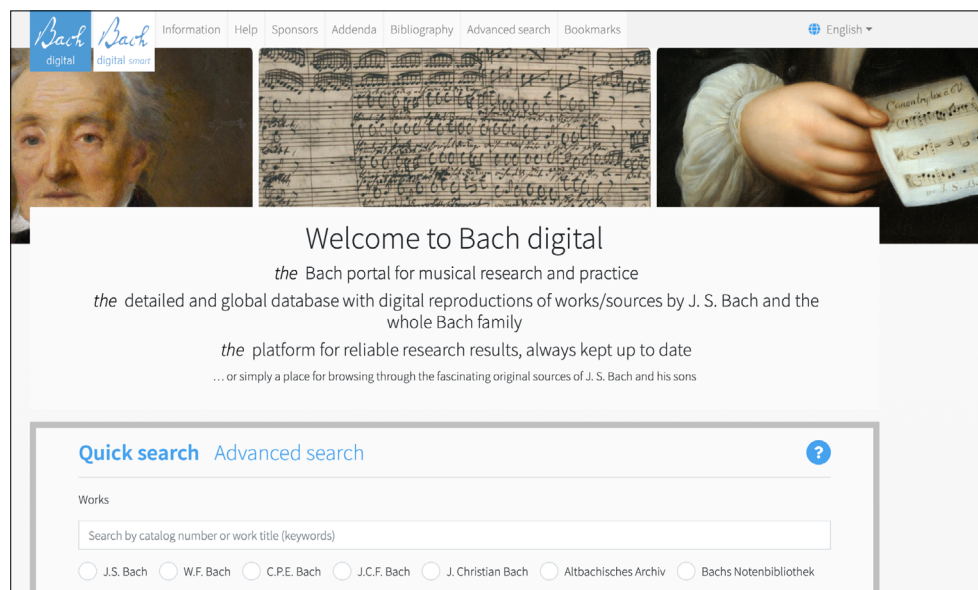
- Digital libraries, archives and museums (metadata and digital content data), in principle offering digital versions of traditional services of this institutions, but potentially including more
 - Metadata created manually by expert cataloguers
 - Digital content files
 - Transcriptions
 - Full text extraction
 - Alternative text to image
 - Speech to text
 - Text to speech
 - Authority files (i.e., named entities recognised manually or automatically)
 - Recognised layout of complex contents
 - Links to high-level authority databases



[Polish Music Heritage](#) — a digital library operated by The Fryderyk Chopin's Institute in Warszawa, presenting digitised music sources from various Polish heritage institutions, with [digital transcriptions](#) available for some.

- Cross-institutional aggregators, like [Europeana](#) (metadata, transformed)

- Monographic, thematic digital platforms presenting various types of digital data and metadata, combined with scholarly information on a given subject (person, cultural centre, historical period, etc.)



An example for a highly developed monographic digital platform is '[Bach digital](#)' managed by the Bach Archiv Leipzig in collaboration with several major German research libraries which brings together digital images of sources relating to compositions by members of the Bach family with a rich array of metadata. Similar projects for other major German composers either exist (for [Beethoven](#) at the Beethovenhaus in Bonn) or are in various stages of development ([Franz Liszt](#), [Christoph Willibald Gluck](#), Felix Mendelssohn).

Active Usage:

- Using API (metadata, digital content, annotations)
 - Application Programming Interfaces (APIs; for databases, so that structured data that sits behind the forward-facing portal for humans is also discoverable by machines). In their simplest form these APIs could be JSON or other standardised ways of publishing information. More complex modes of interaction include SPARQL endpoints for retrieving RDF information, which require considerable skill but are also quite powerful ways of querying large datasets in an intelligent way

```
{
  "license": "https://www.idemdatabase.org/page/terms-conditions",
  "metadata": [
    {
      "label": "identifier",
      "value": "b-af-ms-1"
    },
    { "label": "rightsHolder" }
  ],
  "@type": "sc:Manifest",
  "structures": [
    {
      "canvases": [ "https://lib.is/IE9381778/canvas/canvas-FL9382190.json" ],
      "@type": "sc:Range",
      "label": "001_front",
      "@id": "https://lib.is/IE9381778/range/range-0-0.json"
    },
    {
      "canvases": [ "https://lib.is/IE9381778/canvas/canvas-FL9382191.json" ],
      "@type": "sc:Range",
      "label": "002",
      "@id": "https://lib.is/IE9381778/range/range-0-1.json"
    },
    {
      "canvases": [ "https://lib.is/IE9381778/canvas/canvas-FL9382192.json" ],
      "@type": "sc:Range",
      "label": "003",
      "@id": "https://lib.is/IE9381778/range/range-0-2.json"
    },
    {
      "canvases": [ "https://lib.is/IE9381778/canvas/canvas-FL9382193.json" ],
      "@type": "sc:Range",
      "label": "004",
      "@id": "https://lib.is/IE9381778/range/range-0-3.json"
    }
  ]
}
```

The first part of a IIIF Presentation API Manifest for [F-Pn Rés. Vmc ms. 57](https://lib.is/IE9381778/manifest) (Nivelle de la Chaussée Chansonnier): <https://lib.is/IE9381778/manifest>. Data is organised in JSON format.

- [Model Context Protocol](#) as an open-source standard for connecting AI applications to external systems.
- Linking different databases, integrating models via description of APIs to Large Language Models, both for music data and music metadata.
- Building relations between various resources through Linked Open Data.
- Transformation of downloaded resources in other digital tools, applications, systems.
- Interpretation via traditional academic or educational resources (e.g., journal or magazine articles, monographs, edited volumes, museum placard descriptors, etc.).
- Interpretation via performance (e.g., music and/or dance performances deriving from music data, audio/visual/audio-visual recordings, etc.).
- Interpretation via narrative media (e.g., novels, screen adaptations, opera, musicals, etc.).

2.6. Resilience

Many music sources and data for musicology in Europe remain undigitised and/or are at risk; this is a broad category, including materials in small or regional archives, in private collections, in countries currently experiencing war or socio-political crises, or data related to particular communities which are marginalised and/or targeted (for example, Queer music cultures, Travellers, peoples repressed for

religious reasons, to name only a few). Endangered or at-risk data is a challenging area, and one which needs further development in terms of processes and best practices. On the one hand, a uniform means of representing these musical sources is crucial. On the other hand, these data are often in urgent need of quick and efficient capture, and can thus not necessarily be identified through well-known access points (such as those listed above). While optimally this source data would be in standard formats, containing standardised metadata fields, contingencies existing at the time of capture may have necessitated a more expedient, or a more idiosyncratic, approach to data structure.

Musical heritage resources face many threats. These threats have already been outlined in the context of this [COST Action 21161](#).⁹ However, we believe it is important to name the most immediate risks here, in order to raise awareness about the needs for and challenges to (digital) preservation.

- **Physical degradation.** Written sources are subject to chemical degradation as well as micro- and macrobiological threats and mechanical damage in storage and transport. Carriers of music and sound recordings such as tapes, vinyl records, or CDs are susceptible to deterioration and loss. Therefore, it is very important to carry out conservation inspections of the objects before undertaking digitisation activities. Conservation is aimed at repairing defects and reinforcing the structure of objects which, when subjected to the digitisation process, are exposed to an increased risk of damage. The priority should always be to preserve the original object.
- **Loss of knowledge.** Many traditional musical forms are transmitted orally and failure to capture them threatens cultural continuity. Print restoration (bio/natural restoration) employs recovery techniques that place older (recycled) fragments from the binding back into their original location, again preventing access to them. During restoration, researchers who are involved in researching the fragments ought to be involved, which is unfortunately not the case in all instances.
- **Technological obsolescence.** Older media formats are becoming unreadable as playback equipment is declining. Data (images and metadata) may be held in outdated (and potentially unreadable) formats, and/or on inaccessible or broken hardware.
- **Political, economic, and research/scientific instability.** War, conflicts, natural disasters, and government financial constraints hamper preservation efforts. Termination of projects (both short and long term, national and transnational projects) threatens the systematic continuation of meaningful digitisation opportunities.

9 Grzegorz Joachimiak, ed., et al. (2024), '[Endangered Musical Sources: Strategies for Safeguarding, Digitisation, and International Collaboration \(Report of Working Group 2 Sources\)](#)'.

Many scientific institutions have problematic profiles that are subject to frequent changes and different approaches (loss of identity of scientific disciplines, pursuit of ‘current’ and ‘popular’ topics in scientific fields, etc.).

We emphasise that an important part of managing the risks we mention here is for experts in musical heritage—like musicologists—to become involved in developing preservation and digitisation strategies.

2.6.1. Strategies for Protection and Digitisation

The importance of digitisation as a preservation strategy has been on the European agenda for some years now. Already in 2019, twenty-seven European countries signed a [Declaration of cooperation on advancing digitisation of cultural heritage](#), and Europe has continued to develop extensive digital policies ever since.

Musicology has historically been at the forefront of developing digital tools and projects that contribute to the preservation of musical heritage. The oldest initiative that aims to comprehensively document extant tangible musical sources (manuscripts, printed music editions, writings on music theory, and *libretti*) worldwide is the [Répertoire International des Sources Musicales \(RISM\)](#) – International Inventory of Musical Sources, founded in 1952 in Paris. Today, over 1.7 million records can be searched at no cost through the [Catalogue](#) and [RISM Online](#). RISM records *what* exists and *where* it can be found,¹⁰ and has become one of the main universal and reference tools for musicologists to find and document musical sources.

Incipit search in [RISM Online](#) provides access to detailed information about music sources held in thousands of libraries and archives in Europe and abroad.

DIAMM About DIAMM Search & Browse

A-la Inventar no. KK 5370–5373

Schloss Ambras, Innsbruck, Austria

partbooks: c. 1530

[Description](#) [Inventory](#) [Bibliography](#) [Commentary](#) [Contributions](#)

Archive	Schloss Ambras, Innsbruck, Austria (A-la)
Shelfmark	Inventar no. KK 5370–5373
Image Availability	DIAMM does not have images of this source.
Surface	Other
Numbering System	None
Measurements	150 x 185 and 165 x 215 mm
Other Identifiers	CCM: InnsSA 5374
Notations	black void mensural
Relationships	Charles V (1500–1558) (dedicatee) Charles V (1500–1558) (owner) Wilhelm IV (1493–1550) (commissioned/made for)
Provenance	Bologna, Italy? Augsburg, Bavaria, Germany?
Contents	2 pieces from 2 composers

DIAMM catalogue record for A-la Inventar no. KK 5370–5373; black void mensural notation; shows shelfmark, measurements, identifiers, and authority links. <https://www.diamm.ac.uk/sources/1834/#/>.

Facsimile

Source navigation: E-Boc 05

Piece navigation: Select a piece:

E-Boc 05

[View](#) [Edit](#) [Revisions](#)

City:	Catalunya > Barcelona > Barcelona (ciudad)
Archive / Library:	Centre de Documentació de l'Orfeó Català (CEDOC), Barcelona
Signature:	CEDOC 1.5.1 Ms. 5 [olim 12-VI-12]
Paper / Parchment:	Paper
MS / Print:	MS
Composers:	Anon. Anchieta, Juan de Compère, Loyset Cots, Bartomeu Isaac, Heinrich Josquin Desprez Milans Obrecht, Jacob Peñalosa, Francisco de Plaja, Alonso de la Prats, Marturià Ribera, Antonio de Richafort, Jean
Provenance/Origins/Place of publication:	Catalunya > Gerona/Girona > Girona (ciudad)
Date:	15/4-16/1
No. of works:	22
Genre:	Sacred vocal > Antiphon > Marian antiphon > Regina caeli

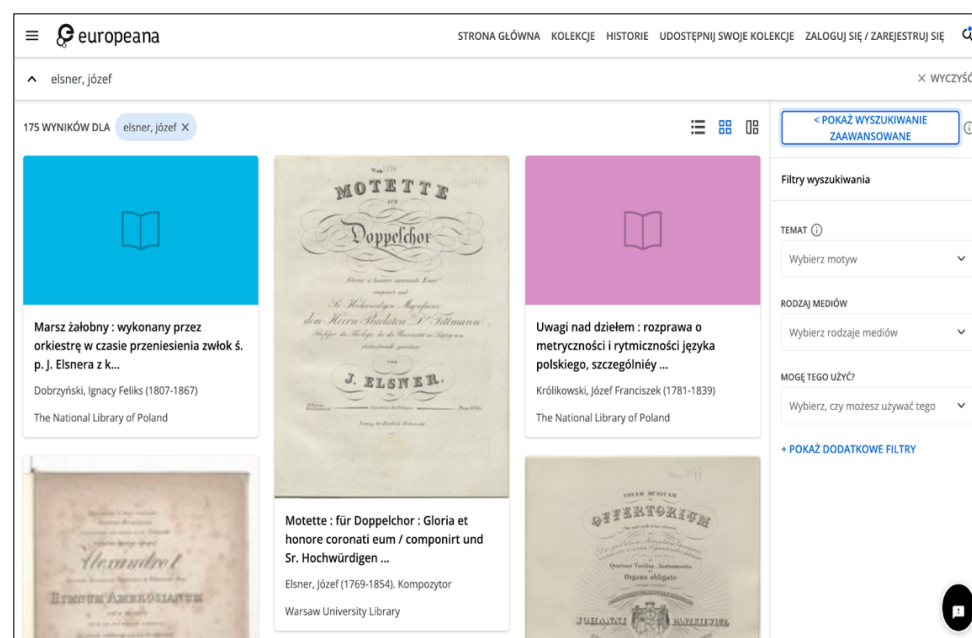
The [Books of Hispanic Polyphony database](#) (catalogue search example) is an open-access catalog with linked images and detailed information about Spanish polyphonic sources.

In recent years, RISM Online has begun to assimilate data from other important musicology projects, allowing for integrated searches. A notable recent addition to RISM searches is the Digital Image Archive of Medieval Music ([DIAMM](#)), which is a great example of a musicology-led project on cultural heritage preservation that has also become a major metadata resource.

Nationally-based projects and initiatives, such as [Books of Hispanic Polyphony](#) or the [Portuguese Early Music Database](#) provide comprehensive information about early music sources in a given country, often going beyond the data recorded by RISM. They remain essential for their contributions to the scientific knowledge of musical sources and their preservation. In future, it would be desirable to link the valuable data of these projects in an interoperable system.

Other resources have begun to incorporate data and digital twins of musical heritage resources. We might return to the example of [Europeana](#), Europe's digital platform for cultural heritage, which has made available over 50 million digital records from the collections of thousands of cultural institutions

across Europe, including sources of musical heritage. This data was collected by various participating organizations (like libraries and museums). However, the data is not always of high quality, due to the particular metadata standard that Europeana adopted.¹¹ This standard does not fit musical objects and resources very well. We could say that, due to its multimodal nature, the digital twin of a musical source would need at least three items: an image of the source (IIIF standard comes to mind), an encoding of the musical information and a recording of its performance, the three of them including all necessary metadata.



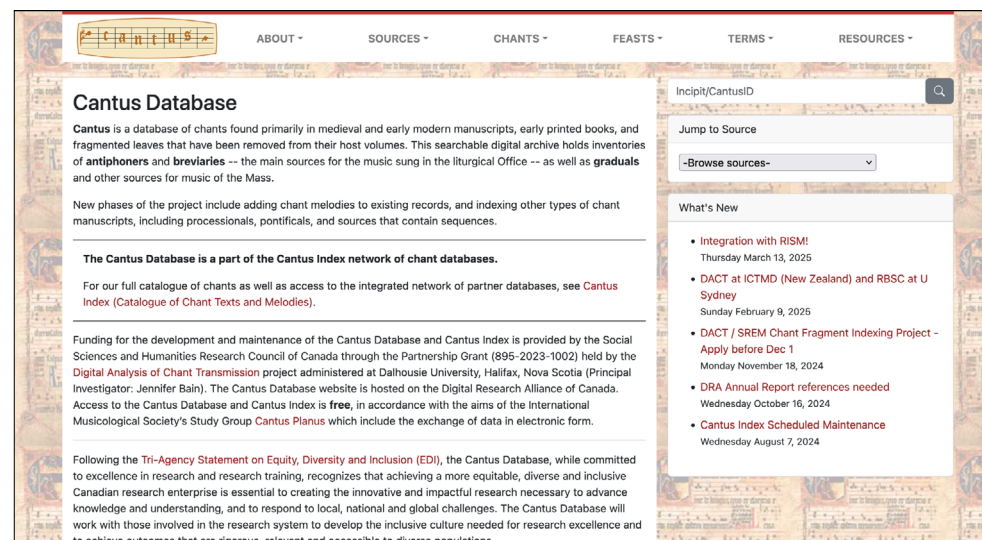
[Europeana](#) aggregator, results from various libraries to search query for a composer's name.

11 Carlotta Capurro, Gertjan Plets, and Jaap Verheul (2023), '[Digital heritage infrastructures as cultural policy instruments: Europeana and the enactment of European citizenship.](#)'

In all such projects, we strongly hold that expert musicological researchers should be involved. We also would like to indicate that those involved in developing such resources be aware of the following global issues:

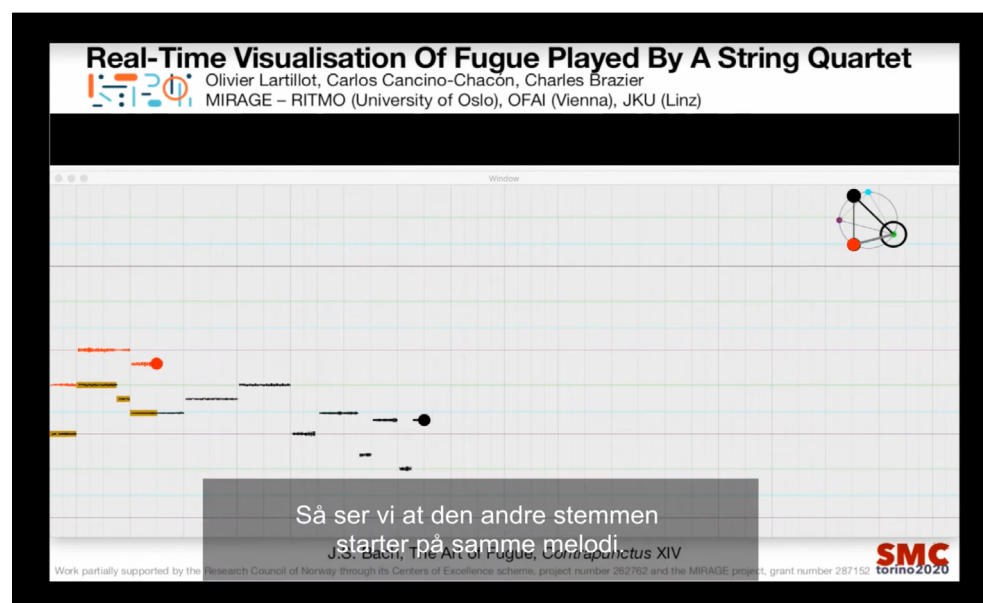
- **Metadata and Cataloguing.** An important step is the local unification and global compatibility of standardised metadata and standard formats (e.g. Dublin Core, MARC, FRBR, BIBFRAME etc.) in order to speed up and facilitate the retrieval of materials and their content.
- **Digital Conversion and Archiving.** The primary objective is to ensure efficient, long-term, and high-quality digitisation of tangible and intangible music sources. Storage needs to be implemented in multiple formats and backups to prevent data loss.
- **Online Accessibility and Open Archives.** The creation of digital libraries and platforms to facilitate global access to musical sources at national or transnational level is a fundamental precondition for a comprehensive elaboration of musical cultural heritage. Cooperation and compatibility of systems with institutions such as [UNESCO](#), national archives, libraries (inventories: [RILM](#), [RISM](#), [CANTUS INDEX](#) network databases, [DIAMM](#) etc.) is fundamental.
- **Community Involvement and Ethical Considerations.** The processes assume the involvement of local/local communities (e.g. religious communities, private collections, etc.) in synergy with ensuring the ownership rights

Most importantly, though, for any digitalisation project to be truly successful, it must result in data that is machine readable, interoperable, and reusable. That means it must be standardised. We expect greater use of artificial intelligence and machine learning applications for sound recognition and historical analysis with **flexible encoding** (supports both modern and historical notation systems), with **metadata-rich encoding** (allows encoding of bibliographic, performance, and analytical information), with interoperability (can be integrated with digital libraries, archives, and other music-related



The [Cantus Database](#) is an international network of chant databases that links metadata and musical incipits from liturgical manuscripts worldwide.

technologies), with preservation and research (useful for digitising manuscripts, encoding historical scores, and supporting computational musicology).



The [MIRAGE project](#) conducted at the University of Oslo is an example for the use of artificial intelligence in visualising and analysing music—here, the tool developed by Olivier Lartillot visualises a fugue from J.S. Bach’s *Kunst der Fuge* in real time.

3. Praxis

Building on the previous section, the following illustrates how musicologists apply the principles discussed above in their work, and how they situate themselves within the relevant frameworks.

3.1. Organising

Beyond the actual **digitisation** of the media in question, a musicologist engaged with creating data for discovery and use, especially within institutionally-preserved heritage, will capture relevant metadata within appropriate structures. Observing best practices in preservation prevents loss and corruption of data, maintains the integrity of objects and relations between metadata and various

files, and ensures long-term availability. Care must be taken to ensure that data is maintained and sustainable across changing systems, with new metadata sources integrated, and new high-level standards adopted and adapted.

In data-providing institutions, data is refined, deduplicated, improved manually and by automatic processes on a regular basis. Different schemas and systems are used among heritage institutions, even in different institutions in one country due to subordination to different ministries (science, culture) or due to the specificity of the collections – different systems for paper-based collections (whether printed or handwritten), or for audio collections. The current state is very often a result of legacy decisions that cannot easily be reversed due to the large quantity of manually created data. Passive and active users of this data should be aware of these challenges.

3.2. Annotating

Annotations in digital editions represent the substantive claims we make about a musical entity, as opposed to the physical characteristics of the source. Typical categories of annotation metadata include:

- **Author ascription.** Cases of doubtful authenticity abound; the ongoing discussion about the works of Josquin des Prez is an example of this.
- **Date:** based on documentary (external) or stylistic (internal) or evidence. Example: claims about the chronology of the Bach cantatas.

Spotlight: [Musical Sources in Slovakia](#)

The Slovak national group of IAML, in cooperation with the Institute of Musicology SAS and other institutions, initiated a nationwide survey in 2024 to obtain as much up-to-date information as possible about musical sources and the institutions which own them. Approximately 500 institutions (libraries, archives, museums, galleries, religious institutions, etc.) were contacted. This involved distributing a questionnaire on the ownership of music sources, the current state of digitisation, and interest in cooperation or in the professional processing of music collections. Only about 60 responses were received. However, all of the respondents agree that they would welcome a better methodology for processing music sources. Departments often do not have expert staff in the field of musicology. The music sources are not processed in any professional way and the institutions rarely have the financial means to take better care of the music sources, let alone digitise them. Where music sources have been digitised, they are often not publicly available; they are only materials intended for the internal use of the institution or for backup and protection against possible loss (alluding here to both legal issues and problems with storing the data in a central national system). Slovak institutions are clearly facing a major staffing and financial crisis. A selected team of expert staff associated with the IAML national group aspires to provide financial and project support to selected institutions in the future and to create a database of institutions owning music sources in Slovakia.

- **Genre or type:** when we say that something is an instance of some class. Example: ‘This piece is a symphony’ (as opposed to other musical genres, such as operas, for example).
- **Style or technique:** the way a piece of music is made and how it is classified accordingly.
- **Value:** that something is good (or good for us), or beautiful; or a good example of its class.
- **Meaning:** claims on the expressivity or semantic determination of a piece. For example, Chaikovsky’s Symphony No. 6 was called ‘Pathétique’ by its composer because of its passionate nature.

Systems of annotation and citation are key to this work. We know what it means to quote or cite a particular page of a book. Music scholars also share agreed reference systems and terminologies by which, for example the phrase ‘the exposition of a given Mozart piano sonata ends in measure 58’ is commonly understood independently of any particular edition of that piece. Musicologists are also developing shared ontologies for analytic claims in musical critical assessments, such as [OMAC](#).¹²

Only when we need to point to a *particular* manifestation of a piece do we need to think carefully about protocols like [EMA](#) or [IIIF](#) that will allow us to ‘point’ (in a digital sense) to a specific image. Such ‘image citations’ (see below) could in turn be exploited for machine processing, that is for an OMR-style reading of the semantic content of the notation, or for palaeographical study of scribal practices or identification. Such machine processing also enables citation systems specific to digital objects. MEI encoded scores, for instance, include XML:IDs—digital reference points that uniquely identify every element in a given document. The [CRIM Project](#) (the joint work of European and North American scholars) includes note-level references to scores, which in turn are surrounded with analytic claims by individual scholars.

Model: *Roland de Lassus, Susanne un jour* < start > <5273>

Susanne un jour Roland de Lassus

Non-imitative duo

Voices:

- 1: Superius
- 2: Contratenor
- 4: Quinta Pars
- 5: Bassus

Entry intervals: 8-
Time intervals: M7
Regularity: Flexed
Sequential: False
Invertible counterpoint: False
Added entries: False

An analytic claim by Andrea Puentes-Blanco about a particular composition by Orlando di Lasso, with selected notes shown in red highlights. <https://crimproject.org/relationships/2706/>. See digital version of the reference via the API: <https://crimproject.org/data/observations/5273/>.

12 Emilio M. Sanfilippo and Richard Freedman (2022) ‘[Ontology for Analytic Claims in Music](#). In [European Conference on Advances in Databases and Information Systems](#)’

Another example from the same project is concerned with the machine-based annotation of MEI scores,¹³ in this case via algorithmic identification of cadential patterns in Renaissance counterpoint. The measure/staff/beat positions of the counterpoint is translated into XML:IDs in a corresponding MEI file and then returned to the user to review.

Title: Ecce nunc Benedicite
Composer: Ludwig Daser
Observation: Clausula Vera

This score excerpt is translated as follows:

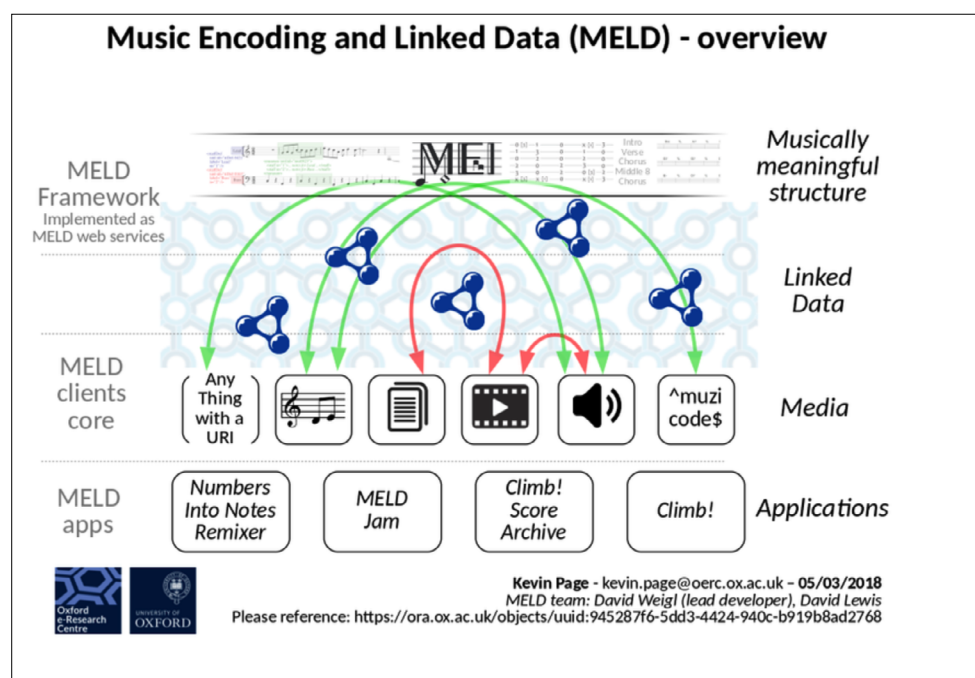
CRIM_Model_0051.mei
 Ludwig Daser
 Ecce nunc benedicite

	CadType	LeadingTones	CVFs	Low	RelLow	Tone	RelTone	TSig	Measure	Beat	Sounding	Progress
Last												
66.0	Clausula Vera	0.0	TC	F3	-M2	D	P5	4/2	9.0	2.0	4.0	0.108553
72.0	Clausula Vera	1.0	CT	D3	-P4	D	P5	4/2	10.0	1.0	4.0	0.118421
84.0	Clausula Vera	1.0	CT	G3	P1	G	P8	4/2	11.0	3.0	4.0	0.138158
112.0	Authentic	1.0	CTB	G3	P1	G	P8	4/2	15.0	1.0	4.0	0.184211

Ludwig Daser, *Ecce Nunc Benedicite* Notebook with CRIM Intervals:
[A Digital Supplement](#) for 'Lasso takes a Second Look: An Imitation of an Imitation Mass?'

¹³ This is accomplished via [CRIM Intervals](#).

For recorded content (audio and video) we also have systems like Music Encoding and Linked Data (MELD), a framework that allows users to create semantic annotations of music concepts and relationships in scores and recordings. Further knowledge is incorporated from external sources using Linked Data, which is also used to match annotation types and contexts to rendering actions displaying the annotations upon the digital score.



The [MELD](#) Specification in schematic form.

Frageverbot 2 – A Minor (x-x-y)

Change modif iteration

Iteration

Poem **Vocal Score** **Orchestration**

Poem

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Vocal Score

Orchestration

Flute
Flute
Flute
Oboe
Oboe
Cor anglais
A Clarinet
A Clarinet
Bassoon
Bassoon
Violin
Violin
Viola
Viola
Lohengrin
Cello

x-segment: Sustained f Flute 1, 2 oboes, cor anglais answered by f 2nd and 3rd flutes and then by octave violins and violas; y-segment p in voice and winds (Flute 1, Oboe 1, Cor anglais, Bassoon 1 and Horn 1) accompanied by pizzicato divisi violas and cellos, cadential leading tone in added three notes for Oboe 2.

Lohengrin Timeline

Vorspiel
Act One
Act Two
Act Three

Grail Realm
Magical Realm

Frageverbot 2

Example of [MELD-based annotation system, from Lohengrin Time Machine](#).

3.3. Enriching

The ability to enrich or extend data stems from adherence to FAIR (Findable, Accessible, Interoperable, and Reusable) principles of research data management. Using widely accepted standards and formats not only facilitates reuse of research findings, but also allows subsequent users to enrich these files with additional data. While a project may have individualised needs and have developed specialised formats and schemas for their data, researchers will often strive to adapt to the data model of an existing standard, thus increasing dissemination of their research contributions and allowing future projects to build on prior work.

Based on XML as the language of the web scholars of historical and literary documents have developed and used the [Text Encoding Initiative](#) (TEI) for some decades now to create dynamic, layered editions, combining data (the texts, including variants, graphical layout) with all sorts of metadata (paratexts about sources, rights, and editorial responsibility) in documents that can be published in forms readable by humans, but also mined for rich information they contain (via various XML protocols like eTree)¹⁴. For the last decade music scholars have paralleled this via the [Music Encoding Initiative](#) (MEI). Similarly to TEI, MEI is essentially an encoding framework. MEI data can be engraved into music notation using Verovio, an open-source rendering library that can be used in a wide range of environments, including web browsers. MEI can do what no printed edition can manage, representing different versions of a piece, editorial interventions, suggestions, and even analytic annotations or links to images or other remote

The screenshot shows a web browser window displaying a musical score for Violino and Bass. The score is rendered in a web browser window. Below the score, the XML encoding is visible, showing MEI notation elements like <note>, <beam>, and <staff>.

The [Verovio](#) music notation engraving library is a versatile tool for rendering MEI encoding scores in a wide range of environments.

¹⁴ eTree stands for 'embedding tree.' It is an XML element used to represent hierarchical, tree-like data structures within a TEI-encoded document, particularly for representing linguistic or structural analyses such as syntactic trees. See <https://tei-c.org/release/doc/tei-p5-doc/en/html/ref-eTree.html>.

resources. Most importantly: it is infinitely extensible and infinitely erasable (as in the case of all XML documents). Scholar B can add to Scholar A's work without ever effacing those interventions. Such encodings are held up as the acid-free paper of the digital age.

In the GLAM sector several initiatives aiming at metadata enrichment on the level of heritage objects have been undertaken—enriching metadata with authority record references. For example, [Annif](#), a machine learning model, can be trained to index full text with controlled vocabulary of subject keywords (authority files registry). The tool has been utilised for Swedish, English, and Polish language as well. On the level of full-text unstructured content, Named Entities Recognition task can be applied in order to find, recognise, identify and annotate fragments of the text with reference to named entity authority file from a selected registry, for example personal name or geographical name. See, for instance, the [tools for Named Entity Recognition](#) listed by CLARIN-EU.

TRY THE DEMO!

INPUT TEXT

Elsner traveled to Paris, Dresden and Posen (Poznań), where he met E.T.A. Hoffmann. Together they founded the Musikressource in 1805. In 1802 he married a second wife, Karolina Drozdowska. Due to complaints that he preferred Germans, he resigned from theatre work.

During his decades in Warsaw, Elsner's name and family life gradually polonized. Elsner's ethnicity should not be evaluated in terms of 19th- and 20th-century national identity, as he continued to refer to himself primarily as a Silesian.

In 1799-1824 Elsner was the principal conductor at Warsaw's National Theater, where he premiered a number of his operas. Elsner also taught at the Warsaw Lyceum, housed in the Kazimierz Palace.

Elsner taught the composers Ignacy Feliks Dobrzyński and Frédéric Chopin. There are also indications that he privately tutored piano composer and virtuoso Maria Szymanowska.[citation needed] Chopin dedicated to Elsner his Piano Sonata No. 1 in C minor, Op. 4 (1828), composed while he was studying with Elsner. As Chopin's only composition teacher in 1823–29, Elsner taught him music theory and composition; Elsner diaried of Chopin: "Chopin, Fryderyk, third-year student, amazing capabilities, musical genius."

On 18 April 1854, Elsner died at his estate named for himself, Elsnerów, which now lies within the Warsaw city limits.

PROJECT (VOCABULARY AND LANGUAGE)

YSO NN ensemble English

MAX # OF SUGGESTIONS

10 15 20

Get suggestions →

annif

SUGGESTED SUBJECTS

composers

Germany

Poland

biographical history

Warsaw

art music

composing

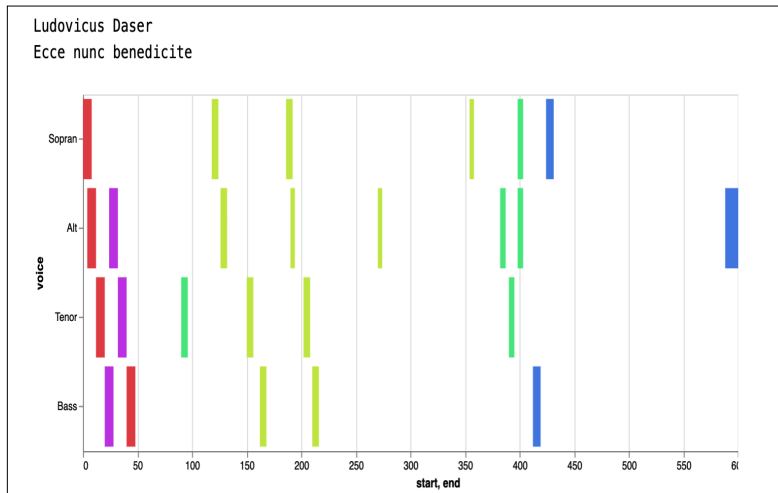
theatre (art forms)

history of music

history

[Annif](#): tool for automated subject indexing and classification.
The results of subject headings extraction on musicological text input.

3.4. Transforming



Ludwig Daser, *Ecce Nunc Benedicite* Notebook with CRIM Intervals:
A Digital Supplement, from [Marcel Klinke and Richard Freedman](#), 'Lasso
takes a Second Look: An Imitation of an Imitation Mass?' 2024.

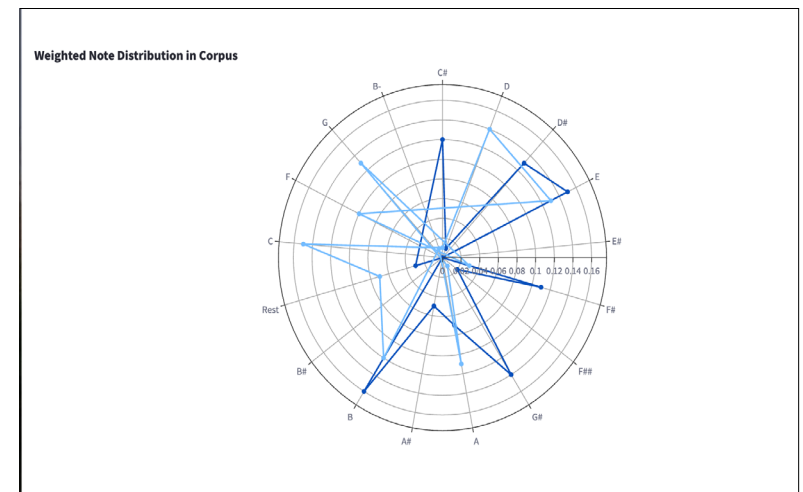
All of these involve some act of translation between purely musical phenomena (the sounds we hear, or perhaps the scores that prescribe them) and some other form or narrative, markup, spatialization, etc. Time series data can easily be rendered in this way, as we see in this 'activity map' of repeating melodic motives in a sixteenth-century motet by Ludwig Daser (colours distinguish the various motives in this piece, moving from left to right from beginning to end of the composition). This kind of schematic reading of musical events as 'derived data' can be an aid to analysis or a means of comparing patterns across pieces.

Other data analysis techniques take us out of the time dimension altogether, viewing a composition (or an entire corpus) as a collection of events, not a series of them.

Such representations do not

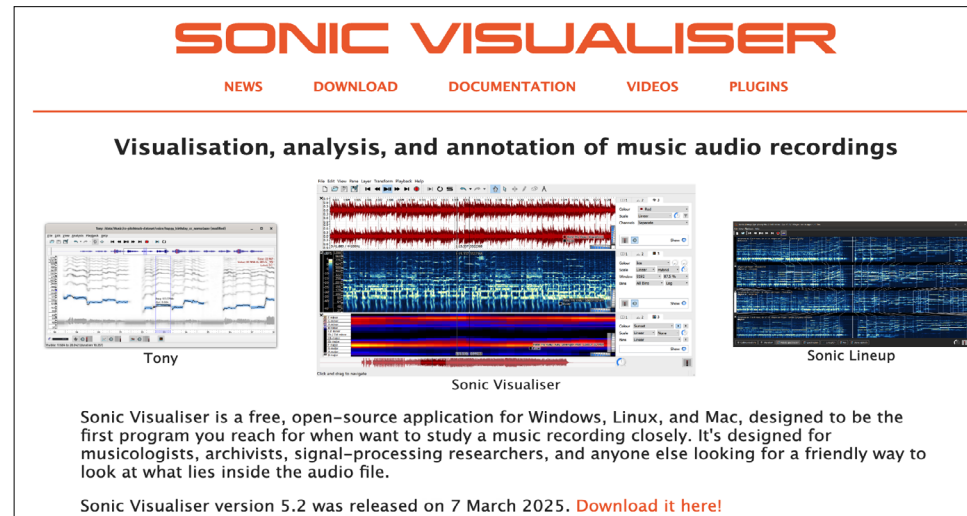
mirror human perception in any direct way. Here, for instance, is a radial representation of the distribution of pitch classes in a pair of J.S. Bach's Two-Part Inventions: one in C major (light blue) and the other in E major (in dark blue), taking into account the total duration of each pitch class in each piece, and rendering these as a proportion of the whole. These 'weighted' distributions reveal what we might call the 'tonal space' of the two pieces in ways that would otherwise be extremely tedious to calculate. But with an encoded score and the assistance of some Python libraries ([Music21](#) or CRIM intervals), this kind of distant reading becomes a revealing possibility.

Indeed, the 'spatial rendering of temporal data' is a key part of many signal analysis techniques in the world of Music Information Retrieval (MIR), which steps back from the direct perceptual flow of events to



Representation of weighted distribution of pitch classes in BWV 772 and 777 made with the [CRIM Intervals Web Application](#).

reveal similarities and difference of a sort that no human reading of a score or audition of a recording could ever manage. The [Sonic Visualizer](#) application, for instance, brings such tools to the desktop of any musicologist working with audio.



Overview of [Sonic Visualizer Software](#) for analysis and annotation of sound recordings.

Of course, these kinds of machine-assisted representations require their own forms of interpretation. By the very nature of these unblinking mechanical eyes and ears, these digital tools force us to make explicit things we know only implicitly, and through long experience with this music. In playing back the results of our formulations to us, our algorithms make us newly aware of biases we did not know we had. This is another of the frequently contradictory effects of digital work: exposing the human in the machine. These tools cannot think, but they materialise thought in ways that force us to reflect on our own methods. Indeed, the process of 'tool criticism' was recently identified by [Frans Wiering](#) (2022) as perhaps the most interesting and important skill that musicologists will need to develop in the years ahead.

We can also mention [ianalyse5](#) and [eanalysis](#), two applications developed by Pierre Couprie, that allow the user to visualise and add annotations to scores or a sonogram, as well as to convey analytical tasks and export them in a variety of formats.



ianalyse software developed by [Pierre Couprie](#).

4. Policy and Legislation

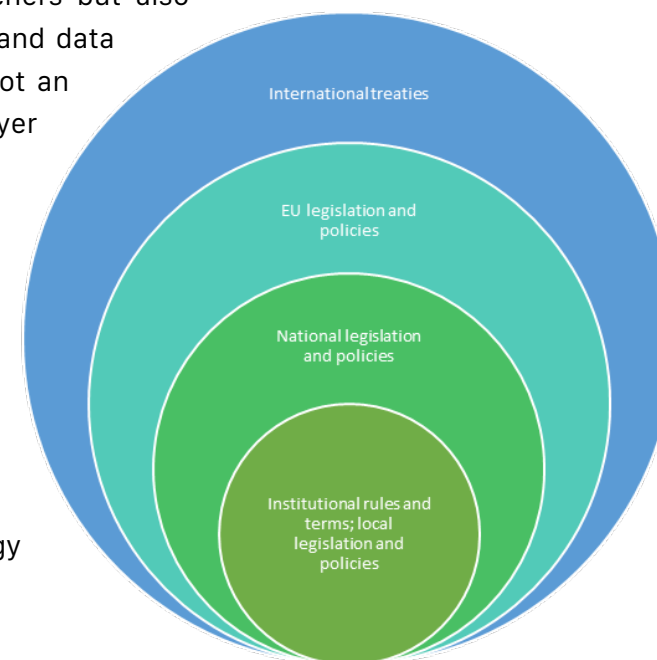
When we think about the challenges and opportunities of musicology as data science and heritage science, many of them turn out to have a legal or policy dimension—often in ways we do not immediately realise or fully understand. Copyright restrictions, data protection rules, and the governance of digital infrastructures all quietly shape what we can access, analyse and share. For scholars or practitioners moving further into data-intensive or heritage science approaches, understanding these legal and policy dimensions is essential.

This chapter lays out the policy and legal landscape (4.1), lists key barriers for the musicological community at large as well as those conducting research on music (4.2), suggests ways to navigate these challenges (4.3) and highlights current developments in policy and legislation that you might want to follow (and potentially, engage with) (4.4).¹⁵

These matters ultimately have direct effects on the position of musicology in the European Research Area. At present, the absence of clear legal and policy frameworks for the reuse of musical recordings, the lack of standardised digitalisation practices, and the fragmented access to resources make it difficult for musical heritage to be fully integrated into broader European heritage science infrastructures. These gaps not only limit what is possible for researchers but also risk excluding musicology from wider European investments in cultural and data infrastructures. In short, understanding legal and policy challenges is not an optional extra; it is a condition for positioning musicology as a central player in heritage science and data science.

4.1. Introducing the legal and policy landscape

Legislation means binding rules like laws, directives, or regulations. They tell you what is legally allowed. **Policy** sets priorities, frameworks, and funding directions. It shapes which projects get supported and which kinds of cultural data are seen as important. Both interact and affect your work. A copyright law may limit what you can use, while an EU funding programme might encourage you to frame your project around ‘data innovation.’ Together, they create the environment in which musicology operates.



Overlapping regulatory frameworks for musicologists.

¹⁵ This chapter specifically focuses on the policy and legislative landscape relevant to conducting musicological research. Policies concerning the funding of research will be discussed in a separate forthcoming paper following the EarlyMuse STSM ‘The Role of Scientific and Cultural Policy in Shaping Musicology and the Early Music Field’ that took place at the University of Malta in 2025, hosted by Jeremy Coleman.

This legal and policy environment has different dimensions:

- At the **local or institutional level**, libraries or archives decide how and whether you can access or digitise collections.
- At the **national level**, governments make copyright laws and cultural policy, often interpreting EU directives in their own way.
- At the **EU level**, the Union has no direct power over culture, but it strongly influences copyright, data protection, and the digital market.¹⁶ It also funds major infrastructures like Europeana.
- At the **international level**, treaties (e.g. UNESCO, WIPO, Berne Convention on copyright) set the global framework for copyright and heritage protection.

Before starting a project, it might be worthwhile to map out which levels of law and policy are relevant to the materials and collaborations involved. This awareness will help avoid legal dead ends and allow the musicological community to strategically advocate for reforms at the right level (local, national, EU, or international). A helpful resource on policies and laws affecting cultural heritage at both the EU and national levels is the [Policy Monitor](#) developed and maintained by the European Heritage Hub. The European Music Council also maintains [resources on cultural policy](#), particularly at the European level, and the [Compendium Cultural Policies and Trends](#) provides a wide range of country profiles.

16 Although the EU has no direct competence in the field of culture, several [types of legislation](#) significantly shape what musicologists can do in practice. **Regulations** are binding legislative acts that must be applied in full across all EU Member States. Relevant examples include the [Regulation \(EU\) 2017/18 on cross-border portability of online content services](#), the [Regulation \(EU\) 2021/818](#) establishing the Creative Europe Programme (2021-2027), the [Regulation \(EU\) 2022/1925](#) on contestable and fair markets in the digital sector and the [Regulation \(EU\) 2022/2065 on a Single Market for Digital Services](#). **Directives** are legislative acts of the European Union (EU) that set out goals that Member States must achieve, while leaving the details of implementation to national governments. Important directives include the [Directive 2014/26/EU \(Multi-territorial Music Licensing\)](#), the [Directive 2019/790](#) (on copyright and related rights in the Digital Single Market, amending Directives 96/9/EC and 2001/29/EC), the [Directive 2019/789](#) laying down rules on the exercise of copyright and related rights in online transmissions and retransmissions of broadcast media, and the [Directive 2019/770](#) on aspects concerning contracts for the supply of digital content and digital services.

Level	Why it matters	Example	Strategy
	Individual archives, museums, or universities often set their own policies on digitisation, licensing, and data sharing. These may be more restrictive than the law itself, out of risk aversion or resource constraints.	A municipal music archive may decide not to digitise recordings even if copyright has expired, due to limited staffing or unclear internal policies.	Building relationships with institutional staff (archivists, librarians, legal offices). Their rules often shape your day-to-day access more than EU law.
	EU directives must be transposed into national law, leading to different rules across Member States. Cultural policy is also largely national, with ministries of culture or copyright offices setting frameworks	The 2019 Copyright Directive was implemented differently across Europe. What counts as a text-and-data mining exemption in France may not be identical in Germany or the Netherlands. ¹⁷	Always checking the national transposition of EU directives in the country where you are working. What is legal in one country may not be in another.
	Even though the EU has no direct competence in culture, its laws on copyright, data protection, and digital markets strongly affect musicological work. EU funding programmes promote open science and FAIR data.	The 2019 Copyright Directive introduced exemptions for text and data mining, but only within certain boundaries, leaving institutions uncertain about how far they can go.	Being aware that EU rules create broad goals, but interpretation is uneven. When working in EU-funded projects, aligning your practices with open science policies.
	Music and research often cross borders beyond the EU. International treaties and organisations (WIPO, UNESCO, Berne Convention, TRIPS) establish global norms for copyright and heritage protection.	A recording held in a US archive may be accessible under US ‘fair use,’ but reusing it in an EU-based project may require additional licensing. Conversely, EU projects can contribute to UNESCO frameworks on intangible cultural heritage.	Always considering international agreements when collaborating globally. Being mindful of differences between ‘fair use’ (US) and ‘fair dealing’ (EU/UK), and explore UNESCO or WIPO channels for broader advocacy.

¹⁷ Text-and-data mining (TDM) exemption: a clause in copyright law that permits researchers to automatically analyse large volumes of digital material (such as texts, images, or recordings) for scientific purposes without needing individual permissions.

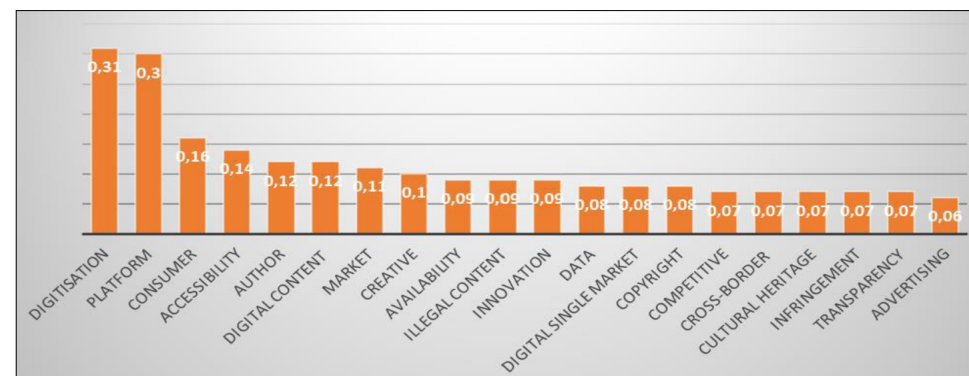
4.2. Current challenges for musicology

The dynamic policy and legislative landscape presents a set of challenges that deserve collective attention within the musicological community. As we outlined earlier (see 4.1), this landscape has multiple dimensions: some rules are set at the local or institutional level, others at the national level, while European and even international frameworks also play a role. For researchers, it can be difficult to disentangle these layers. In this section, we highlight key issues that limit the integration of music into broader European infrastructures for heritage and data science. We focus on the European level not because it is the only one that matters, but because EU legislation and policy increasingly set the framework within which national laws and institutional practices operate.¹⁸ Reading this section with that in mind can help clarify why certain obstacles arise and where efforts to address them might be most effective.¹⁹

Four challenges stand out in particular:

1. Music is rarely recognised as a form of cultural heritage in its own right

While music is frequently celebrated as a ‘universal language’ and a symbol of Europe’s cultural diversity, it is rarely articulated in legal and policy frameworks as cultural heritage in its own right. Many of the laws and policies shaping our work were not designed with musicological research or heritage in mind. Existing policies tend to treat music primarily as part of the ‘creative industries,’ focusing on its economic and commercial potential. Initiatives such as the European Commission’s [Music Moves Europe](#) programme, for instance, emphasise competitiveness and industry development



Keywords in relevant EU legislative and policy documents adopted between 2015 and 2023.

¹⁸ Here, the findings of the Horizon Europe project [FairMusE](#) ('Fair Music Business Models for a Sustainable European Music Ecosystem') are especially relevant. FairMusE systematically mapped the regulatory, economic, and social conditions of the music sector, with a strong focus on fairness, competition, and platform regulation. Its outputs provide both an evidence base and concrete policy recommendations that directly touch on the challenges we outline in this chapter.

¹⁹ Antonio Vlassis et al. (2025), [Deliverable 2.1. Origins, goals and effects of EU law and policy in the online music sector](#), p. 18.

rather than preservation and access to music as heritage. Initiatives like [FairMusE](#) confirm this observation. Their analysis shows that EU music policy is overwhelmingly oriented toward industry growth, competition, and digital platform regulation, leaving heritage-related concerns marginal.²⁰ One of the key recommendations to follow from this would be to broaden the policy lens so that music is recognised not only as ‘content’ in a market but also as cultural heritage with long-term public value.

2. Conflicting stakeholder interests

Music sits at the crossroads of cultural heritage and commercial industries. As a result, different stakeholders often have competing priorities. Cultural heritage institutions seek flexibility to digitise and provide access, while the cultural and creative industries (CCIs) rely on strong copyright protections to protect their revenue streams. Policymakers, meanwhile, often prioritise the economic weight of industry players, especially in relation to global digital platforms, over the needs of heritage institutions and researchers. These conflicting interests create a policy environment where the reuse of musical materials for scholarship, preservation, or public education is frequently restricted or deprioritised.

A major factor exacerbating this issue is that many cultural heritage institutions themselves struggle to navigate the legal landscape surrounding copyright and intellectual property. The uncertainty about what is legally permissible creates hesitation, leading institutions to either delay projects, avoid certain types of audio-enhanced exhibitions, or overestimate legal risks, ultimately resulting in missed opportunities. Museums that are specifically dedicated to music, including collections of musical instruments or particular composers or musical groups, are particularly affected by these uncertainties.

Institutions can also impose their own rules for political, economic, or reputational reasons, which may be more restrictive than the law itself. In practice, this means that institutional or platform policies sometimes set the conditions for access, shaping what is actually possible in a project. For example, archives may hesitate to digitise out of caution, or platforms like YouTube may limit certain types of reuse even when research exemptions exist. While this can feel like an additional barrier, it is

²⁰ *Ibid.*, 24–28.

also an important reminder that law and policy are not the only factors at play: institutional decisions and platform rules are part of the ecosystem we have to learn to navigate. The positive side is that these rules are not fixed: through dialogue, partnerships, and collective advocacy, researchers and institutions can often find workable solutions.

3. Weak legal frameworks for research and reuse

Even when music is acknowledged as heritage, the legal tools available to researchers remain weak. Unlike written or visual heritage, musical recordings and related materials benefit from fewer exceptions and exemptions for research and education. The 2019 Copyright Directive introduced text-and-data mining provisions, but their uneven implementation across Member States leaves researchers uncertain about what is possible in practice. The impact of these legal uncertainties extends directly to musicologists, whose work relies on access to historical recordings, music metadata, and archival or museal materials. Without legal mechanisms that allow for the responsible reuse of musical heritage, institutions struggle to share materials with scholars, limiting musicologists' ability to conduct research, create new editions of works, facilitate performances, and contribute to digital archives. The absence of robust 'fair use' provisions, combined with complex layers of rights in performances,

editions, and recordings, makes it difficult for musicologists to reuse materials. As a result, research outputs (whether datasets, new editions, or digital exhibitions) often remain locked away rather than becoming part of shared infrastructures. The consequences of this legal paralysis are significant. Not only does it restrict public access to Europe's musical heritage, but it also discourages both institutions and researchers from pursuing innovative projects, especially those involving AI or large-scale data analysis.



FairMusE

The [FairMusE project](#) is an Horizon Europe project dedicated to promoting fairness, transparency, and sustainability across the European music ecosystem, particularly in the wake of the dominance of online platforms and algorithm-driven streaming models. The team shares their insights via reports, as well as podcasts and other outputs.

What legal rules decide which materials can be digitised and made available as cultural heritage?

- Copyright law is the main gatekeeper. In the EU, recordings, compositions, and editions can remain protected for up to 70 years after the death of all of the authors, performers and other creative and intellectual contributors. This limits what archives can digitise and put online without licenses.
- Separate rules regulate the protection of privacy in unpublished materials: private content (e.g. private correspondence), personal data, images of private individuals, as well as works that were never published or performed.
- The EU cannot legislate culture directly, but directives (e.g. 2019 Copyright Directive, DSM) and national implementations shape what can be digitised for research, preservation, or education. National variations create a patchwork.
- Unlike written or visual heritage, musical heritage has fewer clear exemptions, making its integration into infrastructures like Europeana or E-RIHS more difficult.
- Even when exceptions exist (e.g. for preservation), archives and museums often hesitate, fearing infringement. This leads to under-digitisation and limited availability.

Takeaway → *access depends not only on copyright duration but also on how confidently institutions interpret exceptions and whether EU/national frameworks provide clarity.*

4. Fragmentation and lack of standards

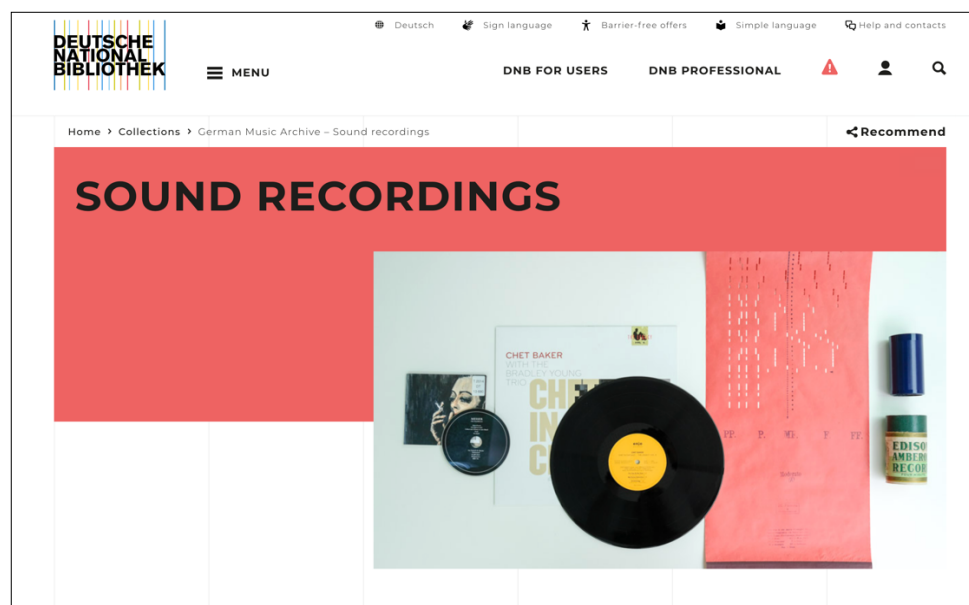
Even when materials are legally accessible, fragmentation remains a major barrier. Institutions across Europe apply different digitisation standards, use different metadata models, and interpret copyright exemptions in different ways. This creates a patchwork system where data cannot easily be shared or combined. For infrastructures such as the *European Collaborative Cloud for Cultural Heritage* (ECCCH) or E-RIHS, which rely on interoperability, this fragmentation undermines the integration of music into broader heritage science initiatives. Researchers trying to work across borders often encounter ‘silos’ of information and face additional costs in harmonising datasets that should, in principle, be reusable.²¹

²¹ On this topic, it will be worthwhile to monitor developments around the EU Data Act (active since September 12, 2025) and the forthcoming [Data Union Strategy](#).

These challenges cannot be solved by individual researchers alone. They require collective responses: stronger representation of musicology in European heritage debates, clearer legal frameworks that balance public and commercial interests, and the development of standards and infrastructures that account for the particularities of music. FairMusE shows that these collective responses are possible: its future agenda explicitly calls for a ‘fairer music ecosystem’ that balances industry competitiveness with cultural sustainability, and opens up opportunities for researchers and heritage professionals to be part of this process. In the final section of this chapter, we will look at future developments and opportunities for us to engage and address these issues, both as individual scholars and as a musicological community.

4.3. (How to navigate) challenges you might encounter

Researchers often encounter legal and policy questions in three main areas: **access, use, and circulation**. Below we outline what this means in practice, with short examples you might recognise from your own projects.



The digitised holdings of the [historical sound archive of the German National Library](#) are searchable in the online catalogue (though only accessible via listening booths in their physical reading room).

4.3.1. Access: what can be digitised and made available?

Access depends mostly on copyright and institutional rules. Can we obtain the materials we need?

Challenges we face are:

- Copyright and related rights: musical recordings and scores may remain protected for decades, creating uncertainty about what can be accessed freely.
- Fragmentation: archives and institutions vary in their access conditions, licensing terms, and digitisation priorities. This creates a 'patchwork' of resources rather than a coherent European landscape.
- Digital divide: while some collections are well digitised and openly available, others remain locked behind institutional walls or exist only in analogue form.

Example 1: Public domain scores. If you want to digitise an 16th-century manuscript from your library, you can usually do this freely because copyright has expired.

Example 2: Recordings of the same music. A 1970s LP of that composition may still be protected. Even if the composition is public domain, the performance and the recording have their own rights. Digitising and sharing that without permission can be a problem.

Example 3: Archive restrictions. Some archives limit digitisation because they do not know the copyright status or do not have the resources to manage permissions. In practice, this means you might get access on-site, but not be allowed to put files online.

Takeaway → ask about rights status and if in doubt, check with librarians or rights offices before planning a digital project. Access depends not only on copyright duration but also on how confidently institutions interpret exceptions and whether EU/national frameworks provide clarity.

4.3.2. Use: what can be analysed with digital tools?

Key challenges around copyright, data protection, and platform rules include:

- Licensing restrictions: some digitised collections allow only personal study, not text-and-data mining or computational analysis.
- Unclear exceptions: the EU's DSM Directive (2019) introduced text and data mining exceptions but their implementation varies across Member States, creating uncertainty for cross-border projects.

- Standardisation gaps: lack of consistent metadata and formats hampers large-scale analysis and reuse across datasets.

Example 1: Text and data mining. The 2019 EU Copyright Directive introduced exceptions that allow researchers to mine text and data (TDM). This means you can, for instance, run algorithms on large corpora of digitised scores. But recordings are more complex: the Directive left many grey areas, and not all Member States interpret it the same way.

Example 2: Personal data in archives. Suppose you are working with oral histories of performers. GDPR rules mean that names, addresses, or even rehearsal comments may count as personal data. You may need consent before analysing or sharing them.

Example 3: Working with streaming platforms. If you want to scrape data from Spotify or YouTube to analyse audience behaviour, platform terms of service (not just copyright law) decide what you can or cannot do. These rules are often stricter than EU law and can shut down projects if ignored.

Takeaway → *having the files does not automatically mean you can use them for digital analysis. Check copyright, data protection, and platform conditions before starting.*

4.3.3. Circulation: what can be shared across borders?

Can we share research outputs like datasets, analyses, or digital editions with the wider community? EU directives and regulations try to harmonise rules, but national copyright laws differ, making cross-border projects tricky. International treaties like the Berne Convention also apply. For example, a recording you can legally use in the US under 'fair use' may still require licensing in Europe. Challenges include:

- Rights over derivative works: even when scholars create new datasets from existing recordings, rights holders may claim restrictions on redistribution.
- Institutional silos: research outputs are often stored in project-specific repositories, making long-term accessibility uncertain.
- Policy expectations: EU programmes increasingly require open science and FAIR data principles, but meeting these demands is difficult without clear legal pathways for musical materials.

Example 1: Different rules for 'fair use.' In the US, using short audio clips in teaching or research may be covered by 'fair use.' In Europe this often still requires a license, even for research. A dataset legal in one country may not be legally usable in another.

Example 2: EU vs. national differences. The EU tries to harmonise rules, but directives are implemented differently in each Member State. A project involving institutions in Germany and Italy might discover that what is permitted in one country is blocked in the other.

Example 3: Sharing metadata. You may think metadata is 'safe', but even sharing basic details like recording dates or performer names can raise legal questions under copyright or GDPR. Some institutions restrict metadata exports, even though they seem like harmless facts...

Takeaway → *circulation is not only about your research outputs but also about the underlying data. Plan early if your project involves partners across countries, and check national as well as EU rules.*

4.3.4. Navigating the challenges: checklist for research projects

The legal and policy environment can feel daunting, especially if you are just starting out in digital or heritage-focused musicology. Still, it is worth our effort. Most projects can move forward once you know where to look for answers, who to ask for help, and how to plan ahead. Navigating these hurdles not only protects your work but also strengthens your ability to advocate for better access and, hopefully, more research-friendly legislation and policy in the future.

A good first step is to map out which levels of law and policy apply to your project. Identify what kinds of materials you will be using (manuscripts, recordings, editions, metadata, oral histories) and check which legal and policy frameworks apply. Being aware of this avoids dead ends and helps you bring questions to the right people. In general, we suggest seeking support (librarians, archivists, and research data specialists often know the latest about copyright and licensing) and staying pragmatic (many issues have workarounds; you do not need to abandon your project at the first obstacle). A local institution with a legal department or a colleague who specialises in law might be able to help you map the national context, both for yourself *and* for joining cross-border projects. Establishing contact with, or acquiring knowledge of, the national authors' rights societies (which play a major role in music-related copyright issues) can also be very valuable. You can find information about the different societies and what they do [here](#) (scroll to the bottom of the page for a directory by country).

Key aspects to keep in mind:

- **Copyright status:** always check whether the material you want to use is still protected. Manuscripts and scores may be in the public domain, but recordings and edited editions often remain protected for much longer. Librarians or research data specialists can guide you through this.
- **Licensing and permissions:** critical editions, recordings, or even performance notes may require licenses before you can reuse or publish them. Remember: using a work in private research does not automatically give you permission to include it in a publication or dataset.
- **Digitisation:** if you plan to digitise sources, make sure this is legally allowed (even if you are doing so only for preservation). Some institutions are risk-averse and may limit what you can digitise without formal clearance.
- **Metadata and analysis:** using metadata for computational analysis can be tricky. Some institutions treat metadata as freely reusable, while others impose restrictions. Confirm what is allowed before investing in a large-scale project.
- **Performances and recordings:** if you record performances as part of your research, you will usually need consent from performers, composers, and rights holders. Sharing these recordings later often requires extra permissions.
- **Publications and open access:** many funders now require open-access publication of research and data. Check your institution's policies and make sure that any musical examples (score excerpts, audio clips, etc.) comply with copyright.
- **Cross-border collaborations:** if your project involves partners in different countries, be prepared for different national implementations of EU law. What is possible in one country may not be legal in another. Review agreements carefully, especially for data sharing.

To help you along, we provide you with a practical list of questions and actions to consider. Think of it as a companion you can return to whenever you are planning, conducting, or publishing your research. This checklist will not answer every question, but it will help you spot red flags early, involve the right people, and make your research more sustainable. And over time, our collective awareness of these issues strengthens musicology's voice in European heritage and policy debates.

Checklist for musicological research projects

Before you start:

- Map out which levels of law/policy apply (institutional, national, EU, international).

- Identify whether your project involves copyrighted works, personal data, or cross-border collaborations.
- Contact your librarian, archivist, or legal office for initial guidance.

Access & Digitisation

- Have you checked the copyright status of the materials you want to use?
- Are the works in the public domain, or do edited editions/recordings carry new rights?
- Does your institution/partner archive allow digitisation for research or preservation?
- Do internal rules (risk aversion, staffing limits) restrict access beyond what the law says?

Use & Analysis

- Do you need licences to use critical editions, recordings, or metadata?
- Does your project involve text-and-data mining (TDM)? Check how the 2019 EU Copyright Directive is applied in your country.
- Are you working with personal data (oral histories, performer notes, letters)? If so, are you GDPR compliant?
- Are you planning to analyse or scrape data from platforms (Spotify, YouTube)? If so, check their terms of service.

Performances & Recordings

- Do you have consent from performers and rights holders if you record performances for your project?
- Do you understand what permissions are needed if you want to share or publish those recordings?

Publication & Sharing

- Do your funders or institution require open-access publication of data and outputs?
- Are the formats and metadata you use (e.g. Dublin Core, MEI) interoperable with larger infrastructures like Europeana or ECCCH?
- If you plan to share across borders, have you checked whether national implementations of EU law differ between your project partners?

Sustainability & Advocacy

- Where will your outputs (data, recordings, editions) be stored for the long term?
- Have you identified potential barriers that could be raised with professional associations, networks or other platforms?

4.4. Opportunities (and ways to get involved)

While we have discussed many challenges, there are also **real openings** emerging in EU policy, infrastructure, and legislative processes. Initiatives are being launched, new calls are being published, and the connections between music as cultural heritage and data are gaining visibility. This section highlights some promising directions and suggestions for how you as a researcher or as part of the musicological community can engage.

4.4.1. Emerging infrastructures & opportunities

- New infrastructures are taking shape that offer concrete opportunities for musicologists. The [European Collaborative Cloud for Cultural Heritage \(ECCCH\)](#) is one of the most significant. Developed under Horizon Europe, it aims to provide digital tools, collaborative environments, and shared infrastructure for digitisation, metadata harmonisation, data storage and usage. ECCCH's funding calls for, for example, 'innovative use cases' and 'innovative tools and methods for digitisation and analysis,' present opportunities for music-related proposals that show how music heritage data, analysis, and access are parts of broader digital infrastructure questions.
- [HorizonEurope](#), the European research and innovation funding programme, publishes many other calls that increasingly focus on (a) open science/FAIR data, (b) alignment with common European data spaces/European Open Science Cloud and (c) collaborative, transnational projects. The current Horizon programme runs until 2027, but contours of the 2028-2034 framework are already underway.²²

Pillar I	Pillar II	Pillar III	Pillar IV
EXCELLENT SCIENCE	COMPETITIVENESS AND SOCIETY	INNOVATION	EUROPEAN RESEARCH AREA
€44.079 BILLION	€75.876 BILLION	€38.785 BILLION	€16.262 BILLION
EUROPEAN RESEARCH COUNCIL	COMPETITIVENESS ¹ : 1. Clean Transition and Industrial Decarbonisation 2. Health, Biotech, Agriculture and Bioeconomy 3. Digital leadership 4. Resilience and Security, Defence Industry and Space	EUROPEAN INNOVATION COUNCIL	ERA POLICIES
MARIE SKŁODOWSKA-CURIE ACTIONS		INNOVATION ECOSYSTEMS AND THE KNOWLEDGE TRIANGLE	RESEARCH AND TECHNOLOGY INFRASTRUCTURES
SCIENCE FOR EU POLICIES	SOCIETY: 1. Global societal challenges 2. EU Missions 3. New European Bauhaus Facility		WIDENING PARTICIPATION AND SPREADING EXCELLENCE

Preliminary structure for the [2028-2034 Horizon Programme](#).

22 The European Commission published [initial proposals for the 2028-2034 Horizon Framework in July 2025](#).

- [FairMusE](#) shows how the push for music data to be Findable, Accessible, Interoperable, Reusable (FAIR) is growing. Projects like the European Cloud for Heritage OpEn Science ([ECHOES](#)) under ECCCH help build essential technical and policy norms.
- The EU's [Multiannual Financial Framework for 2028-2034](#) (MFF) is under negotiation. Initial proposals suggest merging the current Creative Europe programme into a new structure called [AgoraEU](#), focused on Culture, Media, and Democratic Values. This signals an important policy shift: cultural heritage, media, and democracy will be framed together, opening both opportunities and risks for musicology.

A new programme to support Culture, Media and Union values

The new **AgoraEU** programme will:



Promote cultural and linguistic diversity and cultural heritage



Protect artistic and media freedom, support the diversity & competitiveness of the audiovisual sector



Fosters a free and diverse information space, where all voices have a right to be heard



Protect and promote equality, citizenship, rights and values



Support civil society, democratic participation and the rule of law

[Objectives of the proposed AgoraEU programme](#)

4.4.2. Pathways for individual engagement



Example of [webinars on copyright law for cultural heritage studies](#) in 2025.

and partner organisations often host live sessions and [webinars](#) (often recorded for later use) on copyright law, heritage infrastructures, open science and opportunities in Horizon Europe. These are practical entry points for researchers.

- Collaborate across disciplines. Partner with digital humanities, heritage science, or information science. Many technical tools (AI, cloud computing, data visualisation) are developed outside musicology but can be adapted for our field.

In your approach, keep in mind:

- Scale and relevance. Infrastructure calls often favour projects with broad ‘use cases’ and demonstrable societal value. Proposals should connect musicology to broader priorities of the EU and its programmes (i.e. digital transformation, innovation, accessibility, cohesion, democracy, creativity).²³

As an individual researcher, you might:

- Experiment and demonstrate. Propose **projects** that test new approaches to digitising, analysing, or visualising musical heritage (e.g. performance metadata, digital editions, dynamic data, AI-driven analysis).
- Shape governance and standards. Many infrastructures actively seek stakeholders to co-create metadata standards, licences, and rights statements, interoperability. We can help ensure that music’s specific needs are recognised.
- Leverage open data and science norms. When applying for Horizon Europe or related programmes, highlight FAIR principles, open tools, interoperable formats, and reuse to strengthen your proposal.
- Learn and stay connected. European institutions

23 For more information on EC-priorities see, for example, https://commission.europa.eu/index_en and https://european-union.europa.eu/priorities-and-actions/eu-priorities/european-union-priorities-2024-2029_en. Specific priorities for Horizon Europe, for example, may be found [here](#).

- Legal soundness. Plan for copyright and licensing issues early on (including rights clearance, use of metadata). A legally robust proposal ensures that outputs can be preserved, reused, and shared.
- Early engagement. ECCCH and other Horizon calls often require co-creation. Involving archivists, rights holders, and institutions from the start strengthens feasibility and legitimacy.

4.4.3. Pathways for collective influence & engagement

Individual action matters, but collective engagement is essential to secure musicology’s place in Europe’s cultural and research landscape. Consider:

- Monitoring EU frameworks. Follow developments in the new Multiannual Financial Framework (MFF)—in particular policies in the realms of research²⁴, innovation, AI and digitalisation²⁵, and culture²⁶, including [AgoraEU](#)²⁷ – and track how musicology can align with wider EU priorities.²⁸
- Joining or forming networks within broader professional associations, networks and projects to consolidate what musicologists need and advocate for it collectively.
- Contributing to consultations. EU institutions regularly open public consultations on policy frameworks (Horizon Europe, [Culture Compass](#), [Creative Europe](#), data governance). Musicologists can highlight barriers and opportunities directly.

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- 24 Consultations on Horizon Europe could be especially relevant, as well as EC-communications on the broader European Research Area. For example, see [here](#).
- 25 Relevant here are EU Digital Services Act (DSA), Digital Markets Act (DMA) and [Data Act](#). The Data Act came into effect on September 12, 2025 and is a key pillar of the European [data strategy](#). It will make a significant contribution to the [Digital Decade](#)’s objective of advancing digital transformation.
- 26 [Culture Action Europe](#) and other platforms provide detailed up-to-date analyses of developments in cultural policy. For an example of recent EC-communications on priorities in cultural policy, see the [Mission Letter](#) to the Commissioner-designate for Intergenerational Fairness, Youth, Culture and Sport via and keep an eye out for the [CultureCompass](#) that will be adopted by the College of Commissioners in November 2025.
- 27 Initial proposals for AgoraEU seem to welcome research opportunities related to ‘strategic’ themes, such as digitalisation: ‘Research and innovation are essential to developing inclusive, rights-based cultural, creative, and media systems. The initiative will strengthen synergies with the future Framework Programme for research and innovation and the future European Competitiveness Fund. The latter includes support for multidisciplinary research on a variety of topics, including democracy, values, equality, and disinformation, but also on digital and industrial topics closely linked to the culture and creative sectors and cultural heritage. Synergies and complementarities will need to be strengthened to reinforce the European research ecosystem, so that the cultural and creative sectors and civil society fully benefit from the advances of European research and innovation areas. The Programme will thus contribute to the take-up of the results of research and innovation actions funded under the Research Framework Programme.’
- 28 See also, for example, recent developments around the Culture Compass for Europe and the [New European Bauhaus](#). The Culture Compass will serve as a strategic framework for EU cultural policy, aiming to improve the consistency of EU policies and strengthen coordination between funding and policy.

- Producing evidence. Publish case studies, policy briefs, or reports showing both the value of music heritage as data and the barriers researchers face. Policymakers often rely on such evidence.
- Building capacity. Run or join workshops on metadata standards, rights clearance, licensing, and open tools to help the community navigate complex frameworks.

In sum, this moment is promising in part because many pieces are being set in place: infrastructures, funding, policy norms. But to benefit, we need not just to follow but also participate. In drafting proposals, in policy dialogues, in technical or legal working groups. The more visibly the musicological community engages, the more likely it is that musicology (both as cultural heritage and as data science) will become a recognised and supported part of Europe's cultural and research future.

5. Outcomes

Making musicology in a digital age will require us to think carefully about musical texts in all their richness, from original source to computer screen, and from traditional prose text to recorded performance. Familiar ways of working these texts will certainly continue to thrive: close reading of scores, qualitative evaluation of works and their cultural meanings. However, increasingly, we will place these modes of inquiry in counterpoint with new ways of reading-both distant and quantitative. Digital skeptics worry that the machine's eye (and ear) will soon replace the human one. But we need to remember that algorithms seem uncanny precisely because they play back our all-too-human ways of thought and expression. Thus, the key will be to inform ourselves about how these machines work (and how they fail). The patterns they uncover in this way are not answers, they instead prompt us to formulate new questions in a renewed digital-hermeneutic circle. They demand human hypothesis and interpretation. What will this work look like, and how can we prepare ourselves (and the new generation of scholars) to meet these challenges?

5.1. Education, Learning and Professional Development

Working with rich and connected data of the sort we have in mind will both require and inspire new kinds of literacies and new kinds of disciplinary intersections. No doubt we will continue to train researchers accustomed to the solitary humanist, burrowing away in a library carrel in search of unique insights or perspectives. But we also need to prepare a new kind of knowledge worker who is thoroughly at

home in a workplace that looks increasingly like ‘big data’ science and social science, with extended networks of collaborators co-authored publications, and standardised (or at least consensus-based) methodologies that lead to (near) reproducible results.

Preparing ourselves (and in turn, the next generation of musicologists) for this kind of work will require some re-education and reformulation of curricula. We need to foster literacy in new ways of gathering, enriching, combining and interpreting music sources, which are increasingly understood as data. As technologies evolve at an ever-increasing pace, sharing knowledge and educational resources both vertically (to students) and horizontally (between researchers) is the only sustainable option. Important is also to reach out and connect with related fields like Music Information Retrieval and Music Computing²⁹, where high technical expertise exists, and who are prime target audiences for (historical) musicological data of high quality. Such work will be particularly important for the success of institutions and scholars with only modest technical infrastructure.

And so we should be intentional about the creation of:

- **curricula:** modular assignments that can be adapted for different data sets and institutional contexts, including sharable code that can be used to work with various data sets in project-based assignments;
- **workshops** with experts to train instructors, their assistants, and students, both within and across institutions;
- **networks** to exchange expertise and ideas (like a ‘digital musicology skills network’);
- **internships** or even ‘mid-docs’ for emerging scholars, perhaps modelled on programs like the ones offered via the [Price Lab for Digital Humanities at the University of Pennsylvania](#).

To date, musicological research is largely disconnected from the cultural and creative industries (CCIs). While there are numerous points of interaction, long-established ways of engaging with the CCIs, such as CD booklets, are disappearing. It is rarely the case that people from the creative or cultural sector are in dire need of musicological expertise; rather, it is usually up to musicologists to try to establish links or make their work known more broadly.

29 It is a research field that combines scientific, technological, and artistic methodologies in order to understand, model, and generate sound and music through computational approaches.

This is not true for music per se. The music industry is massive (one of the largest globally), having pivoted quickly in the last 20 years from the material mediation of the CD to the world of streaming. In this new landscape, music means almost nothing on its own, but is instead refracted through the behaviours of hundreds of millions of users, at least since the advent of [Matrix Factorization](#). Such work has required a host of computer and data scientists to manage and organise. However, these specialists, as Nick Seaver³⁰ and Liz Pelly³¹ have recently argued, rarely have a background in musicology, and there is an evident skills gap that needs to be bridged.

Apart from educating ourselves and the next generation of musicologists to become visible and appealing to the music-related industries, we see several further points of connection, many of which are already underway:

- Using music data in public music education
- Using music data in multimedia performances
- Using music data for heritage sites

But what do we musicologists actually bring to the table? Arguably, it is the quality of (meta)data that musicology can provide. However, we should remember that in the big data age, quality loses to quantity – at least in principle and from the perspective of the music industry. Thus, it might be helpful to shift the gaze from the very big players to somewhat smaller ones, with whom fruitful interactions seem more likely. National museums and galleries increasingly explore new formats for their exhibitions where music (or sound more generally) plays an important role for user immersion. [New European Bauhaus](#) policy and funding initiative, aiming at sustainability, social inclusion and aesthetics, seems tangential to this particular trend.



30 Nick Seaver (2022), *Computing Taste. Algorithms and the Makers of Music Recommendation*.
31 Liz Pelly (2025), *Mood Machine. The Rise of Spotify and the Costs of the Perfect Playlist*.

5.2. Linking and accessibility

The FAIR principles are a well-established set of guidelines in the world of Open Science (see for instance the [OSCARS](#) project). But for music (and musicology) these principles in many respects remain an elusive but vital goal. Part of the challenge is simply the vast (and often strange) data that are part of the musicological domain. European symbolic-graphical notation forms a kind of ‘interoperable’ standard by which musicians can communicate with each other. But flat, graphical files (like PDFs or images) are hardly amenable to the new modes of reading and interpretation we will need to foster in the decades ahead. Meanwhile, we lack any consensus on a specifically logical/digital means by which we can encode a musical work. Instead we have things like [MIDI](#) files (which originated as a system for controlling electronic instruments), [Music XML](#) (a kind of de facto interchange standard between music notation software), or (for about the last decade) [Music Encoding Initiative](#) files (like the TEI standard, with a rich capacity for scholarly annotation and metadata), among others. Transforming one into the other is no trivial task. Nevertheless, LLMs already have a surprisingly good representation of these structures, and can be of considerable assistance in converting one form to another.³² In brief: interoperability that minimises information loss remains a key priority for work with Music as Data.

Another important challenge for **FAIR** datasets is found on the other side of the equation: data about Music. Of the encoding standards noted above, only MEI contains robust capacity for linking scores to the standard identifiers (like [VIAF](#)) for the composers and editors who create them, and thus for managing the layers of intellectual property that are a key dimension of all ‘**responsible**’ (in the FAIR sense) of work with the performing arts.

Yet even if we could reliably connect the texts with their makers, we would still face an even more difficult problem: the thorny Work Concept itself. RISM, as a resource founded to make a systematic inventory of sources, has so far managed to side-step the challenge of creating persistent work-level identifiers for musical compositions themselves, which remain in many respects convenient abstractions (tests with the exclusive use of printed thematic catalogues of composers are underway). Humans are prepared to understand the many renditions of (for example) a Bach partita: Bach’s autograph manuscript copy, the edition in the [Neue Bach-Ausgabe](#), the copy on your piano, the CD

32 See Richard Freedman and Daniel Russo-Batterham (2024), ‘[Musicology in a Time of Technological Transformation](#)’.

on your shelf, and the many MP3s on Spotify as expressions of one and the same artistic idea. But for machines, ‘finding’ these manifestations automatically across score archives and databases remains a serious challenge.

Do we need formal ontologies and sets of identifiers for musical works as a way of connecting them with scores and the vast array of metadata (biographical, geographical, codicological, institutional) that help us put them in context? Professional librarians and database designers would probably say yes. Yet, the success of public datasets like [IMSLP](#), or [ChoralWiki](#), or even various Kaggle compilations³³ reminds us that while such loosely curated resources generally do not fully conform to our scholarly standards, we should not simply dismiss them as irrelevant. On the contrary, they highlight what many users value: easy access over complicated metadata models, broad coverage instead of deep contextual information, free access over pricey but beautiful printed texts. The solution to this challenge of linking ‘music as data’ with ‘data about music’ will thus likely involve work from two directions: the development of formal schemes for understanding and exposing metadata in a structured way (through published ontologies, unique identifiers, and carefully structured APIs or other endpoints); and experimentation with LLMs (see below) as unsupervised ways of mapping musical knowledge (connecting people, places, roles, events, and even ‘works’ through their contextual proximities rather than through any a-priori categories).

5.3. Reading and Writing

New technologies will provide us with new layered and complex ways of reading and writing musicological texts. In fact, the notion of a musical text will likely broaden further to include corpora of digital music encodings, databases, linked and interconnected repositories, as well as performance recordings. What might these new modes of interpretation and knowledge creation look like in the decades to come?

Reading, broadly understood as distilling knowledge from information represented in some text, will expand to include data-analytical skills necessary to ‘read’ lines of computer code, numerical

33 Kaggle compilations refer to curated collections of datasets available on the [Kaggle platform](#), often used for data analysis, machine learning projects, and competitions. These compilations bring together diverse and well-structured data, including music-related datasets, which researchers and practitioners use to develop, test, and benchmark computational models and algorithms.

data and statistical information. Digital data models of musical (meta) data are becoming increasingly complex and may require abstraction to remain intelligible (readable), for which artificial agents may be leveraged. We can no longer assume we have seen the entirety of the data, even with larger teams of researchers. Instead, scholars will increasingly need to apply pattern-finding and summarization techniques to properly read data from a distance. Retrieving patterns, however, is only the first step in further musicological inquiry or analysis. These patterns need to be connected back to the contexts from which the sources or data stem.

This knowledge extraction will likely happen in increasingly coordinated ways between humans and machines, e.g. when scholars formulate and refine research questions with the help of a LLM ('prompting') in a feedback loop. Growing amounts of data will allow shifting between scales of reading (from close to distant) and enable exploration of new areas yet to be studied. For example, we can attempt to trace the transmission of musical patterns through time and space, or infer communal practices from document distributions.

The emergence of these modes of reading and writing will in turn depend on domain-specific tools, 'Small Language Models' or Retrieval-augmented generations attuned to the unique features of music—the very mixture of Music as Data and Data about Music mentioned above. Viewed from the work of Data Science, the musicology domain is a 'low resource domain': we might think of a corpus of 100,000 encoded scores or theoretical writings about music, or biographical notices about musicians might seem to be Big Data, but from the standpoint of bioinformatics (or Facebook posts), they are decidedly small.

This need not be conceived as a disadvantage of our object of study (and, consequently, our field). Low-resource domains like musicology with 'littleish' data can prove extremely valuable in evaluating and improving existing information processing systems. The challenge they pose in their relative sparsity is that they bring along a considerable amount of uncertainty, ambiguity, and irregularity. Robust and reliable machine-learning frameworks that are supposed to approximate intelligent agents need to be able to deal with unwieldy data as well.

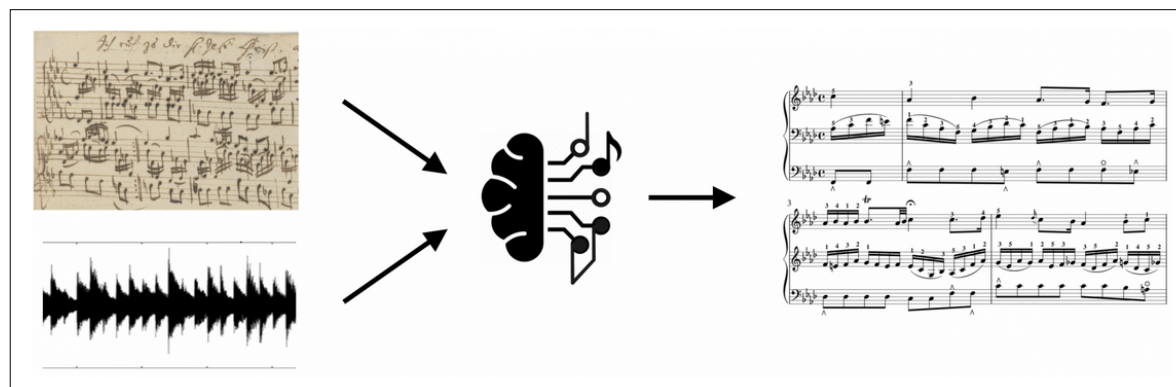
For example, newcomers to machine learning will quickly encounter datasets for classification such as hand-written digits ([MNIST](#)) or clothing items from Zalando ([fashion MNIST](#)). Both are relatively small (60k+10k images with 28x28 pixels), but are relatively easy to classify because they have clear

but relatively few underlying categories (10 digits or fashion items, respectively). Imagine picking 70k recordings of pieces of music (different pieces, not performances). How would we expect that these would cluster together if only 10 categories are allowed? The point is not that musicologists need to come up with clearer categories or ontologies. Music taxonomies like genres (and sub-genres, and sub-sub-genres...) are inherently complex, overlapping, and non-hierarchical, which makes automated classification difficult, given that these categories will commonly not contain tens of thousands of examples.

Recent decades have seen a growing number of projects that produce digital editions or digital corpora of music, and it is impossible to provide an exhaustive list here. But even if they are using the same or similar encoding formats, combining them or filtering a particular subset from all of them is to date unfeasible or highly time consuming. The solution is not a centralised system (like RISM) that hosts (ideally) everything, but a distributed network of interlinked and interoperable datasets that can be queried as needed.

With the right Little Language Model, we thus might be able to imagine several new modes of machine-assisted reading of music as data and data about music. For instance:

- **interact with structured data using natural language** (making the information in catalogues and databases accessible open to new forms of interrogation; Anthropic has recently announced the [Model Context Protocol](#) that aims to make exactly this possible),
- **make structured data from narrative texts** (return entities and relationships from some historical texts, OCR versions of some historical newspaper, or theoretical writings; these as a way of helping advance the creation of catalogues and databases),
- **pose qualitative questions of historical writings** (ask historical texts about 'novelty', 'beauty', 'order' 'harmony', etc.),
- **query musical scores and recordings** (ask a question about a score; align recording and score; discover patterns, large and small, distant and near).



[MULTISCORE](#), a project of the University of Alicante.

Scholarly writing will likewise take new forms. Instead of fixed texts published in print, we foresee a growth in interactive, data-driven publications. These will both make our work reproducible and provide access to a larger audience, e.g. through data visualization or sonification, instantaneous automated translation, etc. The data inform write-ups of research; however, those are not just academic monographs and articles, but also wider distribution of research results through museum exhibitions, books for a wider audience, recordings, films, radio shows, productions, YouTube videos, etc.

Scholarly citation practices may change in various ways. The range of items ‘acceptable’ to cite might broaden from published books and articles to online resources, datasets, and software tools. Persistent and versioned identifiers are therefore necessary to trace exact versions. The digital domain allows for non-linear and dynamic texts (e.g. Wikipedia). Large amounts of data might lead to empirically back up musicological information online by relating statements directly to the sources (links) or databases/sets (statistics).

Authorship will also transform. Traditionally, musicologists tend to produce single-authored texts. We imagine that not only will co-authorship become more prevalent, new and different roles of people involved in producing written research outputs will emerge, similar to practices already established in the (social) sciences (e.g. data collection and cleaning, data analysis, manuscript writing, etc.). We need to ask ourselves how people who have contributed to our work (e.g. students encoding scores during coursework) will be appropriately acknowledged and potentially remunerated.

Digital musicology and artificial intelligence now play a fundamental role in all aspects of the field, from source description to work editing, from prosopographical data to musical information which informs both historical narratives and analyses. The integration of digital tools allows for more sophisticated analysis and visualization of musical data, enhancing the depth and accessibility of research. Digital projects often prove to be effective vectors of collaboration, extending beyond institutional boundaries and geographical limits—but they demand adjustments to our horizon of expectations.

6. New models of publication

Do current forms of publication in musicology align with current requirements regarding data production, interoperability, integration of multimedia elements, and accessibility? Do these publications reflect the diversity of expression modes in musicological approaches, ranging from a readable text to an audio-visual sequence? In a previous report, we explored avenues for the future of musicological publications.³⁴ Here, we address the issues for imagining and designing a new model of musicological publication that pushes the boundaries of traditional publications.³⁵

As already discussed in section 1 of this report, Europe possesses various infrastructures that support the values and principles to which we adhere: open, participatory, and resolutely inclusive science. For example, the European Open Science Cloud (EOSC) offers an ideal framework for the deployment of new publication models. The [Social Sciences & Humanities Open Cloud](#) enables the deployment of tools that will prove necessary for the realization of publication models in which all data contributing to musicological knowledge can be combined. [OPERAS](#) offers opportunities for publications of a new kind.

A new model of publication necessarily implies digital or hybrid publications that:

- are open access (a key aspect in the European landscape of science)
- integrate technologies developed over the last years/decades

34 Philippe Vendrix, ed. (2024), '[Musicological Publications in the Digital Age: Charting a New Course](#)'.

35 See also, for example, Directorate-General for Research and Innovation (2019), '[Future of Scholarly Publishing and Scholarly Communication - Report of the Expert Group to the European Commission](#)'.

- incorporate multimedia elements (audio, video, scores)
- engage with different users
- are more accessible
- address inequalities
- enrich research as much as practice and pedagogy

This new publication model aims to reach diverse audiences:

- researchers, musicologists and performers from all backgrounds
- professionals dealing with music-related materials in heritage institution
- stakeholders in the cultural and creative industries
- decision-makers, from research institutions to European organizations
- the general public consuming music

All of these topics will be addressed in this document. The aim is not to describe a closed model, but rather to outline perspectives for development in the coming years. At the very least, we hope to have provided elements that will allow everyone, in a creative and innovative way, to integrate musicology into the dynamics of an open and participatory science.

6.1. Limitations of traditional publications

The results of musicological research have traditionally been published in monographs, edited volumes and specialist journals. Text- and notation-based publication is embedded in the institutions in which musicology is located as a professional endeavour, both in terms of education and career progression: (peer-reviewed) articles and monographs are currently essential outputs for most scholars engaged in musicology. However, as musicology develops to embrace new technologies and methodologies and to investigate sounds and practices that existed in semi- or non-notated forms, it is creating more inclusive and heterogenous outputs. Traditional publication modes can expand and transform to meet the challenge of delivering these outputs in forms that can be accessible to the widest possible audience.

6.1.1. Physical, linguistic, and economic limitations

In most areas, printed publications are still the standard, although simultaneous or exclusive distribution as e-resources is becoming more and more common.³⁶ For example, a search for the topic ‘musicology’ in WorldCat returns 34,531 hits. Filtering by media type shows that there are 7,200 printed books compared to 3,800 e-books, and 1,000 printed journals compared to 820 electronic journals (publications that appear in both forms are counted twice). The figures for open-access publications are much smaller: only 488 books and 106 journals are listed here.³⁷ The number of open-access journals listed in the [Directory of Open Access Journals](#), which includes only journals that meet certain standards, are even smaller. Here, 105 journals on the topic ‘Music and Books on Music’ are indexed, of which only thirty-six are from member states of the European Union, with ten from the UK. However, a closer look reveals that, for example, none of the ten UK journals come from the field of music history. The same is true for the three German journals indexed and for at least three of the eight Spanish journals.

Not so long ago, the leading journals were still primarily printed journals. This has changed in recent years. Fee-based online access, occasionally with a moving wall (e.g. via services such as JSTOR), has established itself as an additional form of distribution, as has the phenomenon of transforming individual articles into open access (usually through the payment of article processing charges [APCs]; see further below). However, these services often provide access only to the ‘flat’ PDF of a printed article, rather than any enhanced version created on the original journal’s website. In Germany, for example, this applies to *Die Musikforschung* (the journal of the German Musicological Society)³⁸ as well as for other comparatively high-circulation journals such as [Musiktheorie: Zeitschrift für Musikwissenschaft](#), [Die Tonkunst: Magazin für klassische Musik und Musikwissenschaft](#), [Archiv für Musikwissenschaft](#) and [Musik und Ästhetik](#).

36 ‘Both print and html’ is already explicitly a part of all modern content management systems for publishers. See University of Chicago (2024), [The Chicago Manual of Style, 18th edition](#), section 1.87.

37 This is not a European phenomenon only; the numbers given are not limited to Europe. The situation in the US seems to be even more problematic, as reported in Rachel E. Scott and Anne Shelley (2022), [‘Music Scholars and Open Access Publishing’](#).

38 It should be mentioned however, that the [Musikforschung](#) is provided in Open Access via musiconn.publish with a moving wall of thirty-six months.

Other important musicological journals have embraced fully open-access publication, and indeed can be seen to have shown the way. The [Journal of Seventeenth-Century Music](#) (based in the United States) was a groundbreaking online, open-access format without cost to authors when it launched in 1995. However, its format still derives from text-based publishing, with musical examples submitted as PDFs. This is indicative that even a born-digital journal still produces examples as if they were part of flat print editions. Poland's leading musicological journal, [Muzyka](#), is published in both paper and electronic forms and has been fully open access since 2018, via the journal's homepage or through the [Central and Eastern European Online Library](#) platform. However, the PDF articles again cannot sustain interactive audiovisual examples. A different approach has been adopted in Spain. One of the leading journals in musicology there, [Anuario Musical \(published by Editorial CSIC\)](#), is published only digitally (since 2024) and in open-access, and offers authors the possibility of including audiovisual files. In fact, since 2024 Editorial CSIC (the editorial house of the Spanish National Research Council) has moved to a full open-access policy for all its publications—journals, monographs, and the important collected edition [Monumentos de la Música Española](#).

Musicological journals in Europe are often still very strongly anchored at a national level or at least within certain language boundaries. Shelf space as well as the often high subscription costs have been limiting factors in international exchange. While digital publication removes the difficulty of physical storage, subscription costs remain a barrier (whether individually or as part of an aggregated package). Against the background of the usual funding methods, this observation is hardly surprising: journals are usually financed by the subscription price and, where they are affiliated with professional societies or associations, by membership fees. The question is also how this structure might be an impediment to the emergence of new kinds of publications.

While almost all periodicals include at least English-language articles in addition to the respective local language, in reality the vast majority of issues are monolingual. However, a few exceptions should be highlighted here: the Slovenian open access journal [De musica disserenda](#), for example, accepts manuscripts in German, Slovenian, Italian, English and French and has established itself internationally in the field of musicology. The Spanish journal [Anuario Musical](#) publishes preferably in Spanish or English, although it may include works in other languages with the approval of the editorial board. In Belgium, the [Journal of the Alamire Foundation](#) accepts contributions in English, Dutch,

German, French, Italian, and Spanish. By contrast, the Polish musicological journal [Interdisciplinary Studies in Musicology](#) accepts texts only in English. In Italy, the open-access journal [Polifonie](#), funded by the Fondazione ‘Guido d’Arezzo’ is published simultaneously in Italian and English; papers can be submitted in either language and are translated professionally.³⁹ [Acta Musicologica](#), the journal of the International Musicological Society and one of the oldest musicological journals in the world, has been actively seeking to increase the number of languages represented, limited only by the linguistic competence of the editorial board (which is currently very broad) and the relevance of the language to the topic of the article.

While economic and linguistic limitations are often framed in relation to readers, there are barriers for authors, too. Article processing charges, which are an additional source of income for many journals and often the most important one for open-access journals, are not widespread in the musicology ecosystem, and therefore funds for these are often not part of the economic costing of musicological research. In addition, costs arise that authors or editors (or their institutions) are required to cover, either financially or organisationally: book publication fees are a factor, and they increase when books are published in hybrid form, i.e. as a printed book and (open access) e-book, as is currently prevalent practice. The same is true, for example, with charges for permissions, licensing of copyrighted materials, foreign language editing, and the complex costs of creating new multimedia (artists’ and creatives’ fees, licensing and copyright).⁴⁰

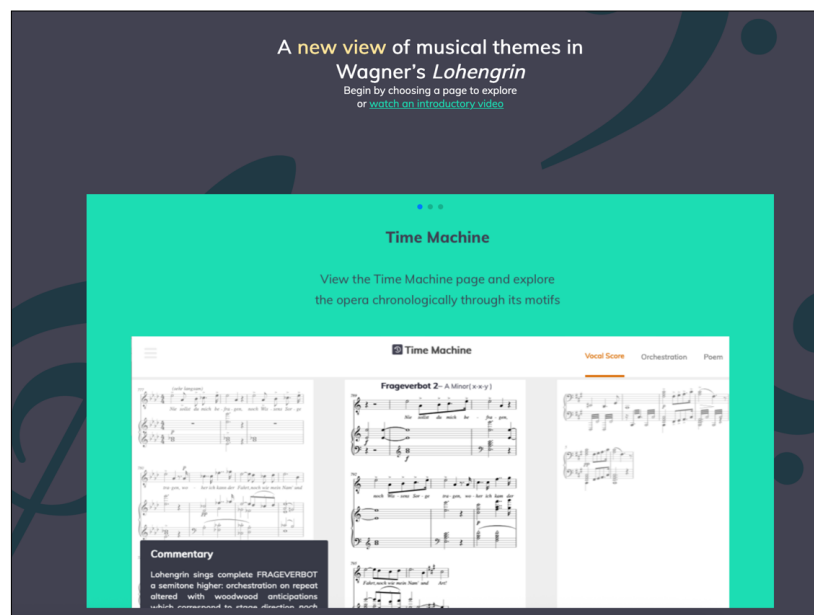
6.1.2. Notation as limitation

Even online publications are usually strongly oriented on the model of conventional print publications limited to text and images, often relying on musical notation as primary evidence for investigation and argument. While text, image, and notation are sufficient for a whole range of musicological questions, other research questions cannot be asked and results cannot be adequately presented by these means alone. On the other hand, musicological work without reference to music (e.g. ‘cultural histories’) sidesteps the notation barrier, but can fail to engage readers with music as a human activity and experience (if there is no music in the scholarship, its reality and affect are absent in the

³⁹ The topic of multilingualism has been extensively explored by [OPERAS’ Special Interest Group on Multilingualism](#).
⁴⁰ International Association of Music Libraries, Archives and Documentation Centres (2025), ‘[Copyright](#)’.

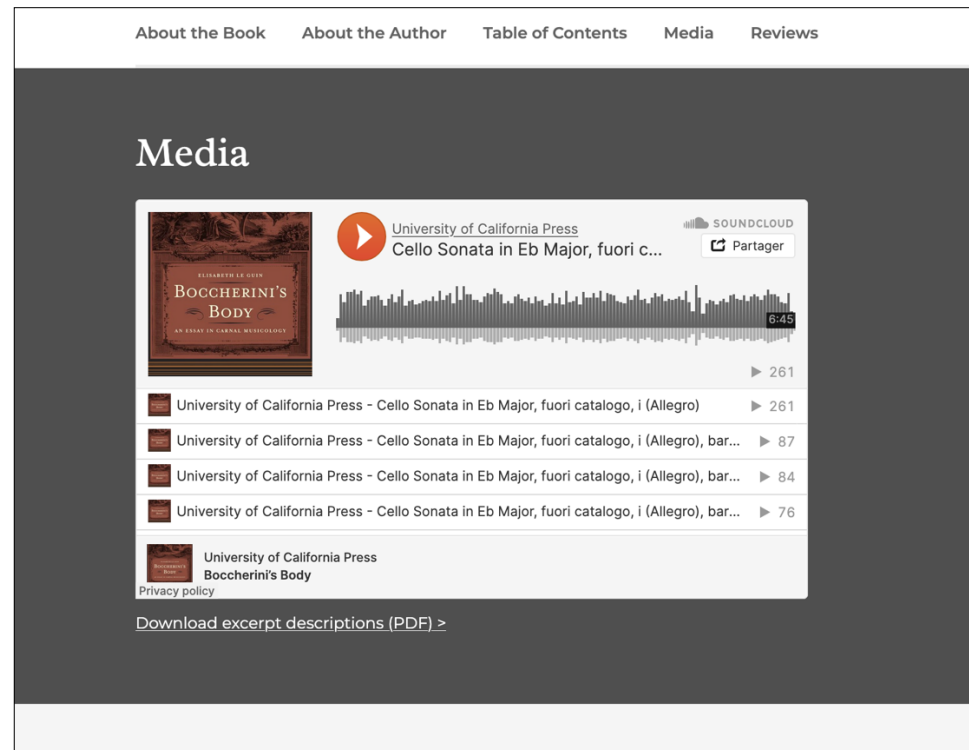
analysis). Practice-based research as well as research into orally transmitted musics, acoustic and psychoacoustic phenomena, performance studies, and sound studies would especially profit from a seamless integration of audio and audiovisual media for effective and comprehensible research communication.

At the same time, the multimedia publication of research results is an important means of making musicological research accessible for scholars from other fields than musicology as well as the wider public. Musical literacy and audiation are not standard competences, so that interdisciplinary exchange, where it does not extend to purely cultural-historical, organological or similar areas, is often made more difficult by the ways the research findings are presented. This is even more important when it comes to knowledge exchange with an interested public.



[Lohengrin Time Machine Digital Companion](#) (2018) was an attempt to overcome the limitations of traditional publications in presenting text, notation, audio, and video resources in an interactive way making use of Linked Data technologies.

An earlier example is the web-based publication [Opening the Geese Book](#) (2012).



There are even earlier examples, though more limited in their scope, such as Elisabeth Le Guin's monograph *Boccherini's Body: An Essay in Carnal Musicology* (2005). University of California Press [includes the musical examples from the accompanying physical CD in open access](#).

The pressing need for new kinds of evidence and argumentation is plainly in tension with the obligations of publishers to produce stable versions of scholarly work. This in turn emerges as a technological opportunity.

6.1.3. Research environment as limitation

Traditional musicological publication is inextricably embedded in research or higher education institutions in a way that makes it difficult for new or innovative models to emerge. Established publication metrics and the volume and type of outputs required for career progression or retention, while they ensure that new research is done, can encourage rushed or very narrow research because of the competition for short-term research funding, or career progression timelines. The policies regarding the validity or weight of publications in an academic environment have not been comprehensively reviewed in equal measures across borders. Nor have institutional or national policies been readjusted in terms of recognition and validation of alternative formats of outputs for musicological research, like databases, surveys, recordings, webpages, exhibitions, installations, concerts or concert series, blogs, radio broadcasts, or podcasts.

Peer review, which is part of the quality assurance environment for many academic institutions, publishers, and scholars, relies on expert reviewers – and the current movement to more and more precarious employment at post-doctoral level reduces the pool of experts who have the time and willingness to provide this academic service. Moreover, ‘rich text’ work should be reviewed in its native format, and not just as a flat text with notated examples. And the cultivation of digital literacies among journal readers should take place through reviewing digital projects, which is rare so far.

A further challenge is that the system of peer review presupposes ‘deliverables’ that have already achieved their ‘final’ form. The system thus excludes research products that are open-ended, continuously developing, or with long-term goals. Coupled with the fact that many research projects exist only via short-term funding that expects swift delivery of final outputs, the result is that long-term goals—like those we advocate here—become unimaginable.

6.1.4. Limitations in narrative structure

The current dominant model of scholarly publication consisting of text, image, and notation in a physical publication, be that book or article, creates a linear narrative that is structured according to national, regional, and linguistic norms. It is not a given that the priorities of writing are the same from one scholarly tradition to another: Continental European scholars may structure their arguments and evidence in a very different way to scholars working in the Anglophone tradition, and these differences cannot be mitigated by literal translation alone. Moreover, some aspects of musicology may not be

well served by linear narrative structures – in this case, the development of musicological scholarship can be limited by the available options for publication.

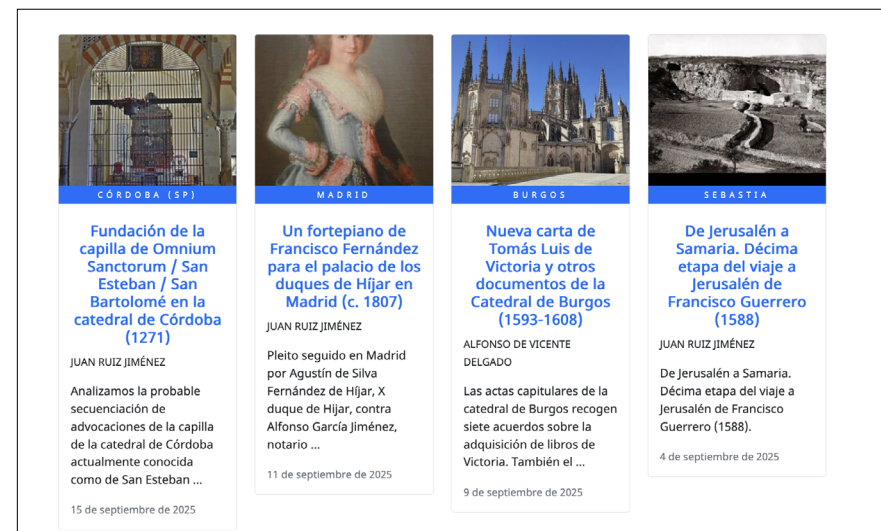


Network of singers of L'Orazio, from the [Opera Buffa Outside Italy](#) project.

A new format that takes advantage of digital platforms would give greater agency to both scholar and 'reader' (or listener, or navigator), allowing a freer experiential pathway through hypothesis, evidence, conclusions, or even further pathways for exploration or knowledge creation. This does not exclude the production of narrative scholarship, but can enhance its reach and understanding.

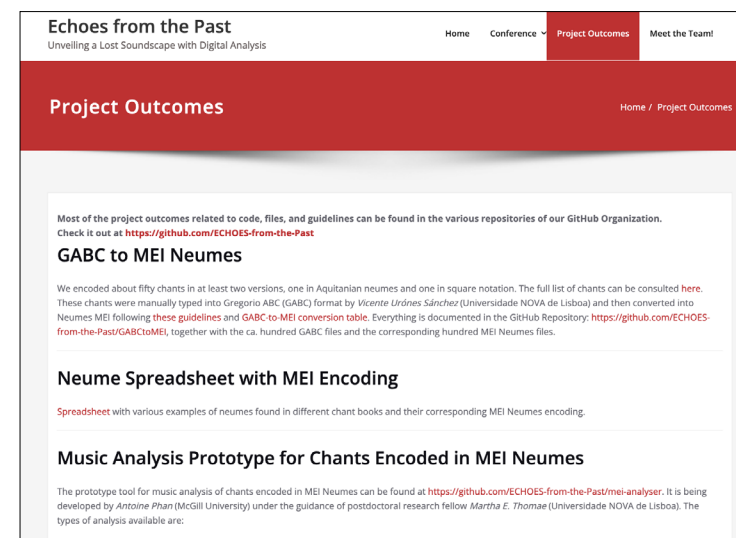
Some projects in historical musicology that use specific methodologies, such as network analysis and sound studies, are already using web-based platforms to demonstrate and present the results of research, but also offer new modes of inquiry:

- Sarah Eyerly, [Moravian Soundscapes](#), multimedia project (musicology, sound files, soundscapes, ArcGIS maps); a companion to the scholarly book *Moravian Soundscapes: A Sonic History of the Moravian Missions in Early Pennsylvania* (Indiana University of Pennsylvania, 2020).
- Kordula Knaus, [Opera Buffa Outside Italy](#) (1740–1765), network analysis and database visualisation.
- NTNU Trondheim, [Norwegian skilling ballads, 1550–1950](#), broadside ballad digitisation project that combines sound recordings and network analyses.
- Juan Ruiz Jiménez and Ignacio José Lizarán Rus (coordinators), [Paisajes Sonoros Históricos](#) (c.1200–c.1800), large collaborative project developing an open-ended, expandable resource.
- Anne-Madeleine Goulet, *PerformArt*, digital project ([database](#) and an [open access publication](#)).



Some projects carried on by [Paisajes Sonoros Históricos](#).

- Danielle Fosler-Lussier, *Music in America's Cold War Diplomacy*, digital companion ([website and database](#) to the book).
- [RicercaDataLab](#), Renaissance Data Projects, collection data from projects conducted over the past twenty years on Renaissance individuals and works.
- [European Ars Nova](#), *Multilingual Poetry and Polyphonic Song in the Late Middle Ages*, digital platform (database, publications and audio recordings).
- [CRIM project](#), *Cyclic Renaissance Imitation Masses*, digital research environment (advanced digital tools to investigate the Renaissance imitation masses; focus on annotation tools and analysis).
- Renaissance Society of America, [RSA Digital Resources](#), online repository (digital work regarding the Early Modern period.)
- [Echoes from the Past](#) project, *Unveiling a Lost Soundscape with Digital Analysis*, development and application of OMR and MEI to early chant repertory from medieval Portugal.



[Echoes from the Past](#) (Universidade Nova de Lisboa) offers tools for analysis and guides for MEI encoding.

A new format of publication could also foster collaborative and interactive research.⁴¹ Traditional, narrative-based publications in musicology are most effectively written by a single person or a small group of people only, and thus do not allow for the integration of multiple points of view. Many interdisciplinary projects, projects that include audio and/or audiovisual contributions and those that rely on citizen science, to name but a few examples, cannot be presented adequately by means of 'traditional' musicological publications, despite being important and promising elements of current musicological work. Furthermore, a publication platform could not only accommodate such projects, but also encourage the exploration of new ways in which we could imagine and organise musicological scholarship.

41 See, for example, Janneke Adema, Simon Bowie, Marcell Mars, Tobias Steiner (2022), '[Books Contain Multitudes: Exploring Experimental Publishing](#)'.

6.2. Leveraging technological advancements for a new model of musicological publication

New technologies of writing have always complicated the relationship between authors and readers. This is especially true of the performing art of music. From the beginnings of Western musical notation to the advent of the printing press, sound recording, and now the digital domain, new technologies of transcription brought about means for controlling the effects and purposes of music, even inaugurating a new sense of it as intellectual property. Each was a ‘new medium’ of its day, and each brought with it new ways for composers, performers, and listeners to interact around musical ideas.

What might such change mean for musicology, and the musicologists who make it? We once viewed print as the durable medium through which we put our best ideas before colleagues and the wider musical public. Now digital texts erode critical authority while simultaneously heightening the need for us to take responsibility for the claims we make. These days almost anyone can create a digital archive to store and distribute the ‘flat’ graphical symbols of standard musical notation (a PDF file will do). Indeed, resources like IMSLP or the Choral Public Domain Library are already heavy with hundreds of thousands of both historical documents and home-grown editions. The authoritative Urtext and error-laden mess are offered up as interchangeable versions of the truth.

Making musicology in a digital age will require us to think carefully about musical texts, in all their richness, from original source to computer screen, and from traditional prose text to recorded performance. To this we add new ways of understanding music as data (through layered, encoded scores) and data about music (the richly layered metadata that puts music in the context of how it was made and heard). What kinds of publications will be supple enough to support this kind of work and the new modes of interpretation and argumentation that will emerge around it? We might see all of this through two pairs of key concepts—ideas that both complement each other and that will serve as focal points for effective policymaking. The first of these is ‘delivery and discovery,’ which are deeply related to each other. The second pair is ‘sustainability and innovation,’ which are also joined, but in a way that is sometimes contradictory. For each, we detail some important matters of policy and practice.

6.2.1. Delivery and discovery

Musicological work will increasingly depend on a very wide range of ‘evidence’. Surely, we will still have a need for traditional kinds of texts familiar in books and print journals: textual documents, graphical scores, and images. But alongside these we will need now to find ways to deliver sound and video recordings (demonstrating different interpretive approaches to the same text), richly encoded logical representations of scores (an XML document with different layers of editorial intervention, for example), or complex datasets and the tools to interpret them (e.g., a network of musicians active in a particular time and place, and the code used to make the connections legible). Musicology is not alone in making use of these kinds of digital texts. But there is a pressing need for the creation of some new platforms that will allow scholars to engage the full range of evidence and argumentation suited for a digital age. These include:

- **Digital publication and content management systems** that will support rich multimedia content, including colour and high-resolution images, audio and video recordings, along with rendering systems for XML encoded scores and interactive digital tools (such as networks or visualizations). It is also the case throughout the natural and social sciences that authors include data sets and even the code for algorithms used in the interpretation of their data as supplementary materials, which are nevertheless not explicitly part of the Version of Record (typically a DOI and associated PDF and HTML). *Associated action item: sponsor work to advance the development of such platforms, perhaps as part of a collective initiative that would share tools and hosting platforms.*
- **Workflows and Best Practices** for editors, authors, and publishers, so that born-digital work can make its way reliably from a scholar’s desktop to a reader’s screen in efficient and reliable ways. The *Chicago Manual of Style* details the modern publication system, from author manuscript, through XML encoding of texts and associated figures and examples, through publication in PDF, HTML, e-book and other forms. These methods should be common knowledge, understood across three key constituencies:
 - **Individual scholars** need to understand this process so they can anticipate how they can think of the full range of materials available for their arguments. Understanding of the digital approach to content management and publication should be a part of graduate training, and the object of discussion during colloquia. *Associated action item: make experts available to visit classes and conferences.*
 - **Editors** need to have reliable ways of managing content and to avoid costly delays or confusion in the production of complex texts. This means ongoing training for the professional team involved in production, and various kinds of ‘on-boarding’ training for the scholars charged with the solicitation and review of materials for publication. Digital and multimedia content (are not simply ‘illustrations’; they are part of

the argument, and editors should understand how to seek appropriate peer review for born-digital work. *Associated action items: create handbooks of best practices, and workshops for editors and professional staff.*

– **Publishers**, whether traditional commercial houses or the various national and disciplinary bodies should have access to professional advice on how to produce such work. *Associated action items: for those who already have robust publication management workflows, there should be technical support that would help them implement some new tools, and document them for others. For small journals as yet unfamiliar with modern content management systems, a 'turnkey' system might be developed that would let them manage their work in a modern way (and move gradually towards some of the new tools and possibilities). Consider 'partnerships'.*

No less important than the texts themselves (in all their variety): how will users *find* the objects, images, scores, and data they need? Digital Object Identifiers (DOIs) are of course now common practice in the world of publishing. But to this we need author-level identifiers (such as ORCIDs). But what other kinds of metadata (and endpoints for accessing them) are needed to ensure *discoverability* by both humans and machines?

The development of literacy and capacity with the following concepts seems crucial:

Application Programming Interfaces (APIs) for databases makes the structured data that sits behind the forward-facing portal for humans discoverable by machines. In their simplest form these APIs could be JSON or other standardised ways of publishing information. Recently, [HumaNum](#) has created a strong solution for accessing information across databases by leveraging high-level terms in differently structured APIs. The operation of such 'federated' searches will depend on having well-documented APIs for every project. See, for example, the clear explanation of the system used by the [Digital Image Archive of Medieval Music Manuscripts \(DIAMM\)](#). For example, compare these representations of the same information:

I-Bc Q.15
Museo Internazionale e Biblioteca della Musica di Bologna, Bologna, Italy
complete choirbook: 15th century, copying completed 1440

Description | **Inventory** | **Images (5.9g in 15 views)** | **Bibliography** | **Commentary** | **Contributions**

Archive
Museo Internazionale e Biblioteca della Musica di Bologna, Bologna, Italy (I-Bc)

Shelfmark
Q.15

Surface
Other

Numbering system
None

Measurements
280 x 200 mm

Other identifiers
RISM: I-Bc/15
RISM: BL
CON: Bn/C D15
also (former shelfmark): Lione Musicale 27

Notations
black full mensural notation in black ink
collection in black ink
collection in red ink

Relationships
Musart, Guillaume (composer)
Gossage, Guillaume (1500–1544) (composition(s) in honour of)
Istaitieh (composition(s) in honour of)
Moussy (composition(s) in honour of)
Foucault (composition(s) in honour of)
Carnot, Étienne (composition(s) in honour of)
Moussy, Albert (composition(s) in honour of)
Moussy, Pierre (composition(s) in honour of)
Moussy, François (composition(s) in honour of)
Zabarella, Francesco (composition(s) in honour of)
Carnot, Antoine (composition(s) in honour of)
Contant, Giovanni (composition(s) in honour of)
Dell, Leonardo (composition(s) in honour of)
Moussy de Pissart, Pierre (composition(s) in honour of)
Moussy, Charles (composition(s) in honour of)
Eugène IV (1503–1547) (composition(s) in honour of)
Eugène (Sigismund) (1506–1547) (composition(s) in honour of)

External links
images
16th-century French music notation tutorials
Transcribed texts

Provenance
Pavia, Italy
Vienna, Italy
Piscina di Northern Italy, Italy

Contents
327 pieces from 54 composers

General Description
This manuscript is the largest international anthology of polyphonic music of the early 15th century. It was compiled in the Veneto, in Pavia 1420–5 (stage I) and Vienna 1420–35 (stages II–III), at request by a single (unidentified) scribe. Later additions include one leafless song and a partial index compiled by Guillaume Musart.
Contents: 323 compositions excluding one Gloria and three motets on Infantes which duplicate items within the volume and now serve as Preludes: 3 Introits, 16 Kyries (including one chant), 61 Gospels, 44 Credos (one duplication), 31 + 88, 10 Sanctus, 8 Agnus, 109 motets, 13 songs (Italian and Latin), 19 French songs, 1 Venetian song, 1 Italian song, 1 Magnificat, 3 sequences.
The first half of the manuscript is mainly devoted to the Mass Ordinary. The second mostly to motets. Songs appear only as late additions in stage I, mostly as additions at stage II. Most of the Mass Ordinary sections are grouped into cycles (some complete, a whole and part, two part systems) or Gloria-Credo pairs, some of which are linked compositionally, others apparently at the compiler's initiative.

For humans: <https://www.diamm.ac.uk/sources/117/>.

We note that accessing the kinds of SPARQL endpoints used in many projects are very challenging.

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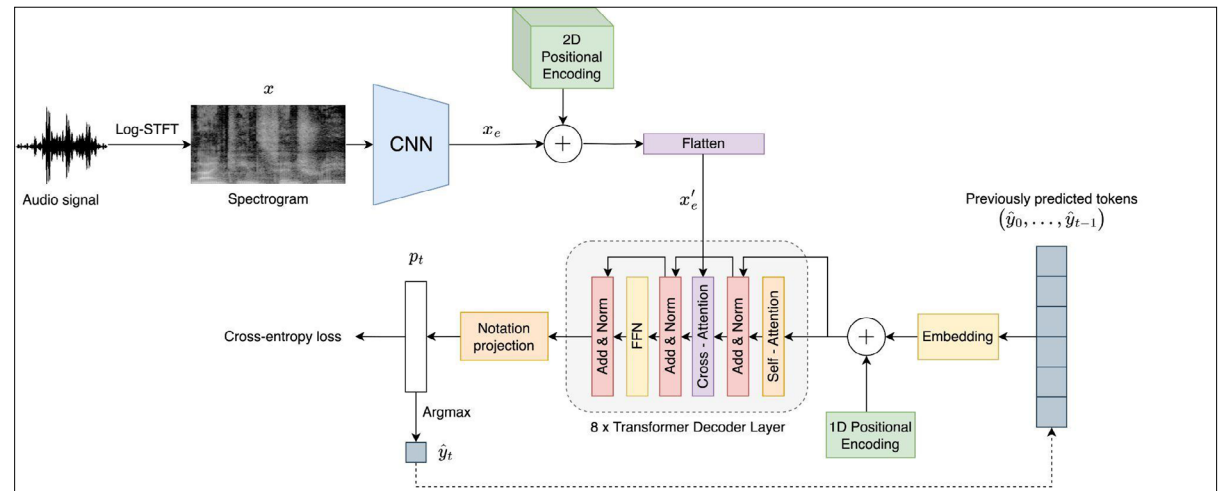
For machines: <https://www.diamm.ac.uk/sources/117/?format=json>.

Linked Open Data has also been a dream of the Semantic web for many years now. There are, of course, some solid systems in place that help us understand biographical, geographical and institutional entities and their relationships (as we think about ‘who studied with whom in which place and at what time’). See, for example, [Cultures of Knowledge](#), a major LOD project. However, the state of the art for intangible heritage (like musical works) is still relatively weak. Much more could be done to develop reliable ways of pointing to such abstractions in ways that would connect scholarship in a digital age.

Artificial Intelligence will probably work both to advance and disrupt how we ‘discover data about music’. In particular, the creation of ‘Small’ Language Models (as opposed to general models of artificial intelligence) could help us interact with databases using natural language, or help researchers develop structured data from narrative and encoded versions of musical scores.⁴² Neural networks are already widely used in numerous applications. A good example is the [End-to-end Audio-to-Score \(A2S\)](#) tool, created during the project Multiscore (Alicante University), which aims to derive a score that represents the music content of an audio recording in a single step through the use of Convolutional Recurrent Neural Networks.

6.2.2. Sustainability and Experimentation

What is sustainable in the digital age? This is not a trivial question with respect to musical scholarship. Many journals and academic publishers rightly think of the PDF as the ‘version of record’ for their work—a kind of flat representation that emulates the layout of a physical book. However, recent highly



A Transformer Approach For Polyphonic Audio-To-Score Transcription: learning scheme.

publicised data disasters (like the cyberattack on the British Library’s online information systems; or the cyber- and legal threats to the Internet Archive,⁴³ which hosts a plethora of material) have caused many to wonder just how safe and sustainable digital repositories actually are. Clearly, we need to assure ourselves—as scholars, as publishers, and as the librarians who maintain the archive of musicological scholarship—that digital materials will be available in a permanent way.

Sustainability is of course also related to access, and the pressing need for open ways of making scholarship available in perpetuity. Musicological work must also be open, since it cannot be a public good if it is not freely available to all. But to this we add a new complexity: **how to balance innovation with sustainability?** If a journal article includes audio or video content, what does the version of record look like? And how much more does this complicate the possibility for new kinds of interactive, ‘born’ digital materials? In brief, how do we ensure that we create things that are the ‘first of their kind’ and not ‘one of a kind?’ A periodical published by Springer dedicated to multimedia publications provides some insights: [Multimedia Tools and Applications](#). To date, there is no fully satisfactory solution.

6.3. Addressing inequalities through new publication models

European music scholarship, while rich and diverse, is traditionally concentrated in specific geographic regions and institutional contexts, hence, the dissemination of research in the field has long been influenced by significant inequalities. This section explores how a new model of musicological publication platform can address these inequities.

6.3.1. The landscape of musicological publishing: existing inequalities

Especially scholars based in less well-funded institutions or working in less widely-spoken languages have faced barriers including:

Financial inequality: Scholars from less well-represented countries and institutions often lack the financial resources required to publish their research in established academic journals or through prestigious publishing houses. Funds are necessary for covering publication costs, editing services, or

43 The copyright lawsuit concerning the Internet Archive, which amongst others hosts the WayBack Machine that archives internet pages and hosts, has only recently concluded. The effect on the field of musicology, certain branches of which rely strongly on the site’s archives, is unclear at the time of this writing.

open access fees, as the current open access publishing model perpetuates inequalities. The financial resources available for musicological projects can be overall much lower than in larger countries, which also affects the quality of research being published.

Linguistic inequality: The vast majority of musicological research is published in English, which, while an international academic standard, presents a barrier to non-native speakers. Musicological research is often grounded in local or regional contexts that involve non-English primary sources, and a significant portion of the scholarship is published in languages such as Italian, French, German, or Spanish. However, these works may remain largely inaccessible to scholars in other parts of the world, limiting the scope of musicological research and impeding international collaboration. Funds for English language editing or translations are generally lacking. Recent developments in LLMs and AI are promising (though not to the same extent for all languages), but open new questions of intellectual property and research ethics.

Representational inequality: The traditional publishing landscape remains dominated by a handful of well-resourced publishers and journals, many of which focus on the study of Western European music traditions and publish in English. Scholars from regions with less institutional support and smaller languages find it difficult to access prestigious venues, which limits opportunities for researchers outside of Western academic hubs. Hence, their topics are less well represented internationally, and unequal representation can result in unequal career development.

Social and ability inequality: The basic principles of universal design - creating products that allow maximum participation regardless of ability - contend that good design benefits all that use the product. Universal or barrier-free design should encompass equity, flexibility, perceptibility, tolerance for error, and simplicity. It should also anticipate feedback from users and allow for future adaptability in response to that feedback. This last principle of responsiveness is crucial to longevity as well as accessibility. Universal and barrier-free design the social, cultural, intellectual, and physical accessibility to the understanding, practice, and enjoyment of the published products of historical musicology by the widest possible constituency of scholars, readers, and audiences.

6.3.2. Arguments for developing a new model

To foster a more equitable environment for music research, a new publication model should prioritise inclusivity and accessibility. This means ensuring that scholars from diverse institutional and linguistic backgrounds are given the resources and platforms to publish and share their work, while creating space for the different types

of material produced: academic texts, editions, digital copies, audio and video recordings as well as catalogues and database applications.

Open-Access Publishing: One of the most promising ways to address inequalities in publishing is through open-access platforms. In the best case, open access provides a level playing field by removing financial barriers for researchers, enabling all scholars to share their work freely with the global community. In the context of musicology, this would allow valuable research on less-studied repertoires, traditions, or sources to be disseminated without the financial burden that often accompanies traditional publishing. However, the question of funding open-access publication remains unsolved and perpetuates funding inequalities.

Multilingual Publishing: To promote more equitable access to the scholarship, journals and publishers should embrace multilingual publication models. This could include bilingual or multilingual publications, along with translation services for non-English contributions. By offering research in multiple languages, scholars from around the world can engage with each other's work, fostering a more diverse and international exchange of ideas. Examples are the already mentioned journals [De musica disserenda](#) and [Anuario Musical](#), or series of critical hybrid editions such as [Monumenta artis musicae Sloveniae](#) or [Corpus Musicae Ottomanicae](#) or [Monumenta Musicae in Polonia](#).

Multimedia Publishing: To foster innovation in historical musicology, new publication venues should offer the technical infrastructure for presenting the wide range of research output produced in the field. [Voix du Mercure Galant](#) is an example for such an endeavour. The latest developments in artistic research and research creation are especially promising, but require technical support. Multimedia publication should be seen as an inspiring option, not as an additional complication. A growing trend in artistic research is hybrid publishing, which integrates multimedia content with analytical and reflective writing. For example, [Music & Practice](#), and as mentioned earlier [Anuario Musical](#), supports not only traditional articles but also contributions incorporating audio, video, and images. Similarly, platforms like [ESMAE's HTML-based model](#) enable researchers to embed multimedia content directly into structured, navigable documents, without requiring coding skills. These models allow artistic processes and outcomes to be documented more faithfully than conventional print formats; moreover,

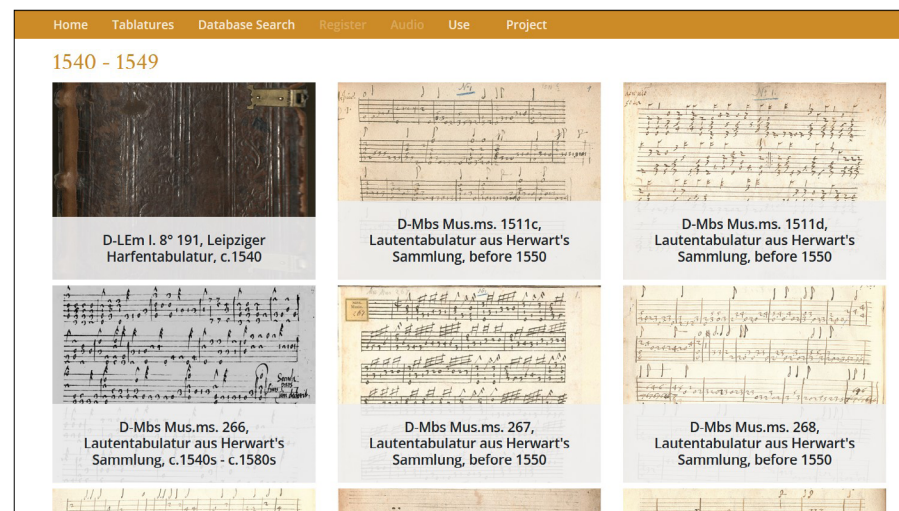
by engaging with the material through multiple media, they potentially enable researchers to draw different kinds of conclusions than those typically reached through paper-based research alone.

Collaborative, Scholar-Led Publishing Initiatives: A collaborative publishing network specific to musicology could be an important means of promoting equitable access to research platforms. By developing scholar-led, community-driven publishing models, such as collaborative online platforms or partnerships between institutions, music scholars could bypass the major commercial publishers.

Metrics and Recognition: Traditional publication metrics, such as journal impact factors, often fail to capture the diverse range of musicological scholarship, particularly when it comes to research from less mainstream contexts or regions. A novel solution would incorporate the equality goals stated by the Declaration of Research Assessment ([DORA](#)).

Several recent initiatives, exemplified by the case studies below, are setting a precedent for more inclusive practices.

- The [e-LAUTE](#) project creates an open-access comprehensive and interactive hybrid edition of the lute tablatures of the German-speaking area between 1450 and 1550.
- The research project [Digital Presentation of the Long-Sixteenth-Century Church Music Connected to Carniola](#) provides much of its results (music editions as digitised post-editions, articles, chapters in monographs) in open access.
- The [Lost&Found](#) Project at Lisbon NOVA University presents Medieval and Early Modern fragments of music as digital copies, editions containing reconstructions of missing parts as well as a database of analytical observations.
- [English Broadside Ballad Archive](#) offers over 9000 ballads free to the public as text, art, and music.



E-LAUTE [browse view for 1540–1549](#).

6.3.3. Steps towards a tailor-made solution

A scholarly multimedia publication platform on the European level would solve several equality issues at once, while specifically addressing the needs of musicological research.

An integrated, controlled or licensed **AI application** for translation and language editing will enable publication in diverse European languages, which results not only in equal active and passive access, but also in the preservation of a wider range of scholarly languages constituting a type of cultural heritage in themselves. A flexible structure will allow for **diverse types of publication** that represent the variety of musicological research output (scholarly article or monograph, edition, sound and video recording) that can be connected with each other, creating **clusters of knowledge** and unexpected synergy effects. It will be adaptable to the needs of different academic cultures and traditions (e.g. cutting across the traditional divisions between universities and conservatoires). Additionally, it will enable **accessibility functionalities** in accord with [Universal Design](#) principles.

However, when developing new digital models, it has to be taken into account that top-down, one-size-fits-all approaches can create fresh problems, for instance by overriding existing structures or disregarding established disciplinary cultures. Addressing inequalities in musicological publications requires a paradigm shift toward more accessible and inclusive practices. Open access platforms, multilingual publishing, collaborative networks, and alternative recognition metrics are crucial components of a new publishing model that can provide scholars from less well-funded institutions and non-English-speaking regions the opportunity to share their work on equal footing. But only an integrated solution could help to overcome the addressed inequalities.

6.3.4. The European Accessibility Act (2019)

The EU's Web Accessibility Directive ((EU) 2016/2102) describes four core principles related to universal design: perceivability, operability, understandability, and robustness.⁴⁴ These principles are incorporated into the European Accessibility Act (2019), which addresses divergence in national accessibility requirements related to goods and services, the outcomes of which should become applicable by 28 June 2025. The common requirements are laid out in accessibility standard EN 301 549,

44 See Paragraph 37 in European Union (2016), '[Directive \(EU\) 2016/2102 of the European Parliament and of the Council of 26 October 2016 on the Accessibility of the Websites and Mobile Applications of Public Sector Bodies](#)'.

which is comparable, but not identical, to the Web Content Accessibility Guidelines (WCAG) published by W3C. It should be noted here, however, that the Directive and the Act allow some exceptions that relate specifically to musicology:⁴⁵

- 3.(e) third-party content that is neither funded nor developed by, nor under the control of, the public sector body concerned;
- 3.(f) reproductions of items in heritage collections that cannot be made fully accessible because of either:
 - (i) the incompatibility of accessibility requirements with either the preservation of the item concerned or the authenticity of the reproduction (e.g. contrast); or
 - (ii) the unavailability of automated and cost-efficient solutions that would easily extract the text of manuscripts or other items in heritage collections and transform it into content compatible with the accessibility requirements;

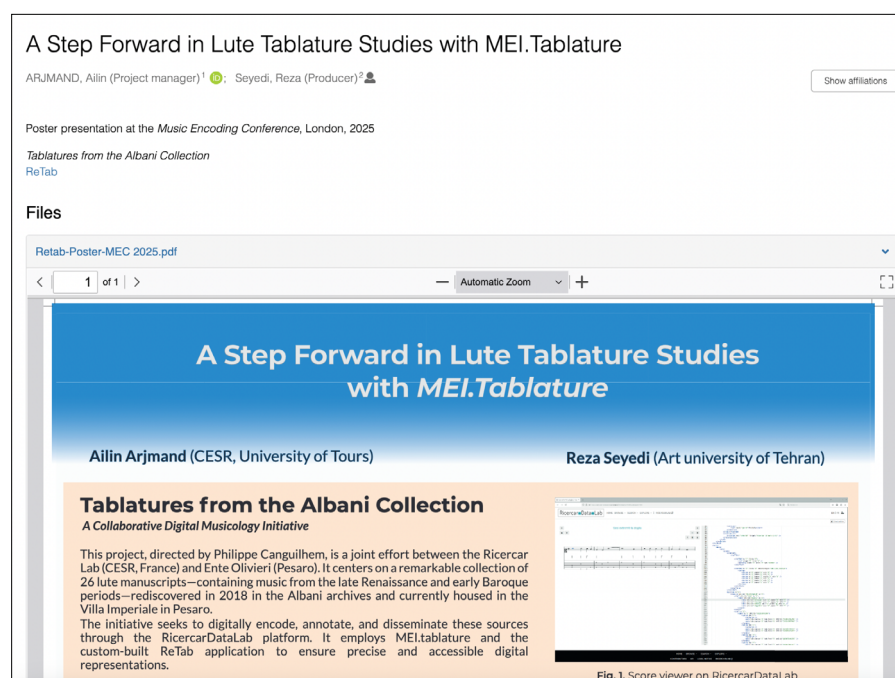
Addressing accessibility and inclusivity is an ongoing project, with continual revision and innovation taking place at both national and EU level: best practice within the EEA is summarised and updated by the European Commission via its [Digital Inclusion](#) platform. Any shared accessibility standards for musicological publication will require a similar commitment to revision, and while the directive does not require products that are essentially archives created and completed before September 2019 to be updated, maintained websites funded or developed by public sector bodies will need to conform to further revisions of the standard.

A new model for musicological publication that embraces technologies to mitigate or eliminate the limitations and inequalities identified in this document should comply with the accessibility standards set by the EU Directive. While it is very helpful to have a single set of standards that transcend national boundaries, it is nonetheless unrealistic for individual researchers to be expected to understand all the design implications for their projects. There is a real need for a stable advisory team, with discipline-specific knowledge both of the needs of researchers as well as the (always developing) technological opportunities available to them and the regulatory framework within which digital publication must operate.

⁴⁵ However, metadata related to heritage collections should be accessible; Paragraph 37, (EU) 2016/2102.

6.3.5. Open Science and peer-review systems

In the last years, the European framework of science has developed several Open Science initiatives and platforms, such as the [European Open Science Cloud](#) (EOSC, creating a federated infrastructure to manage and share research data and services across disciplines and borders), [Open Research Europe](#) (open-access publishing platform for European Commission-funded researchers across all disciplines, with no authors fees), [Zenodo](#) (free, open-access repository, also developed at the European level, which allows researchers from all disciplines to store, share, and preserve research outputs of all kinds), [OPERAS](#) (European research infrastructure dedicated to open scholarly communication in the social sciences and the humanities). All these initiatives and platforms clearly reflect the importance of open science and FAIR principles in the European landscape of science.



Zenodo consultation interface for a paper on the project [ReTab](#) with links to standards such as ORCID.

In parallel to the [DORA agreement](#) at a global level, Europe is also deploying policies towards a transformation of the research assessment landscape. In 2022, the European Commission officially opened for signature the [Agreement on Reforming Research Assessment](#). The creation of this agreement involved more than 350 organisations from 40 countries. The agreement was subsequently and progressively signed by numerous organisations from across Europe. Following this agreement, the Commission implemented the [CoARA](#) network whose mission is to undertake a systemic reform of the research assessment towards more inclusive and effective assessment practices. As of May 2024, 730 organisations were already involved in this network.

Some of the principles that guide these initiatives⁴⁶ are:

- Recognise the diversity of contributions to, and careers in, research in accordance with the needs and nature of the research.
- Base research assessment primarily on qualitative evaluation for which peer review is central, supported by responsible use of quantitative indicators.
- Abandon inappropriate uses in research assessment of journal- and publication-based metrics, in particular inappropriate uses of Journal Impact Factor (JIF) and h-index.
- Avoid the use of rankings of research organisations in research assessment.

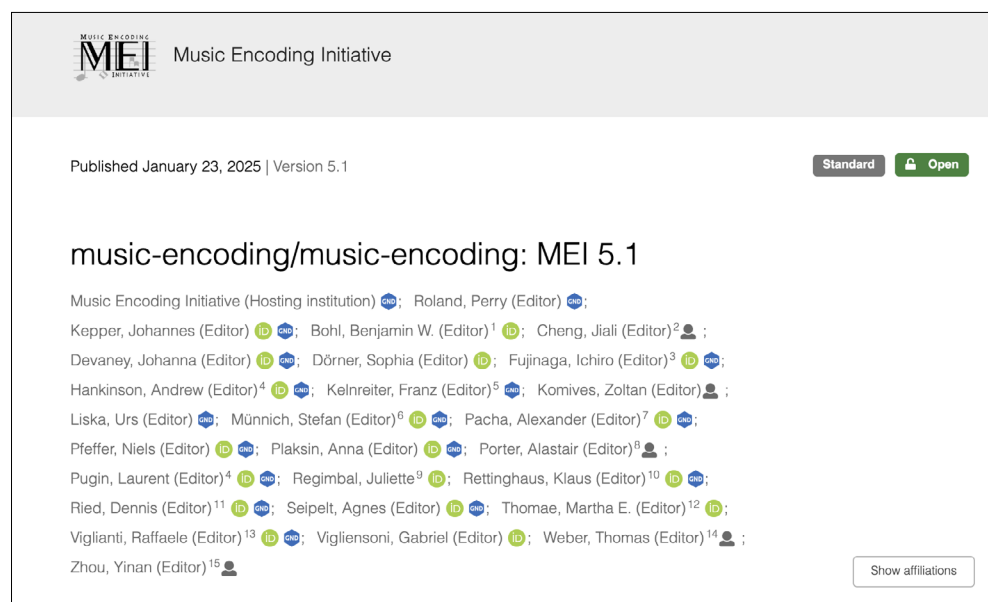
All these principles claim for a recognition of diverse outcomes, practices, and activities in the European research landscape, and consequently the need for a new model of the research evaluation system.⁴⁷ A new model of musicological publication could also be an opportunity to embrace a new attitude to peer review based on existing open-review platforms (Open Research Europe; Wellcome Open Research),⁴⁸ always recognising, however, that professional competition in a narrowing job market and disciplinary hierarchies have complex ethical implications for non-anonymised reviewing.

46 See CoARA (2022), '[Agreement on Reforming Research Assessment](#)'.

47 '[Reviews in Digital Humanities](#)' started in 2020 and is one of the few journals that publishes evaluations of digital humanities projects.

48 Tony Ross-Hellauer (2017), '[What is open peer review? A systematic review](#)'.

Traditional text, image, and notation-based musicology is often produced by a single researcher, but the developing musicologies that derive from and can be communicated in more diverse ways require the input of more creatives/artists, which takes both time and funding that are difficult to resource for many researchers, both those with academic positions and particularly those on precarious contracts or working independently.



The screenshot shows the Music Encoding Initiative (MEI) website. At the top, the MEI logo and name are displayed. Below the header, it states 'Published January 23, 2025 | Version 5.1'. There are two buttons: 'Standard' and 'Open'. The main title is 'music-encoding/music-encoding: MEI 5.1'. Below the title, a list of editors is provided, each with a small icon indicating their affiliation or role. The list includes: Music Encoding Initiative (Hosting institution), Roland, Perry (Editor), Kepper, Johannes (Editor), Bohl, Benjamin W. (Editor), Cheng, Jiali (Editor), Devaney, Johanna (Editor), Dörner, Sophia (Editor), Fujinaga, Ichiro (Editor), Hankinson, Andrew (Editor), Kelnreiter, Franz (Editor), Komives, Zoltan (Editor), Liska, Urs (Editor), Münnich, Stefan (Editor), Pacha, Alexander (Editor), Pfeffer, Niels (Editor), Plaksin, Anna (Editor), Porter, Alastair (Editor), Pugin, Laurent (Editor), Regimbai, Juliette, Rettinghaus, Klaus (Editor), Ried, Dennis (Editor), Seipelt, Agnes (Editor), Thomae, Martha E. (Editor), Viglianti, Raffaele (Editor), Vigliensoni, Gabriel (Editor), Weber, Thomas (Editor), and Zhou, Yinan (Editor). A 'Show affiliations' button is located at the bottom right of the list.

6.4. An economic model

A new model for musicological publication is indeed justified by the development of certain tools and the need to connect diverse knowledge. It is also justified by the current state of the book and music markets. While comprehensive studies are lacking, partial studies exist, for example, on [English-language publications](#) in the humanities or on [musical productions](#). Generally, a book in the humanities sells only a few hundred copies (rarely exceeding 500). Musical editions, and particularly critical editions, are also experiencing an erosion in their sales. Creating a new publication model that

would allow combining multiple sources of knowledge dissemination must be based on a convincing economic model.

Creating accessible multimedia content for musicological research—such as incorporating audio, video, and interactive elements—is achievable but often entails substantial costs. These expenses may include:

- licensing fees for multimedia materials,
- the expertise necessary to produce high-quality digital resources,
- the technical infrastructure required for hosting and streaming,
- recurring server costs,
- development and maintenance costs.

Determining how to cover these costs is a complex issue. A comparison of past and current initiatives led by [OPERAS](#) does not allow for the identification of a single model.⁴⁹ This is especially true as the case of musicological publications requires mobilising specific resources (audio recordings, etc.), which require more data, more storage space, and more maintenance.

From a product perspective, the material and human needs for a new publication model include:

- Digital resource designers: professionals who create and develop the digital content and resources.
- Designers: experts responsible for the visual and user experience aspects of the publication.
- IT specialists: technicians who handle maintenance and ensure the smooth operation of the digital infrastructure.
- Communication services: teams dedicated to disseminating information and promoting the publication.

The functioning of this type of publication relies on support from both public and private institutions to unlock their full potential. This dual support system is crucial for:

- Funding: ensuring adequate financial resources for development and ongoing operations.
- Expertise: accessing a diverse range of skills and knowledge from various sectors.

49 John W. Maxwell et al. (2019), '[Mind the Gap. A Landscape Analysis of Open Source Publishing Tools and Platforms](#)'.

- Infrastructure: utilising existing networks and resources from both public and private entities.
- Credibility: gaining trust and recognition from a wider audience through institutional backing.
- Sustainability: creating a more stable and long-term model for the publication's growth and success.

It is undoubtedly illusory to imagine a single solution based on a concentration of actions, whether in terms of design, implementation, or maintenance. The risks of centralization are easily identifiable, being those of any monopolistic system.

It would therefore be appropriate to deploy a shared solution based on the model of an infrastructure that would allow the combination of human resources, technical means, and scientific guarantees. The project-based research model proves to be an obstacle to long-term projection. Most [musicological research laboratories](#) do not have enough permanent staff and even operate in a hybrid model of perpetual and project-based resources, as is the case in several academies of science. This accumulation of pitfalls does not, however, prevent the development of a solution that would articulate the contribution of:

- Willing research laboratories or university institutions,
- Local or national facilities to house the data,
- Private partners.

By leveraging the strengths of both public and private institutions, this new publication model can achieve greater reach, impact, and innovation in the digital publishing landscape.

Private partners are even more necessary because:

- Some publication elements may come from private producers (recordings, films, editions) guaranteeing royalties to rights holders.
- Communication methods are more solidly developed in certain private companies (this is particularly true in the music industries).

There can be a dual presentation of musicological research: a first one responding to the new model and including all the elements of the research file (databases, catalogues, detailed descriptions, etc.); a second one manifesting in another format (a CD, a synthetic book, a radio program, etc.). And this dual presentation does not exclude other presentation modalities that could be imagined in the future.

Public institutions like universities, research centres, and government agencies may provide stability and continuity in funding. This ensures the long-term viability of projects by enabling sustained research efforts without constant fundraising and by maintaining essential operations like server upkeep. Public funding also aligns with open-access principles, promoting societal impact by disseminating knowledge as a public good. Additionally, public institutions foster collaboration across universities, research centres, and international organizations—similar to strategic partnerships that drive innovation in the business world. To maximise the value of publications, a hybrid funding model that combines public and private support offers the most promise. Public institutions provide a stable foundation for long-term initiatives, while private entities contribute flexibility and additional resources. This collaboration balances risks and rewards, ensuring the sustainability and impact of scientific editions—much like strategic joint ventures in business.

Encouraging private companies to sponsor scientific publications as part of their corporate social responsibility (CSR) initiatives can enhance their reputation while advancing knowledge—paralleling how businesses align operations with ESG (Environmental, Social, Governance) principles. Crowdfunding platforms also offer an opportunity to engage broader communities and stakeholders. This approach democratises funding while fostering a sense of shared ownership among supporters, creating a dedicated base invested in the success of scientific editions.

Overall, developing viable business models for scientific editions requires a clear value proposition that emphasises societal benefits, educational impact, and innovation potential. Monetization strategies could include: subscription-based access to premium content, licensing fees for commercial use, specialised services like consulting or customised data analytics for private organizations

6.5. Long-term preservation

Choosing an innovative form of publication, depending on the legislation of a given country, may mean that the publication will not be subject to mandatory protection and long-term preservation in its original form by the designated institution for the safe-guarding of national or local written heritage (e.g., a national library). In such a case, the creators must ensure and secure the publication's durability themselves, as in many countries legislation has not yet responded to changing publishing practices and the digital dissemination of research results.

Long-term preservation (LTP) of both data and software in new models for publication is something that has to be considered from the early stage of planning and creation. Over the years, heritage institutions have developed standards for LTP of digitised heritage objects, including paper-based scholarly writings and digital surrogates, such as e-books, e-scores and e-journals. New types of publications, that are not fixed and linear, or consist of various multimedia types, pose a challenge that need to be addressed. We already see digital humanities projects concluded some years ago, for which both data and software are no longer available. Both scholars and policy makers should think more about the long term perspective of maintenance and preservation before undertaking projects with such innovative digital products. The mere preservation of any digital data is not a technical problem, but preservation that enables the logical order of information to be recreated and managed in the future, in particular for continued inquiry, is.

Archival systems dealing with preservation packages of data and metadata have their own implemented data models, designed for the needs of the objects they must manage. Bringing the products of digital multimedia musicology projects to one common denominator, one common data model, would be a huge challenge. Therefore, it is important to strengthen the knowledge of international standards and reference data models among musicologists so that their projects are compatible with standard data models (for example: IFLA LRM, CIDOC CRM, IIIF Presentation API data model, Web Annotation Data Model by W3C), thus facilitating the preservation of objects resulting from projects within existing systems, without the need to create new, one-of-a-kind, infrastructures, systems and processes.

In any project dealing with data and creation of software, it is important to establish a strategy for long-term data storage, accessibility, maintenance, development, as well as the durability of the software necessary for processing, managing, presenting, and sharing data. Due to the human and hardware costs discussed above, as well as the necessary domain expertise input for maintenance, it may be beneficial and sustainable for musicology projects to partner with a stable public institution that specialises in long-term storage in accordance with international standards, such as those in the GLAM sector.

6.6. Building public engagement into publication platforms

Considering a wide spectrum of different musicological outputs as valuable for general knowledge can show new perspectives in the world of publishing as well. Integrating public engagement into scientific publication venues could feature tools and applications to:

- Drive traffic to the platform (SEO, AI discoverability, linked content on high-traffic platforms to drive engagement with the publications),
- Make research and its authors easily discoverable and digestible for producers of traditional media such as journalists, producers, media researchers, and for professional users in the cultural industries such as festivals, film companies, museums; and for policy makers,
- Allow content to be embedded into other online platforms in different ways, given the [CC Licence](#) permits it,
- Be optimised to integrate with social media if desirable,
- Allow critical and creative re-use of content,
- Allow audio and visual content to also be engaged with through sound systems and home cinema (e.g., audio playlists, screen casting),
- Allow multiple pathways and views of a publication content so that different user groups can navigate it in different ways,
- Facilitate engagement with specific interest groups,
- Enable open community review and comment by communities of interest and practice outside of academia,
- Facilitate participatory research (such as public contributing sources or annotations to a database),
- Be compatible with accessibility standards,
- Incorporate AI tools for searching, summarising and presenting content in different formats (such as visualisations, podcasts, blogs),
- Gather data on users and usage,
- Supports the inclusion of add-on features and widgets such as visualisation tools, analytical plug-ins.

Such a platform would also need to be supported by a human infrastructure of professional skills and expertise that can enable researchers to get more engagement with their work. This could include training, consultation and practical support with:

- Content creation and management for social media,
- Media and public relations,
- Making links with Culture and Creative Industries partners and relevant communities of interest,
- Best practice in meeting accessibility needs,
- Best practice in copyright and intellectual property,
- Responding to and working with emerging technologies and standards,
- Designing participatory features,
- Working with programmers to develop features and add-ons,
- Feeding back issues and suggestions for the future development of the platform.

7. Developing Communities

Coordinating all these ways of knowing and representing music will require that we develop new communities of practice. Of course each scholarly discipline is just this: a community that has drawn up (with varying degrees of formality) some rules that govern evidence and how it is interpreted. What we would like to emphasise here is that a community of practice *learns* through community interaction.⁵⁰ Now we need to imagine what sort of ‘communities’ might emerge as musicology learns to go digital, and what kinds of digital musicology might emerge from such collaboration.

Learning how to use certain tools requires people to receive hands-on experience working on digital methods, converting them into digital practitioners. While digital specialists can provide this training, the project’s hosting institution also plays a role by ensuring that training, opportunities for practice, and collaborative spaces are available. Developing new communities of practice in digital matters requires an effort in building people, communities, institutions and their capacity. Here we consider a series of specific projects and deliverables in turn.

50 ‘Communities of practice are groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly.’ Etienne and Beverly Wenger-Trayner (2015), [Introduction to communities of practice: A brief overview of the concept and its uses](#).

7.1. Building people

We must not dictate the tools to be used. On the contrary, we should provide guidance on the available tools and train researchers to use the tool of their choice (the one they judge as the most appropriate for their purposes). This training can be done in different ways.

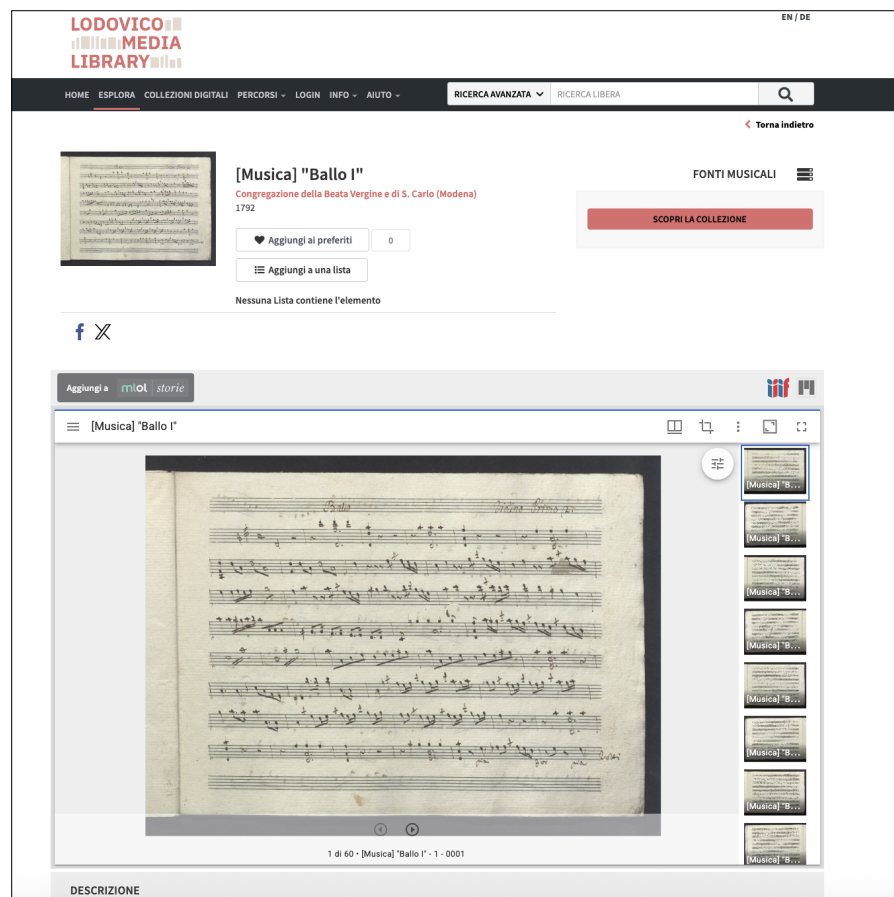
- *Training for Scholars, Editors, Archivists, Librarians, and Publishers*, for instance through Summer Institutes (2-3 week programs) to build skills. Examples to consider:
- [Best Practices for Coding in Digital Humanities](#) (Cambridge).
- [Cultural Heritage Data School](#) (Cambridge).
- [DARIAH Training and Education](#) (EU based and open, with a ‘[registry](#)’ of offerings from Uppsala to Granada and from Dublin to Rhodes on many special topics, both as degree programs and stand-alone courses).
- [Training and education in imaging basics](#) (DIAMM).
- [Edirom Summer School](#) (Centre for Music – Edition – Media ([ZenMEM](#)) at Paderborn University) deals with research questions on digital editing and digital humanities, especially in workshops on TEI, MEI, and the Edirom tools.
- [Short-Term Scientific Missions \(COST Actions\), such as the ones organised by the present COST Action EarlyMuse CA21161.](#)
- *Create Internships, Studentships, and Mid-Doctoral Fellowships.* These can and do take a variety of forms at different institutions. Melbourne University in Australia, for instance, supports a [Digital Studio](#) program, in which students partner with faculty and technical experts to gain initial exposure to digital methods over about 45 hours to total work. A far more extensive form of applied digital skills training can be found at the University of Pennsylvania’s Price Lab for Digital Humanities. Here, a number of PhD students are offered [mid-doctoral fellowships](#), again building on the idea that students can use these skills through their theses and throughout their careers.
- *In-person or online workshops on the use of a specific tool.* Recordings of these workshops can be made and shared online to make the material globally accessible, addressing issues of inequality among institutions.
- *Creation of ‘Skills Network’* to find the connection among people, so that they can work on a peer basis.
- *Transforming professional development curriculum for musicologists and humanists.* Enhancing the professional education with project planning and management, data literacy, data modelling, the basics of computer science, to facilitate communication and cooperation in digital humanities projects.

7.2. Building institutions

There are wide differences among organizations, and wide differences among their needs and capacities.⁵¹ Some institutions have invested heavily in the creation of specialist laboratories, including necessary digital research infrastructure and equipment. Centres for Digital Humanities, for example, have emerged recently as a model in many universities to serve as an umbrella institution for digital services, closely connected to those of the university library, and open to the entire community of faculty and students. In this way, digital projects in diverse disciplines can have access to the needed technology, under the guidance of experts to comply with standards. This model of shared infrastructure is equally valid for public institutions like libraries, which could serve the same purpose for the general public.

Digital specialists in musicology, even if they do not easily fit in the traditional roles of faculty or staff, are clearly vital partners in all aspects of novel musicological digital publications, and would play an important role in any such Centre. Creating multi-year positions in such centres would also foster Citizen Science, innovative and sustainable digital initiatives, as well as collaboration among cultural and academic institutions.

⁵¹ See [OPERAS-D's 'Developing network and e-infrastructure strategy. Report on online survey on optimizing e-infrastructure' \(2018\)](#) and [OPERAS's white paper on Best Practices \(coming soon\)](#).



Lodovico is an interactive, open, and transversal platform that collects the historical manuscript and photographic heritage in digitised form, from archives and libraries, with an openness to museum heritage.

7.3. Building community

Several projects and organizations have guidelines and handbooks for best practices which are extremely useful to build a community of practitioners. The [Music Encoding Initiative](#) (MEI) is a particularly good example of community organization, bringing together ‘technologists, librarians, historians, and theorists in a common effort to define best practices for representing a broad range of musical documents and structures.’ The results of discussions are formalised in the MEI schema, a core set of rules for recording physical and intellectual characteristics of music notation documents expressed as an eXtensible Markup Language (XML) schema. The MEI schema is complemented by the MEI Guidelines, which provide detailed explanations of the MEI model and suggested best practices. The schema is developed and maintained by the MEI Technical Team, an international group of experts.

Other possible resources or models for Best Practices which promote knowledge exchange among people, therefore building communities of practice, are the following:

- [Handbook for Best Practices in creating and managing repositories \(GitHub\)](#)
- [Best Practices for Digital Scholarship](#) for authors, editors and publishers published by the Renaissance Society of America.
- [Awesome International Image Interoperability Framework \(IIIF\)](#): Content includes helpful resources around each of the standard APIs, demonstrations of their use, tutorials and presentations. As they indicate, the list is especially helpful for orienting new community members and developers.
- [Best Practices Special Interest Group of OPERAS](#): Interest group of best practices in academic publishing.

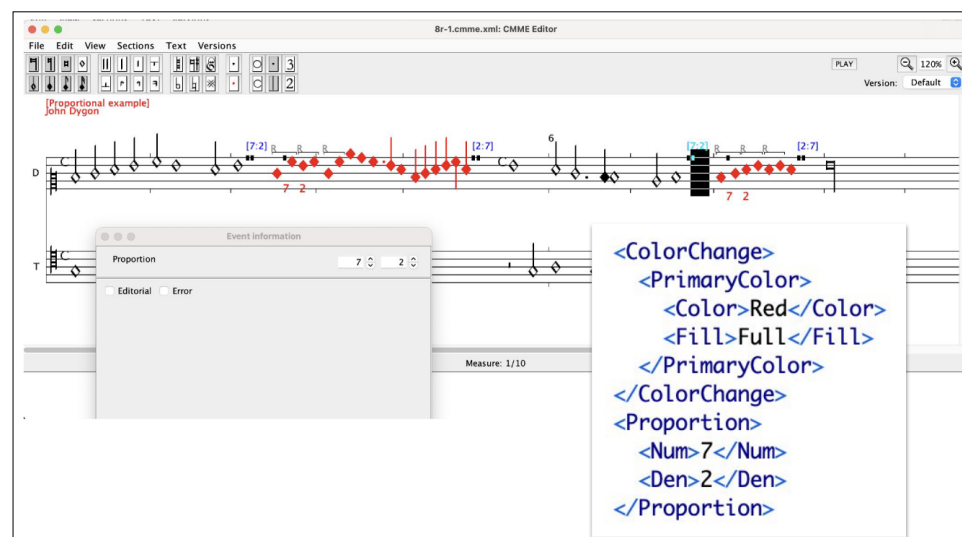
Among the technological topics discussed by the communities are the following:

- Digitisation and handling of special collections. Some information about this can be found in [FADGI Technical Guidelines for Digitizing Cultural Heritage Materials \(3rd Edition, 2023\)](#), [DFG’s Practical Guidelines on Digitisation \(2009\)](#) and [DIAMM’s Technical Overview](#) website.
- Documentation and version control: Using version control for documenting workflows and practices followed by the institution (e.g., GitHub: <https://docs.github.com/en/get-started/using-git/about-git>).
- Workflow management: Determining the steps and tools needed to take the source to the screen, how to keep track of the completed steps and work of the multiple participants involved.
- Data about music: Metadata (who, what, when, where), using Authority Files and Identifiers (VIAF, GeoNames, and so on).

- Work authority registries.
- Role authority registries for performing arts.
- Ontologies for Music and Intangible Heritage more generally.
- Relational Databases and how to query them.
- APIs (for human and machine discovery).
- Reusable Data: Flat CSV or JSON files as ways of preserving data beyond the lifespan of any specific application that might deliver it.
- Data Cleaning: This is a major part of every project, especially since many projects have long histories as a series of informal spreadsheets or other legacy work.
- Data Validation: Process of verification that your data is well formed, and learning how to update your data to conform with current practices and schemas (e.g., how to use XSLT to automatically update your XML or MEI file to the current schema of the encoding).
- Music as data: Encoding Scores, Recordings.
- Retrieval and transformation of information: For example, transformation from one encoding format to another, transformation from an encoding format to PDF or to audio, retrieval of the parts from a MEI score, or the metadata in and out of a MEI file, scraping data from a website.
- Data visualization: Systems like [Scalar](#) (an open-source system for publication using rich multimedia), [Verovio](#) (an open source tool for rendering high-quality, digitally engraved music scores), and [Plotly](#) (an open source Python library for graphs and charts).
- Identifying missing or corrupted data: Ways to facilitate the identification of gaps in data, how to automate this, how to clean/repair data.
- Summary of digital tools for specific purposes of manipulating or generating music data: Tools for **optical music recognition** (for common Western music notation or for early music notation), tools for data analysis **of music** (e.g., music21, Humdrum, and CRIM intervals), editors for encoded early music notations (CMME editor, Measuring Polyphony Editor), editors and renderers for encoded music (e.g., mei-friend and Verovio), and others.⁵²
- The Quotable Text: [IIIF](#) (with support for [images](#), [audio](#), and [video](#)), Quoting Digital Scores ([EMA](#)).

52 See Laurent Pugin, Martha Thomae, Marnix van Berchum, K vin Roger, and David Fiala (2025), ‘[A new XML conversion process for mensural music encoding: CMME_to_MEI](#)’.

- Annotation (related to previous). What can you 'add' to a digital text?
- Leveraging machine learning to help build or query data.
- Rights Management (how and when you can reuse things).



Implementation of a process for converting CMME files to MEI.

7.4. Building Capacity

As musicology progresses into the ever-more-digital future, there is a need for sustained and sustainable efforts in tool development (also consult [OPERA's white paper on Tools Research and Development](#)). Here we note both desiderata and currently-available tools that are promising for future development, in order to provide inspiration:

- **Last Kilometer Tools** that will help things move from source to screen.
 - Editorial tools for creating digital scores (such as MuseScore plug in, or enhancements to MEI Friend).
 - Viewers that would take encoded scores and put them online, either standalone or as part of a Digital Musical Example engine (e.g., using Verovio). These could be on some kind of free license for publishers to use. [Here](#), for instance, is an example of a REST interface that returns MEI encoded examples to the browser, with highlighted elements to represent analytic annotation; code at: <https://github.com/eleon024/ema>

[react_app](#). Some of this could emerge from community/volunteer work. But we could imagine some kind of ‘commissioning’ program for open-source or licensable tools, with review by some technical committee responsible for maintenance and help with implementation for individual users.

- The OPERAS site includes a [Tools and Standards Special Interest Group](#), which also maintains a [list of schemata and tools](#) of wide interest. What is relevant to music here? What is missing?
- [Verovio](#) (free resource for high quality graphical music notation from encoded scores).
- [MEI Friend](#) (free online editor for MEI).
- [EMA](#) (addressability specification for digitally encoded music, allowing users to ‘point’ to specific passages and return them as code slices for presentation or further analysis).
- [MuseScore](#), a free music notation tool that both reads and exports MEI, and has rich capacity for enhancement via various custom plugins. It will not meet all needs as it has basic support for exporting MEI from MuseScore (it is supposed to work only for common Western music notation), but could be part of an effective low-cost array to support publishers of digital scholarship.

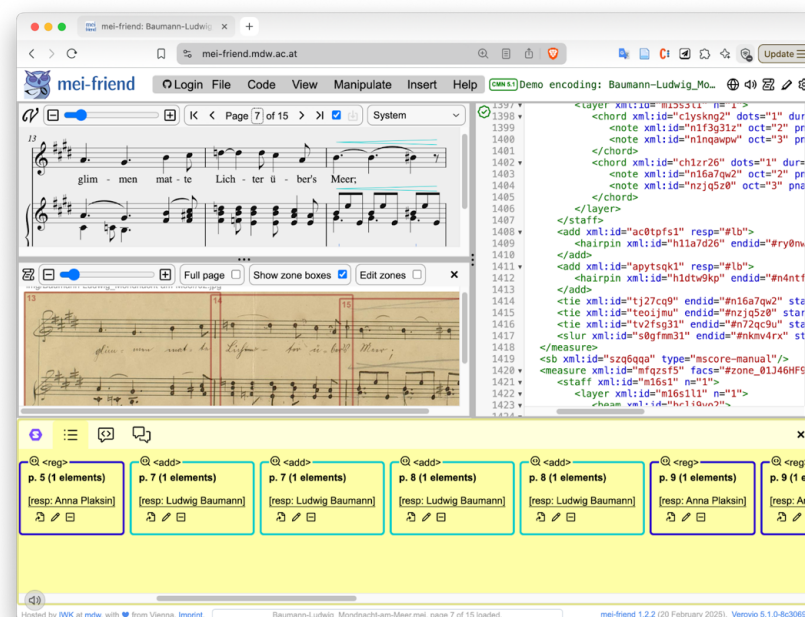


Illustration of [MEI friend with editorial](#) addition in XML, rendered with Verovio and linked to IIIF image.

- **Large Language Models** (LLMs) have had a lot of notice in the last two years, as part of a rapid expansion of general AI, and provide some promising possibilities:
 - LLMs can be made more reliable through various preparatory techniques, including **Retrieval Augmented Generation** (RAG), which reviews results and offers focused natural language queries based on relevant texts. **Domain specific training sets** (such as hmBERT, which is designed to favor historical texts in English, French, and German) afford more reliable results than larger models.⁵³
 - LLMs can also be taught to help us to move between structured and unstructured information about music. Once prepared to understand the structure of an API or SPARQL endpoint, we can use such systems to ask natural language questions to a database without the need to engineer complex query languages. We can also reverse the process: returning structured responses (such as lists of people, places, and events, and their relationships) from prose texts. Such methods could vastly expand our capacity to use existing databases (which could be read by machines no less than humans) or could be used by development teams to speed compilation of metadata.⁵⁴
 - **Linked Open Data Ontologies for Music** (and the Performing Arts more generally) remain a pressing need. See: [MELD](#) (Music Encoding and Linked Data) is a flexible software platform used by several academic research projects to combine digital representations of music, such as audio and notation, with contextual and interpretive knowledge in the Semantic Web.
- **Equipment Bank**
 - Scanning equipment for special collections (especially oversized, early music manuscripts) is hard to obtain for small institutions. A solution for small archives could be to borrow these technologies from bigger institutions. An example of this type of work can be seen in the digitisation campaigns carried out in Braga (Portugal) with equipment borrowed from Centro de Estudos de Sociologia e Estética Musical (CESEM) as shown at [Musicologist Elsa De Luca's '13th October 2023' blog entry](#), and in Guatemala City (Guatemala) with equipment borrowed from the Marvin Duchow music library (McGill University, Montreal, Canada) as detailed in [Thomae, Cumming, and Fujinaga's 'Digitisation of Choirbooks in Guatemala' at DLFM \(pp. 19-26. 2022\)](#). Also, DIAMM offers [imaging services](#).
- **Editorial Workflow Systems, Hosting Platforms, Server Space**
 - [Open Journal Systems](#) (OJS), for example, is a leading end-to-end scholarly platform for journal articles, publishing them online fully indexed in global discovery services like Google Scholar, Crossref, DOAJ, and

53 See Stefan Schweter, Luisa März, Katharina Schmid, Erion Çano (2022), '[hmBERT: Historical Multilingual Language Models for Named Entity Recognition](#)'.

54 See Carlos-Emiliano González-Gallardo et al. (2023), '[Yes but.. Can ChatGPT Identify Entities in Historical Documents?](#)'.

many others. See the schematic overview of the process from author MS to final PDF and Ebook or HTML [here](#). Support is needed, though, for specific needs of music.

- DARIAH offers workshops on [Open Access Publishing](#).
- In addition to platforms like OJS (see above), there is a need to create low-cost or free hosting platforms for associated data (MP3, Images, encoded scores, datasets).

8. Enhancing public engagement and impact measurement

Musicologists create, improve, and transmit knowledge about music as cultural heritage, but arguably every musicologist has heard the question: ‘So, what instrument do you play?’ Musicology as a humanities discipline seems to lack a clear public profile, and opportunities to benefit from musicological expertise often remain unseized. Although musicologists are engaged in a wide range of activities including research, teaching in secondary and higher education, work in the GLAM sector⁵⁵ as well as at festivals or cultural institutions and various forms of applied musicology (journalism and music criticism, radio, TV or podcast hosting), the visibility of musicological research and the added value musicology can have in society as a heritage science and as a data science continues to be low. A reason for this may be that music, in popular perception, is primarily associated with its performance instead of its academic study. The present chapter deals with options for increasing the visibility of musicological research in society.

As in other humanities disciplines, musicological research is disseminated in formats that are targeted at the academic community itself but also, to some extent, to professional performers. There is no established practice or tradition of musicological discourse in the public sphere, and training in public engagement is, if present at all, not a core feature of most doctoral programmes in musicology.⁵⁶ Disseminating musicological research through formats that are accessible to a general public with an often limited musical literacy and previous historical knowledge can result in publications that are remote from the original research.

55 Galleries, Libraries, Archives and Museums; cultural institutions that collect and maintain cultural heritage in the public interest.

56 As an example for compulsory dissemination activities, the educational component of the [PhD program in musicology at the University of Oslo](#) requires doctoral candidates to fulfil 2 ECTS in research communication.

In order to bring the identity of musicology as a heritage and data science into sharper focus in society at large, communication must reach beyond the discipline-specific platforms and channels to engage wider audiences, to arrange *impactful community engagement and dissemination initiatives* for musicology.⁵⁷ The following aspects should be considered:

- Go beyond the academic field by embracing best practices in public engagement, collaboration and participation;
- Build and sustain a long-term, discipline-wide relationship with the public rather than seeking to engage through successive short-term projects and initiatives;
- Develop and showcase representatives of musicology through engagement with public media platforms and outlets;
- Learn to articulate the value of musicology to wider society, and the importance of understanding history, to bridge past and present, and to shape and inspire the future;
- Think beyond scholarly publications to achieve wider dissemination of ideas through different formats, platforms and spaces, including but not limited to social media.

A successful example of showcasing representatives of the field comes from Lithuania, where a series of interviews was initiated called '[Musicologist in the Spotlight](#).' Every Saturday an interview was published in the media (including social media channels). Musicologists were asked about their activities and responsibilities; additionally, broader topics were discussed that connected them with wider cultural society. It was well-perceived by the wider public and its reach was wide.

8.1. Musicology in the public space

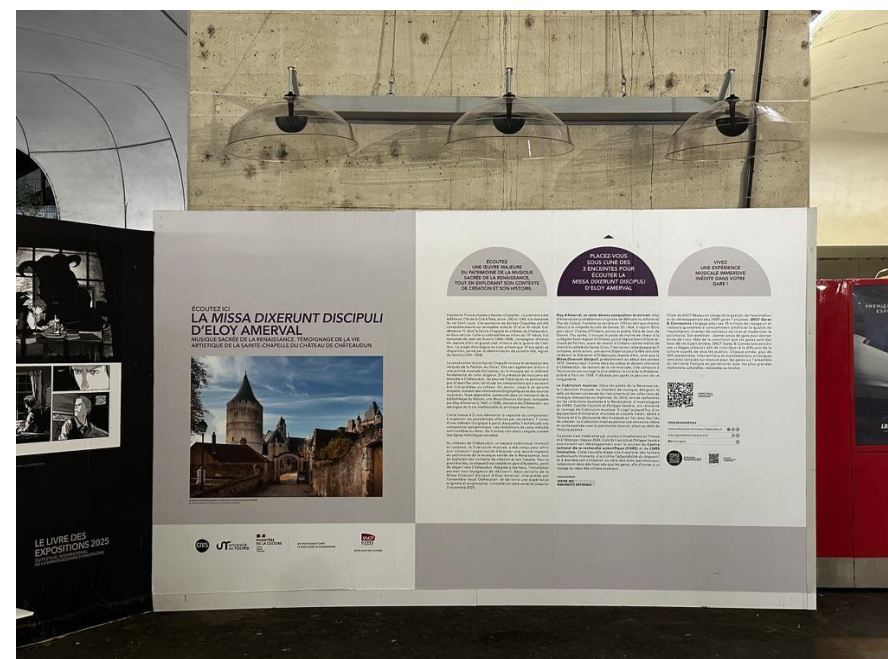
A variety of terms is used to describe activities that seek to engage the wider public with musicological research, for instance 'science communication' (Wissenschaftskommunikation, vetenskapskommunikation), 'dissemination', variations of 'mediation' (médiation culturelle,

⁵⁷ Dissemination = one-way communication. Public engagement = two-way, participatory exchange. Impact = broader societal change (may result from engagement, but not identical).

forskningsformidling) or ‘popularization’ (popularyzacja nauki). These terms can encompass the communication of research in forms including:

- ‘Popular science’ books and articles
- Articles in mainstream media, presenting musicological research for a general audience
- Public-facing websites and blogs for musicological associations and institutions⁵⁸
- Podcasts, as published for example by [REMA](#) / Early Music in Europe or the [Sound Expertise project](#)
- Digital humanities projects that allow the public to interact with, and in some cases participate in, musicological research⁵⁹
- Live events, performances and exhibitions, where musicologists curate, present and/or contribute to the content⁶⁰
- Publications to support live events and media, such as programme notes, essays for festival books or websites, and notes to accompany recordings.

The challenges of this practice often centre around balancing accessibility of content with scholarly depth and rigour, and bridging the gap between academic and public interests. In the face of the overwhelming amount of user-generated content



The [Cubiculum Musicae Châteaudun](#) project was showcased at Paris’s Gare d’Austerlitz, offering the station’s 23 million annual travellers the chance to discover 15th-century polyphonic music.

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- 58 The [Epaveldas platform](#) is dedicated to cultural heritage in general, with a section dedicated to musicological research objects.
- 59 See, for example, the [Space, Sound and Memory](#) project (conducted by James Cook and the Binchois Consort at Linlithgow Palace in collaboration with Heritage Scotland) and [Cubiculum musicae](#).
- 60 The Centro Studi Opera Omnia Luigi Boccherini conference ‘[Early Music Pedagogy Then and Now](#)’ (2022) highlighted some of these public projects, for children, in higher education, and for groups of amateurs of varying levels of musical skill. Other examples might be the [Mozarthaus](#) and [House of Music in Vienna](#). Also, the [Early Music Festival](#) in Utrecht includes workshops on for example Guidonische Hand singing and early music dance traditions preceding concerts. They also include late night lectures for a general public in their programming. See also the [Sound in Museums](#) conference.

on the internet, musicologists also face the challenge of countering widespread misinformation and establishing the credibility of their position.

In order to meaningfully engage with a wider public, it is important to identify the concrete target audience and understand why this specific audience should be interested. This helps design and deliver public engagement outputs that cultivate meaningful ongoing engagement between musicologists and specific communities (defined geographically or in terms of shared interest and activity). This has the potential to benefit the researchers involved, in terms of visibility for their work, pathways to career development, and the opportunity to consider their research from different perspectives.

8.2. Participation and Collaboration in Public Engagement

Public engagement can take the form of presenting findings to the public through publications, talks, exhibitions and online content, but dialogue with and involvement of members of the public as well as organisations in the design and execution of the research itself can be meaningful in many regards.

The new ecosystem of musicology needs to reflect the imperative of the Open Science Policy to be open, participatory, and inclusive by building on existing best practices in public engagement to build relationships in the public space. A wide range of different groups engaging with historical musics exist, ranging from independent and amateur practitioners whose engagement with theoretical concepts, primary sources and practical activities can reflect a high level of understanding and ability, and concert-goers who are lifelong consumers of music history; through to those whose interest is primarily in the sonic experience of a particular genre, or the immersive atmosphere of a particular kind of event, or associations with another interest or activity (for instance historical reenactment or video games taking place in historical settings).

To this can be added Cultural and Creative Industries organisations (including libraries and museums, film, television, video games and multimedia, festivals and venues). Each of these groups and sectors represents opportunities for musicology to [engage the wider public through participation and collaboration](#), as the EU's open science policy postulates, 'thereby accelerating the discovery process, improving research quality, and making science more impactful and central to human and societal development'. For instance, the [Early Recordings Association](#), an open-access resource dedicated to

early recordings, is inviting the general public alongside academics to contribute to the database and publications.

The UK's National Coordinating Centre for Public Engagement describes public engagement as 'build[ing] an inclusive higher education sector where communities can contribute to, and benefit from, knowledge, teaching and research.'⁶¹ The Centre emphasises active public participation and contribution, rather than passive consumption, to enhance the quality, relevance and accountability of publicly funded research.

At the EU level, [Engage2020](#) focused on mapping and exploring public engagement methods and tools to make European research more inclusive. The project produced resources detailing current practices of public engagement, aiming to improve the two-way communication between scientists, policymakers, and citizens to ensure regular exchanges of views. The [Knowledge Valorisation Platform](#) undertook analysis of citizen engagement for knowledge valorisation practices, drawing on 60 selected case studies from 37 countries, across the EU and internationally, mapping the benefits of participatory processes and exploring key elements for successful valorisation of knowledge and research results with the engagement of citizens. The [Mutual Learning Exercise](#) (MLE) 'Public Engagement in R&I' (2023–4) aimed at exchanging success stories, experiences, and challenges in fostering meaningful public participation in research and innovation. However, none of the reports produced by these initiatives contain any reference to music or musicology.

This highlights the need to consider public engagement more fully in relation to musicology in Europe. There is a need for a focal point to foster discussion and share best practices in this area, in order to develop a shared understanding of how musicology can respond to the wider imperative for public engagement.

8.3. Research Policy and Public Engagement

[Horizon Europe](#) places significant emphasis on citizen engagement to align research outcomes with societal needs, through meaningful engagement with and integration of citizens' needs and interests into the agendas and outputs of publicly funded research. This focus is articulated through

61 NCCPE (2025), '[Homepage](#)'.

the emphasis on [citizen science](#) and dedicated funding for [public engagement](#). However, the design of these initiatives is largely concerned with research in the sciences, while the [Creative Europe](#) programme deals with public access to the arts. The focus of Creative Europe is on the Cultural and Creative Industries,⁶² rather than academia, hence, the program is not geared towards musicology.

Case Study — The [UK Research Excellence Framework \(REF\)](#)

The UK context offers an example of how changes in research policy can be achieved to foster public engagement with the field of musicology. The REF (the national research assessment exercise) defines 'Impact' as 'an effect on, change or benefit to the economy, society, culture, public policy or services, health, the environment, or quality of life, beyond academia.'⁶³ Impact results from Knowledge Exchange, which is defined as a 'collaborative, creative endeavour that translates knowledge and research into impact in society and the economy.'⁶⁴ In previous REF submissions, subject areas were required to submit 'Impact Case Studies' whose weighting in terms of funding return were several times that of an academic monograph. This led to impact being embedded as a strategic area for development and support in UK universities, with specific resources and funding streams available to support the design and measurement of impact activities. However, with a narrow definition of impact on easily quantifiable effects and changes to wider society in the UK, REF often excluded the kinds of public engagement activities that music and the arts more generally excel in, making the wider value of the research difficult to report. This meant that these subject areas and individuals did not always receive due credit for them and such activities were not necessarily supported by institutions or rewarded by the REF. Broadening the scope of assessment to incorporate Public Engagement alongside Impact is expected to have a material effect on Public Engagement strategies and support within institutions, as well as the credit given to the academics who excel in this area, stimulating more activity in this area.

A robust funding structure that covers the technical costs of innovative dissemination formats but also the work hours for public engagement that are not usually specified in academic employment contracts is obviously required as the basis for these developments.

62 European Commission (2025), '[Music - Culture and Creativity](#)'.

63 UKRI (2025), '[How Research England supports research excellence](#)'.

64 As formulated in the [Knowledge Exchange Concordat](#).

8.4. Considering impact strategies in musicological research projects⁶⁵

The notion of impact refers to the deep consequences of academic research on the general public, outside the scientific community. Impact can be cultural, economic, environmental, social, health-related, legal, or even technological. In the United Kingdom, it represents a key issue for university funding, meticulously documented for submission to the *Research Excellence Framework*⁶⁶ and demanding long-term strategic planning. In Continental Europe, this concept is beginning to take hold, with more national research funding bodies adopting criteria related to societal impact that move beyond scientific valorization of published research results.

It is crucial to take impact into account in all stages of scientific projects, from initial planning to research, analysis and outputs. Impact can take place during the funded phase of a project, but frequently develops after the research team has dispersed: this creates a positive legacy, but also poses challenges for the management and measuring of impact. In the UK, the underpinning research of the project also has to be published before impact can be said to derive from it: another challenge to be met. The experience of recent collaborative research demonstrates that devising and delivering impact can encourage unexpected research paths: the impact deriving from one pathway, but also stimulating subsequent and unanticipated strands of research. Consequently impact can allow us to imagine new ways of approaching the discipline, as well as sharing results with a wider audience with long-term influence on the perception of music history.

Over and above the academic evaluations that are necessary to obtain the funding inherent to the continuation of research, taking impact into account is invaluable for long-term dissemination. Impact allows us to think about how we can share the results of our research and rethink our publishing practices beyond our usual ecosystem. How do we visualise and communicate rich data, or link musical data and history? What are our practices in investigating the specificities of a musical period? Finally, how can we actively engage the audience in crafting the research beyond standard period dissemination?

65 This section is largely inspired by Braud et al. (2025), '[Considering impact strategies in historical and musicological research projects](#)'.

66 For more information, see UKRI (2025), '[How Research England supports research excellence](#)'.

Thinking about impact from the inception of a project allows us to consider the global scope of scientific spin-offs, integrating the wide sharing of knowledge into the very heart of the scientific proposal. Taking this a step further, it is thus possible to use societal observations linked to the state-of-the-art of a discipline as a starting point for questioning it, in a sort of reverse engineering process made possible by reflecting on the importance of impact.

Implementing impact strategies must aspire to unite communities around perennial scientific themes; it is therefore important that events organised as part of a project gather a wide audience in contrast to a *niche* of researchers. In fact, we should specifically commit to targeting audiences peripheral to the world of research in order to demonstrate inclusivity in changing the understanding of historical and/or musical facts in a thorough way.

Among numerous impact cases studies, the notion of identity is regularly mentioned. It is a focal point around which we can build projects, both from the point of view of impact and of the research itself. We can thus question the nature of identity in the context of the study of music, where the coalescence of many parameters shapes the political and historiographical role of a work, as well the identity—both as essence and as performability—of its performers, composer and the people to whom it is tied. By attempting to recreate the performative contexts in an immersive way, it seems possible more thoroughly to connect the identities being studied with the identities of the audience.

Even more accessible to a range of communities (for instance, people's homes) than live performance is the video medium, whether through films or documentaries. However, working on this kind of media comes with challenges such as very high production costs and difficulties in translation (as discussed below).

In order to give an account of the scientific work carried out as part of a research project, a process of translation needs to be considered to demonstrate the depth of the issues studied. This rendering process does not only target the purpose of the project in terms of impact—the communities identified during the prospects, that will be met during later events—but also the various agents involved in the logistical organisation of events, external partners such as musicians and singers, sound technicians, *etc.*, in short, all those who make the impact possible by internally shaping it. Mutual understanding is thus a key resource for healthy exchanges and helps to give a new impulse to the discipline, from

the inside. One should also be wary not to confuse this work with cultural mediation, which dwells in explaining artistic practices through example and talks.

Despite the efforts made, the vast majority of researchers report that there is still a palpable resistance from the public to musical heritage, whereas patrimonial and historiographical elements seem to be more easily perceived and integrated into existing knowledge. Although this can be explained by a tendency to feel more at ease with historical figures and their *identities* than with musicians, even less than with works and their contexts, this still shows the reach of the work needed to make a profound and authentic impact on diverse communities throughout the presentation of musical works.

Moreover, unlike its historical counterpart, musicology often tends to be viewed negatively by the scientific community, particularly in terms of its ability to legitimise an impact on the public. For example, rejections of scientific projects have sometimes been justified in reports by a simple lack of interest of the reviewers in 16th-century music, without any other explanation; this can be a major problem among funders with multi-disciplinary peer reviewers. In a context where funding is becoming increasingly competitive, these situations lead to considering multidisciplinary projects in order to integrate the musical experience into social, political and historiographical frameworks.

In this respect, the example of the '[Henry VIII on Tour: Landscapes. Communities and Performance](#)' project led by Anthony Musson with John Cooper, Magnus Williamson, and Kate Giles, is worth considering. Their impact strategy is structured around four main areas unified by the reconstruction of Henry VIII's geographical journeys:

- Raising awareness for local communities of the existence of places crossed by Henry VIII through site visits.
- Archaeology of pre-identified sites: discovery of the past combined with community sharing open to all ages, enhanced by digital visualisations of the site.
- Reconstruction of ceremonies of progress including actors and reproducing banquets: inclusion of communities in the stories of Henry VIII's hosting through convivial and festive moments.
- Musical performances of newly edited music, in accordance with the corresponding liturgy, given in pre-identified places of progress: participants and communities experience service enactments.

While some of these suggestions may seem very far away from the European researchers' daily practice, they constitute a key standard for the UK practice of impact and show us that interdisciplinarity and collaboration between researchers and a wide range of seasoned professionals are absolutely

fundamental to interfacing with communities. It is thus necessary to plan for these tasks as soon as the project proposal is submitted, since they require a high level of financial and inter-personal investment, as well as carrying out preparatory surveys prior to submitting funding applications. Those will enable us to identify the key operators with whom to collaborate: associations, theatre companies, archaeological centres, but even ecclesiastical communities or caterers, as seen in *Henry VIII on Tour's* banquets! Having already strong links tied with the communities, they have much to offer to us in terms of better understanding of impact.

Considering the audience is one thing, but it is also important to think about how research projects fit into the communities' environments. Drawing on historiographical data is a first step towards rediscovering heritage sites, as those places can hold significant meaning for individuals, highlighting the connection between the appreciation of places and mental health. In this regard, music seems to be a perfect candidate for crafting the sonic ecology of a place through imaginative use of sound and space through a real musicological expertise.

Spotlight: '[Listening to the Commons](#)'

This project is testimony to how impact can stimulate new research ideas rather than dictating the research, and allows the building of further links between the research fellows, unexplored places and new communities. A project team combining historical, acoustic, and digital humanities expertise succeeded in showing that, thanks to a ventilator driven through the old House of Commons ceiling, women (formally excluded from political life) could access debates in the Commons with in some cases a better listening experience than the male MPs down below. The study covers the period from 1820 to 1834, taking the overall chronology of the project to six centuries. Twenty-five tickets were available in the spaces accessed through the ventilation ducts, and it was possible to buy drinks, making it a social space. Two sketches of the space by women survive. In 2018, the [Voice & Vote exhibition in Westminster Hall](#) (107,000 visitors) recreated a replica of the ventilator, simulating how women may have experienced the sound of the House of Commons. The exhibition was curated by senior parliamentary staff, but dialogue with the research project enabled them to upscale the visitor experience with 'authentic' sound: one example of the dynamic relationship between host institutions and research-derived impact. A historic debate on the slave trade was also staged within the Commons chamber, drawing on project expertise and calling on Members of Parliament and parliamentary staff as 'actors'. Two concerts of the sacred music of Nicholas Ludford were also performed, drawing on the Parliamentary choir and the choir of Gonville and Caius College Cambridge, in spaces associated with St Stephen's Chapel: putting music probably composed for pre-Reformation St Stephen's back into its original space. Events were filmed, and also audio-recorded for use in future acoustic modelling. These events wove a strong connection with two communities: visitors to the Palace of Westminster, and the politicians and staff who work there. Feedback forms showed that the exhibition played a role in profoundly changing attitudes, as well as inspiring new stories and ideas.

Spotlights: '[A Musical Journey](#)' at the KBR Brussels

The KBR Museum in the Royal Library of Belgium has recently opened the exhibition *A Musical Journey*, centered around the library's rich collection of illuminated manuscripts of Franco-Flemish vocal polyphony from the library of the Dukes of Burgundy. The manuscripts are displayed with other artworks and objects from the period. Characters from the manuscript illuminations are projected on the ceilings, and visitors can listen to music and stories at audio stations. In addition, the exhibition is framed by concerts and workshops, and the library blog features a scholarly but generally accessible [article](#) by Brett Kostrzewski from KU Leuven on the musical repertoire.

While being highly successful manifestations in terms of impact, it must be stressed that the human and logistical cost of these events is colossal. Many events require legal authorization or the build-up of trust over many months, not to mention the staff mobilised as research support. It would therefore seem that the quality of impact obeys a circular logic that offers the best-endowed establishments the opportunity to organise more efficient impact strategies.

Although music researchers are amplifying their efforts with endeavours to promote the results of scientific research to the public, they still inherently face resistance from funding institutions. When applications are submitted, it is not uncommon to come across remarks such as '*what's the point of having musical performance ?*'... It is therefore up to the researcher to rethink the term in order to give it an interdisciplinary value—by referencing the performance of 'experimental archaeology', for example. In an era where sharing music has been completely rethought through the internet and streaming in particular, it seems more necessary than ever not to miss the step to connect to the cultural industries, so as not to become even more isolated than we already are.

Collaborating with the *art-de-vivre* industry as well as fashion may seem far removed from our concerns; these collaborations do, however, make sense in the context of refined reconstructions of musical performances, bringing together newly rediscovered or edited music to all sorts of communities and identities interested in clothes. Although this might be truer in the UK, where history courses offer a very visual approach to the Renaissance, we still have many lanes to explore in order to offer immersive experiences that can raise the awareness of diverse communities.

In conclusion, musicology is equipped to take on the tasks that are crucial for accessing, safeguarding, and disseminating cultural heritage on the basis of scientific methodology and standards. The visibility and accessibility of the discipline in society at large must however be increased in a way

that musicologists are perceived as the experts they are. However, both infrastructure and funding options must be improved.

9. Communication and collaboration

Music plays a vital role in shaping cultural heritage, identity and memory, but it has been underrepresented in cultural heritage initiatives. One reason for this could be its hybrid nature. It is both tangible in manuscripts, prints, instruments, paintings, etc., as well as intangible in the nature of performance and the knowledge required to interpret and bring sources to life. While this duality has often been flattened out in cultural heritage initiatives, the way forward is to celebrate it. The experience of people working within the broader umbrella of cultural heritage shows how important it is to approach heritage not only as a static legacy of the past but as something dynamic, constantly reinterpreted and renegotiated in the present. At its core, music, and the music scholarship that invigorates it, is the apotheosis of living heritage, a shared resource that shapes collective identity and memory.

Musicology needs to move beyond seeing itself as a niche academic field to claim its rightful place as a torchbearer that transforms scholarship into a living practice: attending to the past while looking toward the future. There are many possible paths to achieve this end, but they all have a few elements in common. People working in musical scholarship need to come to a consensus on the best ways to work together towards common goals. They need to reach outside of music history circles and engage with policy makers, funding organisations and culture heritage promoters across disciplines. In policy and legal discussions, it is crucial to make a compelling case for the richness and distinct needs of music heritage, highlighting how it differs from other heritage domains in its reliance on sound recordings, performance practice, and complex metadata. In short, we need to shift the narrative and take our place as leaders in the cultural heritage space.

People who work under the broader umbrella of cultural heritage—especially those who receive research grants aimed at preservation, interpretation, and dissemination—can teach us a great deal when it comes to the heritage of music. Musicologists should learn from them, and adopt their methods of community engagement and public history projects. This would significantly influence the direction of policies and research and cultural programs.

Musicological research needs to highlight the ways in which it combines traditional research methods with digital innovation. By embracing both analogue rigor and digital innovation, we can rethink what it means to do musicological research today, especially through hybrid models which combine traditional research methods with digital innovation in interdisciplinary teams.

These kinds of collaborations could provide a realistic pathway towards embedding musicological research in European digital initiatives and could prove successful in acquiring funding.

* * *

We conclude this document with several actions that we musicologists can already undertake, focusing first on legal reforms and policy and then on project-based actions that must follow. We provide examples of potential partners.

→ **Active participation in consultation processes, working groups, engaging with policymakers at the European and national level.** Active participation means, for example, drafting Position Papers outlining why music should be a priority in EU heritage policies or about the unique value of music heritage, requesting meetings with relevant EU cultural policymakers, or maintaining a seat at the table during critical legislative discussions such as the upcoming review of the EU Copyright Directive in 2026. Potential partners include:

- [DG EAC \(Directorate-General for Education and Culture\)](#)
- [DG RI \(Directorate-General for Research and Innovation\)](#)
- [DG CONNECT – Directorate-General for Communications Networks, Content and Technology](#)
- [Committee on Culture and Education](#)
- Council of Ministers for Culture (to ensure national-level buy-in)
- [ECCCH \(European Cloud for Cultural Heritage\)](#)

The upcoming 2026 evaluation of the Copyright Directive as highlighted by Henna Virkkunen, Executive Vice-President for Tech Sovereignty, Security, and Democracy, presents a critical moment

for stakeholders to advocate for reforms.⁶⁷ The time is now, then, to argue for solutions that better accommodate musicological research, digital preservation, and metadata accessibility. As AI-generated content, digital musicology, and text-and-data mining (TDM) become increasingly relevant, the upcoming review offers a strategic opportunity to push for legal adaptations that ensure fair access to historical recordings and metadata for research purposes.

→ **Advocating for music heritage-specific exemptions in copyright law.** This could include explicit legal exemptions for heritage institutions, clarification of metadata usage rights and greater alignment with fair use models which recognises that research-based exploitation of copyrighted works does not necessarily undermine rights holders' financial interests. We recommend using the [Fair MusE Deliverable reports](#) and [European Heritage Hub Policy Monitor](#) as examples and foundations.

As the EU considers updates to its copyright framework, it is imperative that the voices of musicologists, heritage professionals, and researchers be included in these discussions. By positioning musical heritage as a key pillar of digital innovation and European cultural policy, we can help shape a future-oriented legal framework that not only protects intellectual property but also fosters research, accessibility, and preservation in the digital age.

→ **Promoting music as cultural heritage in the EU** engaging with institutions, NGOs, and lobbying organizations that focus on culture, heritage, and creative industries. The following are some potential partners:

- [Creative Europe](#): The EU's flagship program supporting the cultural and creative sectors, including funding for music as heritage.
- [European Heritage Label](#) (EHL): Recognises cultural heritage sites, and music traditions could be integrated into this framework.
- [Music Moves Europe](#) (MME)
- [Europa Nostra](#): A major pan-European NGO dedicated to cultural heritage advocacy.

67 European Parliament (2025), '[Commitments made at the confirmation hearings of the Commissioners-designate 2024-2029](#)'.

- [European Music Council](#) (EMC): Represents the European music sector and promotes music's role in cultural heritage.
- [International Music Council](#) (IMC): A UNESCO-affiliated organization supporting music as an essential cultural asset.
- [Culture Action Europe](#) (CAE): A lobbying network advocating for better cultural policies in the EU.
- [European Network of Cultural Centres](#) (ENCC): Supports cultural initiatives and local heritage preservation, including music.
- [UNESCO Intangible Cultural Heritage Program](#): Helps protect and promote music traditions as part of intangible heritage.

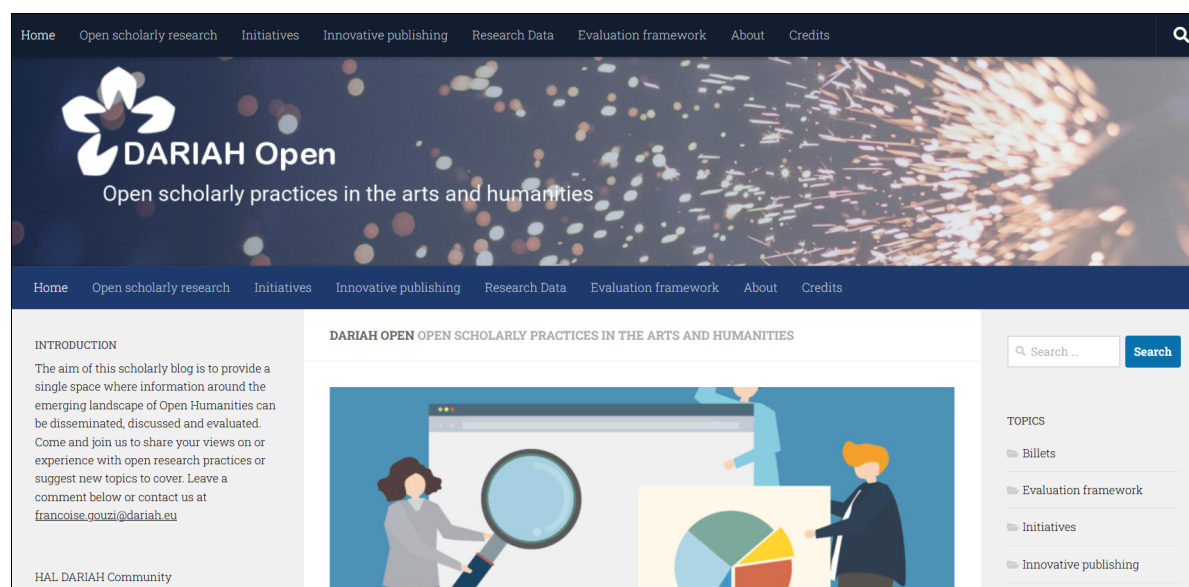
→ **Participating in EU events** such as [European Heritage Days](#), [European Capitals of Culture](#).

→ **Actively engage in media campaigns** through social media and hashtags such as #MusicAsHeritage.

→ Create a sustainable strategy for **accessing EU Funding and apply for EU Cultural Grants** partnering with experienced organizations to apply for multi-country funding projects. Some target programs are:

- [Creative Europe – Culture Strand](#) (for cultural cooperation projects)
- [Music Moves Europe](#) (for innovation & sustainability in the music sector)
- [Horizon Europe](#) (for research on music and cultural heritage)

→ **Engage with interdisciplinary consortia bringing together musicology, heritage, and digital technologies**, such as [ECCCH](#), [DARIAH](#), [CLARIN](#), [European forums on music heritage](#). These consortia, as well as others explained in Chapter 1, provide new opportunities for integrating music and musicological research into European heritage infrastructures.



<https://dariahopen.hypotheses.org/>

→ **Establishing cross-disciplinary agreements and protocols** between musicologists, heritage scientists, and data specialists, fostering collaboration on digitisation standards, metadata protocols, and data-sharing methodologies. The [Common European data spaces](#) provide guidelines about best practices for managing data on [Cultural Heritage](#).

Ultimately, these actions call for an academic environment that not only concentrates on high-impact research and publications, but also commits to safeguarding and advancing musical heritage.

