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MUSICOLOGY AND EUROPEAN PARTNERSHIPS: RESILIENT CULTURAL HERITAGE AND VIRTUAL WORLDS

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Abstract:

This report examines how musicology can position itself within European research and innovation partnerships, shifting the focus from research infrastructures to long-term agenda-setting, consortium-building, and strategic visibility. It concentrates on two especially relevant frameworks, Resilient Cultural Heritage and Virtual Worlds, where musicology's work with manuscripts, instruments, sound archives, repertoires, places, practices, and communities connects tangible, intangible, and digital heritage. Its central argument is that the field is under-positioned rather than under-qualified: musicology already holds the methodological, documentary, and interpretive expertise needed to contribute to climate resilience, heritage preservation, social cohesion, immersive environments, digital twins, sound-space reconstruction, and culturally responsible virtual mediation. The report therefore identifies pathways through which musicological knowledge can become legible to European partners, funders, policy actors, cultural institutions, and technology developers without requiring disciplinary reinvention. It argues for a more collective and strategic translation of musicological expertise into partnership vocabularies, open standards, FAIR data practices, co-creation models, sustainability frameworks, and policy-relevant forms of research collaboration.

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INTRODUCTION: THE PARTNERSHIPS

1. Scope, Audience, and Rationale

This report continues the work of our report [*Historical Musicology and European Research Infrastructures and Initiatives: A Practical and Strategic Integration Framework*](#), while shifting the focus from infrastructures to partnerships. The earlier report examined the European research infrastructure ecosystem as a layered environment of services, standards, repositories, platforms, and governance frameworks that increasingly shapes access to data, tools, collaboration, and long-term preservation in musicology. The present report starts from that foundation but addresses a different question: not how musicology can enter infrastructural environments, but how it can position itself within long-term European research and innovation partnerships.

Under Horizon Europe, [partnerships](#) are long-term structuring environments in which the European Commission and public and/or private partners align agendas, resources, governance, and investment around major societal or technological challenges. As such, they shape not only funding opportunities, but also the language of priorities, the composition of consortia, the forms of legitimacy expected from participants, and the strategic horizons within which research fields become visible. For musicology, moving from infrastructures to partnerships therefore means moving from questions of access, standards, and services to questions of agenda-setting, strategic translation, and collective positioning.

The present report has a practical and analytical purpose. It is intended to help the musicological community understand how partnerships work, why they matter, and where the most robust entry points for the discipline currently lie. Like the infrastructures report, it is designed as a reference tool. Unlike a purely descriptive landscape review, it takes a strategic position: musicology should not remain a peripheral observer of partnership ecosystems but should learn to read them as environments in which disciplinary expertise can be translated into collaborative, fundable, and policy-relevant forms.

The report is addressed first to musicologists, understood in the broadest sense of the word as incorporating all researchers involved in the academic study of music, who wish to understand how their

research practices, collections, networks, and expertise can be made legible within European strategic frameworks. As such, it is equally relevant to curators, librarians, archivists, and collection managers whose work intersects with infrastructures, standards, preservation, and access, and who may become essential partners in future consortia. A further audience includes project officers, research managers, policy actors, and infrastructure professionals who need a field-sensitive account of what musicology can contribute to current partnership agendas.

Different readers may use the report in different ways. Some will read it as an overview of two emerging partnership environments. Others will approach it as a practical orientation tool for proposal development, consortium building, or institutional positioning. Still others may use it as a governance document—as a way of understanding how the field might organise itself more collectively in relation to long-term European priorities. Across these uses, the central claim remains the same: musicology's mixed tangible, intangible, and digital profile makes it highly relevant to both partnerships; the field is under-positioned rather than under-qualified; and the main task is not disciplinary reinvention but strategic translation.

2. Method, Sources, and Definitions

This report is based on a systematic reading of three core sources: the previous report on Historical Musicology and European Research Infrastructures and Initiatives, the [ARCHE Strategic Research and Innovation Agenda](#) (ARCHE SRIA), and the [Strategic Research and Innovation Agenda for Virtual Worlds](#) (VWP SRIA).¹ These documents play different roles. The infrastructures report provides the conceptual and strategic precedent. The ARCHE SRIA provides the policy and research foundation for the future European Partnership on Resilient Cultural Heritage (RCH), while the VWP SRIA outlines a strategic technology agenda for the emerging co-programmed partnership on Virtual Worlds.

The method is strategic reading. This entails attending not only to declared themes but also to governance models, implementation mechanisms, institutional vocabularies, and underlying assump-

¹ We refer to the versions of these documents that were available in the first half of 2026: ARCHE Consortium, *ARCHE SRIA and its Synthesis* (2025) and *Virtual Worlds: Solving Real-World Problems*, SRIA version 1.0, June 2025. We are aware that as of July 2026, a major revision of the VWP SRIA is in progress. For updated information, consult the Virtual Worlds Association SRIA [platform](#).

tions about impact, interdisciplinarity, and societal relevance. On that basis, the report cross-maps themes identified in the SRIAs to musicological practices, collections, infrastructures, and methods. It also constructs use cases in order to identify where musicology can enter partnership environments most convincingly and with the strongest argumentative grounding.

This approach treats the SRIAs as operational documents that define future conditions of eligibility and collaboration. The aim is not to produce a complete inventory of everything musicology could do within these frameworks, but to identify robust pathways by which the field might become a visible and credible partner.

The report focuses on only two partnerships: [Resilient Cultural Heritage](#) (RCH) and [Virtual Worlds](#) (VWP). This selectivity does not imply that other partnerships are irrelevant; rather, these two currently offer the clearest entry points for the field. Resilient Cultural Heritage speaks directly to musicology's long experience with tangible, intangible, and documentary heritage and its methodological engagement with climate-related challenges. Virtual Worlds engages acoustic, spatial, and experiential questions to which musicology can make a distinctive and well-evidenced contribution.

The report should be read as a structured intervention designed to help the field anticipate opportunities, understand the logics that shape them, and begin preparing forms of collective response.

3. From Infrastructures to Partnerships

The shift from infrastructures to partnerships marks an important transformation in the way European research environments are organised and in the kinds of strategic visibility that are required from scholarly fields. This is not a rupture but a cumulative development. Project-based funding created episodic opportunities for collaboration. Research infrastructures then stabilised parts of the ecosystem by providing services, standards, repositories, technical environments, and governance structures that outlived individual projects. Partnerships extend this evolution by adding a further layer: long-term agenda-setting environments in which research, innovation, governance, and investment are aligned around broad societal or technological challenges. Partnerships also require cross-disciplinary and cross-sectoral innovation and stimulate public-private cooperation.

For musicology, this shift changes the level at which positioning becomes necessary. Within infrastructural logic, the main questions concern access: how to use services, how to adopt standards,

how to deposit or connect data, and how to work with platforms and tools. Within a partnership logic, the questions become strategic. What kinds of problems does the field help define? In what language can professional expertise be made intelligible to mixed consortia? How can disciplinary knowledge be translated into forms legible not only to researchers, but also to policymakers, funders, technology developers, cultural institutions, and civil-society stakeholders? Answering these questions is a matter of strategic translation rather than disciplinary reinvention.

The distinction between infrastructures and partnerships in the European research environment can be stated clearly, while recognising that the two overlap and reinforce each other. [Infrastructures](#) provide tools, standards, services, repositories, facilities, and long-term technical environments that support access, preservation, interoperability, and data circulation. [Partnerships](#) organise agendas, roadmaps, governance frameworks, co-investment logics, and joint calls. They do not primarily solve the problem of access to resources; rather, they shape the environments within which priorities are defined and resources are mobilised. If infrastructures help determine how research can be conducted, partnerships increasingly help determine which kinds of research become strategically visible and fundable.

In Horizon Europe, European Partnerships are initiatives in which the European Commission and public and/or private partners commit shared resources to support a common research and innovation programme. Three main types currently exist:

- **Co-funded partnerships** combine Commission funding with national or regional commitments from participating states and agencies. Partners implement joint transnational calls with co-funding from Horizon Europe. Resilient Cultural Heritage belongs to this category, drawing 30% of its budget from the Commission and 70% from the participating countries.
- **Co-programmed partnerships** are based on shared agendas between the Commission and organised stakeholder communities, with implementation through Horizon Europe calls and matching contributions from industry and academic partners; Virtual Worlds belongs to this type.

- **Institutionalised partnerships** involve more formalised structures governed under EU law, including joint undertakings and European Institute of Innovation and Technology (EIT) [Knowledge and Innovation Communities](#) (EIT KITs).²

As of 2026, around sixty partnerships operate across six strategic areas. Resilient Cultural Heritage is located in [Cluster 2](#) (Culture, Creativity and Inclusive Society), while Virtual Worlds is situated in [Cluster 4](#) (Digital, Industry and Space).

Infrastructures and partnerships should not be opposed. Their relation is one of complementarity. Infrastructures provide the operational foundations on which partnership activities build: data environments, standards, repositories, interoperability frameworks, and communities of practice. Partnerships create the strategic and financial conditions under which these assets are mobilised, extended, or connected to new priorities. The ARCHE SRIA explicitly calls for synergies with [EOSC](#), [DARIAH](#), [E-RIHS](#), [CLARIN](#), and the [Cultural Heritage Cloud](#). For musicology, the implication is clear: infrastructure literacy does not become less important when moving into partnership environments. On the contrary, it becomes more valuable, because the task now involves translating existing technical competencies and collaborative networks into agenda-setting contexts where research fields must justify not only what they preserve and study, but also why they matter strategically.

4. Why is Musicology a Strategic Test Case?

4.1. Between Tangible and Intangible Heritage

Musicology is distinctive because it works across tangible and intangible heritage. Its objects are never objects in isolation. A music manuscript points to practices of writing, reading, circulation, and performance. A musical instrument points to materials and a history of construction, but also to gestures, sounds, playing techniques, and forms of embodied knowledge. A musical place—a church, theatre, concert hall, studio, festival, or ritual space—is at once a site, an acoustic environment, a social memory, and a framework for performance.

² We note that there is an EIT KIT for [Culture & Creativity](#). It is unclear if this will provide future opportunities to our field, but it might be worthwhile to track the developments in this area.

This position gives musicology a useful profile. The discipline connects textual sources, instruments, places, sound archives, repertoires, performance practices, and living traditions. It does not reduce musical heritage to preserved collections. Nor does it reduce it to practices detached from their material, documentary, or institutional forms. Instead, it shows that musical heritage exists through the articulation of traces, objects, sounds, gestures, places, and communities.

This articulation is central to the Resilient Cultural Heritage partnership. Threats to musical heritage rarely affect a single element in isolation. They affect chains of transmission: the disappearance of venues, the weakening of communities, the loss of craft knowledge, the degradation of archives, the transformation of sound environments, or the interruption of ritual practices. Musicology can therefore help identify what is at risk, while also showing how musical practices sustain memory, social cohesion, intergenerational transmission, and cultural resilience.³

The same profile matters for the Virtual Worlds partnership. Reconstructing an instrument, a hall, a ceremony, or a festival does not simply mean producing a visual model. It also requires attention to sound, gesture, space, use, listening position, historical context, and uncertainty. Musicology can therefore help build virtual environments that are not only technically convincing, but also scientifically grounded and culturally meaningful.

Musicology is therefore a strategic test case because it requires objects, practices, places, technologies, and communities to be considered together. And, as we have previously demonstrated, musicology engages both [heritage science and data science](#). This mixed profile—articulating tangible, intangible, and digital heritage—is what makes the field relevant to both the Resilient Cultural Heritage and Virtual Worlds partnerships.

4.2. A Small, International, Distributed Field

Musicology is a relatively small field, but a strongly international one. Our Infrastructures report describes historical musicology as a small but well-connected community, structured around major reference tools such as [RISM](#), [RILM](#), [RIPM](#), and [RidIM](#). This is relevant for European partnerships. The

3 See the report on the work carried out by the *EarlyMuse* WG 2 Sources during the Wrocław meeting: Grzegorz Joachimiak, ed., [Endangered Musical Sources: Strategies for Safeguarding, Digitization, and International Collaboration](#) (2024).

field's strength does not lie in institutional size, but in its long-demonstrated ability to connect dispersed sources, institutions, and forms of expertise.

This dispersion is part of musicological work. Manuscripts, instruments, sound archives, documentary collections, repertoires, performance sites, and musical traditions rarely fit within a single national or institutional frame. A single research question may require sources preserved in several countries, different languages, distinct catalogues, engagement with different communities, and expertise from libraries, museums, archives, universities, and conservatoires.

In a European framework, this distribution can become an asset. Partnerships do not fund isolated projects. They structure agendas, organise consortia, align priorities, and create conditions for sustained collaboration. Musicology already works in this way: it studies circulation, transfer, networks, shared traditions, and objects preserved across multiple locations.

The strategic task is therefore to turn often informal internationalisation into a clear collective position. If musicology remains dispersed, it risks staying marginal within large European frameworks. If it organises its networks, sources, and competencies more visibly, it can become a relevant partner for programmes built around transnational cooperation, interoperability, shared data, and common research agendas.

4.3. At the Crossroads of Major Agendas

Musicology can enter several major European agendas without abandoning its core values. These agendas already run through the objects, methods, and institutions of musicology. Heritage, climate, digital transformation, open science, inclusion, immersive mediation, well-being, and cultural diversity are not additions to the field. They are areas where musicology already has relevant experience.

Heritage is the clearest entry point. Musicology works with manuscripts, instruments, sound archives, places, repertoires, and living practices. It is therefore directly concerned with conservation, documentation, access, transmission, and reuse.

Climate and environmental change also concern musicology. They affect places, communities, ritual practices, oral traditions, soundscapes, and forms of transmission. Musicology can document these vulnerabilities, while also showing how musical practices support memory, social cohesion, and cultural resilience.

Geopolitical crises also affect musical heritage, intangible and otherwise. Like climate and environmental change, manmade crises threaten various aspects or areas of musicological interest, and connect with more interlinked problems between musicology and other fields.

Digital transformation and open science are already part of the field's working conditions. Catalogues, databases, digital editions, sound archives, music encoding, metadata, interoperability, and open repositories now shape how musicological knowledge circulates. The task is not to make musicology digital, but to organise its existing practices and digital resources within shared European environments.

Musicology can also contribute to **inclusion, well-being, and cultural diversity**. Musical practices involve communities, languages, minority traditions, migration histories, amateur participation, collective learning, and shared forms of experience. Musical practices make culture visible as participation, recognition, and social connection.

Immersive mediation is another important area. Virtual worlds can make instruments, places, performances, archives, and soundscapes accessible in new ways. But their value depends on sound, gesture, historical context, uncertainty, and interpretation. Musicology can help ensure that immersive environments are not only impressive but also accurate, meaningful, and ethically responsible.

Musicology therefore stands at the crossroads of several European priorities. Its strategic task is not to adopt agendas imposed from outside, but to make its existing expertise legible in the language of European partnerships.

PART I – RESILIENT CULTURAL HERITAGE

1. The RCH Partnership: Priorities and Principles

1.1. Genesis, Governance, and Institutional Context

The [European Partnership for Resilient Cultural Heritage](#) (RCH) operates as a co-funded Partnership under Horizon Europe, Cluster 2, Destination 2 – Culture, Creativity and Inclusive Society (for the definition of co-funded partnerships, see Introduction section 3). It is the first Partnership to be established in this cluster, and its emergence must be understood against the background of two converging processes: the long-term development of research programming in cultural heritage at the European level, and the growing urgency of climate-related threats to heritage environments, communities, and practices.

The institutional foundation of the RCH Partnership lies in the [Joint Programming Initiative on Cultural Heritage and Global Change](#) (JPI CH), created in 2010 to support excellent transnational research and innovation in cultural heritage. The JPI CH progressively built a shared research agenda, a network of national funding agencies, and a series of joint calls and capacity-building activities. Its 2020 SRIA provided a consolidated strategic framework that the ARCHE project has since developed and updated. The 2022 joint white paper [Cultural Heritage and Climate Change: New challenges and perspectives for research](#), produced together with JPI Climate and building on the Belmont Forum, marked a pivotal moment as it explicitly frames cultural heritage as a resource for climate mitigation and societal adaptation, not merely as a target of conservation.

This conceptual evolution shaped the pathway to the RCH Partnership. Within the JPI CH, a Climate Task Force—drawing on expertise from the Netherlands, United Kingdom, Belgium, Norway, France, Greece, Austria, and Germany—coordinated the preparation of the new SRIA and, in 2023, organised a first Pilot Call on Climate and Cultural Heritage, jointly with JPI Climate and the Belmont Forum. The call involved fifteen countries across Europe, North America, Asia, and the Pacific, and funded four transnational projects exploring intangible heritage, coastal adaptation, Arctic material culture, and urban governance. This pilot call demonstrated both the demand for transnational research in this area and the feasibility of co-funding mechanisms across agencies with different national rules.

As validated, the Partnership brings together twenty-four EU Member States—Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, and Sweden—alongside six Countries Associated to Horizon Europe: Egypt, Moldova, Norway, the United Kingdom, Iceland, and Türkiye.

The RCH Partnership identifies two core research challenges that cut across all its activities. The first concerns the underdeveloped state of research and evidence on the impacts of climate and environmental change on cultural heritage, including the inadequacy of existing adaptation strategies. The second concerns the need for enhanced understanding, use, and recognition of how cultural heritage can inform policies and guide implementation measures towards a more resilient society, in particular through the mobilisation of traditional, local, and indigenous knowledge. Both challenges require transdisciplinary research, evidence-based approaches, and sustained engagement between research communities, heritage professionals, policy makers, and civil society.

1.2. The ARCHE SRIA as Foundation

The [Strategic Research and Innovation Agenda](#) (SRIA) of the Alliance for Research on Cultural Heritage in Europe (ARCHE) is the foundational document on which the RCH Partnership's research and governance activities are built. The ARCHE SRIA endorses a holistic definition of cultural heritage, drawing on the Council of the European Union's 2014 Council Conclusions on [cultural heritage as a strategic resource for a sustainable Europe](#): cultural heritage consists of the resources inherited from the past in all forms and aspects—tangible, intangible, and digital (born digital and digitised), including monuments, sites, landscapes, skills, practices, knowledge, and expressions of human creativity, as well as collections conserved and managed by public and private bodies such as museums, libraries, and archives. This definition is important for musicology because it places musical instruments, manuscripts, sound archives, oral traditions, performance practices, and living repertoires unambiguously within the scope of cultural heritage in its fullest sense.

The ARCHE SRIA is not only a research agenda but also an institutional positioning document. It aligns with a set of international frameworks—the [Paris Agreement](#) (2015), the [Sendai Framework for Disaster Risk Reduction](#) (2015), the [Kunming-Montreal Global Biodiversity Framework](#) (2022), the

[UN Pact for the Future](#) (2024)—and with European frameworks such as the [Horizon Europe Strategic Plan 2025–2027](#) and EU cultural policies. It is also aligned with key conventions, including the [UNE-SCO Convention for the Safeguarding of the Intangible Cultural Heritage](#) (2003), the [Faro Convention](#) (Council of Europe, 2005), and the [World Heritage Convention](#) (UNESCO, 1972). For researchers positioning musicological work within the RCH Partnership, familiarity with this normative landscape is not optional: the vocabulary of these frameworks shapes the language in which project proposals, outcomes, and impacts will be evaluated.

1.3. Budget, Timeframe, and Implementation Logic

The RCH Partnership is expected to run for ten years, with activities starting in 2026. Its overall budget is €205 million, of which 70% derives from the participating countries—through their national funding agencies—and 30% from Horizon Europe, Cluster 2. Thus, the RCH Partnership operates not as a single centralised funding body but as a distributed co-investment framework in which national agencies retain authority over the funding of their own teams. For example, for French researchers, the national funding agency is the ANR ([Agence Nationale de la Recherche](#)), which applies its own eligibility rules to the French teams participating in joint calls. Similar arrangements apply in each participating country; it is advisable to check the information provided by the national research funding agency of your own country.

The main funding instrument of the Partnership is the Joint Transnational Call (JTC). Seven calls are planned, one per year from 2026 onwards, each with a budget of approximately €25 million (for more information on the calls, see I.4. below). Each call funds transnational consortia composed of at least three research teams from three different participating countries, with project durations of 24 to 36 months. Calls follow a two-stage procedure: a short pre-proposal submitted via a centralised platform, followed by a full proposal evaluated by an independent peer-review panel. A right of reply (rebuttal) is introduced before the final assessment of Stage 2, allowing applicants to respond to questions on feasibility. Applicants have access to anonymised expert reports.

The Partnership combines focused research funding with a broader ecosystem of activities designed to ensure long-term impact. Additional work packages support: a Knowledge Hub and consultative network; Living Labs for knowledge transfer to policy and society; regional, national, and transna-

tional mapping of research communities and heritage resources; monitoring and impact assessment; training and capacity-building programmes; strategic foresight and SRIA updates; alignment with research infrastructures; and international cooperation extending the Partnership’s network globally. Together, these instruments ensure that the Joint Transnational Calls are embedded in a broader process of community-building, agenda-setting, and evidence-to-policy translation.

2. The ARCHE SRIA Principles, Themes, and Priorities

The priorities of the Resilience programme derive from the [ARCHE SRIA](#). This section will therefore discuss the priorities of the ARCHE SRIA in order to show the ways in which musicology can insert itself into the dynamic of Resilient Cultural Heritage.

The ARCHE SRIA organises its research agenda around three Priority Areas and three Cross-Cutting Themes, underpinned by seven Research and Innovation Principles. Understanding their structure and content is essential for identifying where musicological expertise can be positioned most effectively.

2.1. Research and Innovation Principles

Seven **Research and Innovation Principles**, aligned with the European Code of Conduct for Research Integrity, define the ethical and methodological conditions under which the SRIA is to be implemented. They are not aspirational statements but operational criteria that will shape how proposals should be written, and ultimately evaluated and funded.

Diversity, Equity and Inclusion. Inclusive participatory models—co-creation and co-development—should be integrated into research design. Ethnic and geographical diversity, intergenerational equity, and a comprehensive gender lens are required. For musicology, this means ensuring that research on musical heritage does not reproduce the historic marginalisation of non-elite, minority, or indigenous traditions, and that communities are engaged as co-producers of knowledge rather than merely as objects of study.

Capacity Building and Learning Opportunities. Research activities should support the development of a new generation of cultural heritage researchers and practitioners. Early career researchers should have access to structured development opportunities, and intergenerational and cross-disciplinary

collaboration should be actively fostered. For musicology, this translates into mentoring schemes, joint training activities, and shared methodological development across conservatoires, universities, archives, and museum contexts.

Digital Pathways. Digital technologies, including human-centred AI, should be integrated into the study, documentation, diagnosis, conservation, and transmission of cultural heritage. A critical digital studies approach must ensure that these tools are accessible, sustainable, ethical, and environmentally responsible. For musicology, this means building on existing infrastructure—Music Encoding Initiative (MEI), linked open data (LOD) frameworks, music encoding standards, digital sound archives, etc—while assessing critically what can and cannot be captured digitally.

Minimised Environmental Footprint of Research Activities. Research activities should minimise their environmental impact through energy efficiency, digital sufficiency, and reduced mobility-related emissions. This aligns with the EU's carbon neutrality target by 2050. For musicology, this involves reflective assessment of fieldwork, archive visits, conferences, and digital resource usage, and the development of sustainable approaches to research dissemination.

Collaborative Research Across Disciplines and Sectors. Research should be inter- and transdisciplinary, crossing boundaries between heritage science, climate science, humanities, social sciences, and the arts, and should involve collaboration with public institutions, NGOs, industry, and civil society. For musicology, this is a natural working mode—the field already engages with Digital Humanities, conservation science, acoustic engineering, ethnography, performance practice, and archival studies.

Open Science and Open Innovation. The FAIR principles—Findable, Accessible, Interoperable, Reusable—must guide data management. Cooperation with [EOSC](#), the [Cultural Heritage Cloud \(ECCCH\)](#), and [E-RIHS DIGILAB](#) is strongly encouraged. For musicology, this means ensuring that datasets, encoded scores, sound recordings, metadata, and analytical results are deposited in interoperable, open-access repositories, and that publication practices align with open access requirements.

Complementarity and Additionality with Existing Initiatives. Researchers should build on existing networks, platforms, and infrastructures rather than duplicating them, and should identify clearly what new developments are needed to address current gaps. For musicology, this means articulat-

ing explicitly how projects build on the established reference tools and research infrastructures (like RISM, RILM, RIPM, RIdIm, [MIMO](#), the [Cantus Database](#), DARIAH, CLARIN, E-RIHS), and on previous [Horizon Europe-funded projects](#) (try a sample search on “music”).

2.2. Cross-cutting Themes

The three **Cross-Cutting Themes** for Enhancing Cultural Heritage Research Impact of the ARCHE SRIA are not independent work areas but transversal frameworks that are expected to shape the design, conduct, and communication of research across all three Priority Areas (see ARCHE SRIA, 2025, pp. 28–29). Their function is to ensure that funded projects are scientifically rigorous, socially relevant, technologically engaged, and policy-oriented.

Communication, Education and Public Engagement (CEPE) requires that researchers communicate their findings effectively to diverse audiences—not only academic peers but also heritage professionals, policy makers, educators, and the general public. For musicology, this implies reflecting on how musical heritage can be made accessible, how communities can be involved in research processes, and how the knowledge produced can feed back into cultural practices, formal education, and public debate.

Science, Technology and Innovation (STI) calls for the integration of research with technological development, emphasising equitable participation in innovation processes, sustainable digital practices, and shared research infrastructure. For musicology, this implies engaging with digital documentation tools, music encoding standards, interoperable metadata, knowledge graphs, and audio-visual technologies—not as external technical requirements but as research instruments that belong fully within the field.

The **Science, Policy and Society Interface** (SPSI) demands that research contributes to evidence-based policy and maintains a sustained dialogue between the research community and decision-makers at European, national, and local levels. For musicology, this implies translating research outcomes into policy-relevant language: contributing to heritage risk assessments, informing conservation strategies, supporting regulatory frameworks on intangible cultural heritage ([UNESCO Convention for the Safeguarding of the Intangible Cultural Heritage](#) 2003, Arts. 11–15), and providing evidence for cultural policy.

2.3. Three Priority Areas

The three priority areas identified in the ARCHE SRIA will structure the future calls of RCH. Here we will briefly introduce them; in the next section, we will discuss in more detail how musicology could contribute to these priorities.

Priority Area A – Cultural Heritage and Environment: Strengthening Resilience through Risk Assessment and Management, Climate Mitigation and Adaptation

Priority Area A focuses on the relationship between cultural heritage and the physical environment, particularly in the context of climate change, pollution, biodiversity loss, and the [Triple Planetary Crisis](#). Its five Core Themes address:

- The integration of data and knowledge for impact assessment, risk prevention, and risk management (A.1);
- The role of cultural heritage in climate change adaptation and mitigation strategies (A.2);
- Innovative and green solutions for managing and safeguarding heritage resources in a climate-positive way (A.3);
- The rediscovery of human-environment interactions embedded in past and present cultural practices (A.4);
- The ways in which climate change is reflected in different dimensions of cultural heritage, whether as a threat, a source of evidence, or a framework for adaptive knowledge (A.5).

For musicology, each of these themes offers a distinct entry point: from the acoustic documentation of changing environments and soundscapes (A.4, A.5) to the environmental assessment of instrument materials and performance practices (A.3) and the use of musical archives as climate proxies (A.1, A.5).

Priority Area B – Cultural Heritage and Society: Enhancing the Resilience of Society

Priority Area B addresses cultural heritage as a resource for social cohesion, community resilience, and the mitigation of social vulnerability in times of crisis. Its five Core Themes address:

- The loss and damage of cultural heritage caused by climate and geopolitical events (B.1);
- The relationship between heritage, geopolitical crises, conflicts, and climate change (B.2);
- Traditional, local, and Indigenous knowledge and practices as resources for resilience (B.3);
- The role of cultural heritage in fostering well-being and quality of life (B.4);

- Cultural heritage as a framework for critical thinking (B.5).

These themes connect directly to musicology’s longstanding engagement with communities, living practices, oral traditions, and the social meanings of musical heritage. They make explicit the argument that heritage is not merely an object of preservation but an active agent in the construction of resilience, belonging, and collective memory.

Priority Area C – Cultural Heritage and Governance: Seizing Opportunities towards Sustainable Development

Priority Area C turns to the institutional and policy dimensions of heritage research, addressing governance frameworks, economic models, sustainability of the heritage sector, and questions of justice. Its five Core Themes address:

- Cultural heritage and sustainability governance frameworks (C.1);
- Making the governance of the cultural heritage sector sustainable and climate-neutral (C.2);
- The connection between climate change and cultural heritage use (C.3);
- The economics of cultural heritage for climate action (C.4);
- The relations between climate justice and the right to cultural heritage (C.5).

For musicology, Priority Area C is less immediately legible than A or B, but it is nevertheless important. Governance questions arise in relation to the sustainability of archives, digital repositories, and collection management; in relation to the equitable distribution of knowledge and access; and in relation to the rights of communities—including minority, Indigenous, and migrant communities—to their own musical heritage.

3. Musicological Responses to the Priority Area Themes, in Detail

We see many possible ways in which musicology can and does respond to the priority areas of RCH. Our field is rich and diverse, with a breadth of methodological and theoretical expertise. In this section, we will proceed through eight of the core themes in priority areas A and B in detail, offering suggestions on how musicology can be located within this partnership. Please note that we have not

explicated every theme: we invite our readers to use their own expertise and imaginations to connect their own work to the themes.

3.1. Core Theme A.3: Innovative and Green Solutions

ARCHE SRIA theme A.3 seeks to realise opportunities for applying circular, innovative and green solutions in cultural heritage preservation, use, conservation, and management. The theme aims to develop more sustainable conservation methods and materials and to promote the eco-friendly materials and practices.

As has been shown by a growing number of scholars, notably within the area of ecomusicology, musical practices have a remarkable environmental impact. The environmental impact of music extends to:

- Materials: Sourcing, producing, distributing and discarding musical materials such as musical instruments, recordings, etc.
- Live performances: travel of audiences and performers, movement of equipment and set-up of public events, including festivals and large-scale performances.
- Digital streaming and repositories: the use of data centres, which are water and energy heavy, but also digital interfaces specifically geared towards music making, storage and consumption, including the use of chemicals, rare elements, batteries, etc.

This awareness can extend to musicological work responding to this theme. For example:

- Reinterpreting traditional materials for musical instrument making: an overview of endangered and environmentally heavy materials used for musical instrument making, an identification of their core characteristics from a mechanical, acoustical, cultural perspective and an exploration of alternative materials, considering the perspective of makers, performers, audiences and musical communities.
- Assessing the environmental impact of current music formats on different platforms (is Spotify more energy intensive than YouTube, and eventually why), also in view of the impact of earlier formats, including long-time survival, towards developing best practice approaches in collaboration with the industry, archives and musicians. Are we using the best, environmentally sustainable formats for music practice, and what does a more sustainable future for music look like?
- Developing best practices for the circulation of live performance, including individuating and assessing the impact of festivals, the touring of ensembles, teaching and training. A few musical groups already analyse their practices towards the development of more sustainable approaches, but the sector might benefit

from a comprehensive life-cycle analysis that goes beyond simply planning and executing these events, but towards developing a code of practice which develops and extends current music industry initiatives.

- Developing green solutions for musical heritage preservation: Active strategies to reduce the impact of heat, humidity, UV light, etc. to preserve material heritage in museums and archives, including fragile musical instruments and manuscript materials, were developed decades ago, under different conditions. They are now proving to be more and more energy intensive and financially burdensome, necessitating new solutions from experts familiar with the needs of the materials.

3.2. Core Theme A.4: Rediscovering Human-Environment Interactions

This theme seeks to understand how people have historically interacted with their environments, in order to develop solutions for protecting heritage from climate change. Key to A.4 is to recognise the interconnectedness between human culture and the environment, with special attention paid to the involvement of local and Indigenous communities in a co-creative manner that respects cultural and environmental rights, as well as to human and non-human relationships.

Relevant examples of musicological work responding to this theme include:

- Soundscape studies enable the mapping and reconstruction of interactions between human, animal and plant ecosystems. By documenting changes in acoustic environments over time, musicology and sound heritage contribute to understanding environmental transformations and the resilience of both cultural and natural systems. Listening-based methodologies, combined with historical documentation, offer innovative ways of monitoring biodiversity—for example, by comparing historical and contemporary sound recordings to detect the disappearance or return of species. They also reveal long-standing relationships between human societies and natural resources, such as the selection and use of wood, reeds, skins and other organic materials for the construction of musical instruments.
- Musical practices that rely on human and non-human interaction, such as traditional practices that combine nature sounds in dialogue with human music making, are affected by the disappearance or shift of areas and behavioural patterns determined by climate change.
- Studies of the effects of musical heritage on non-human animals. There is a growing body of literature on the uses of music in agronomy and animal husbandry, where selected musical repertoires have been shown to enhance animal welfare, behaviour and productivity. Such studies might demonstrate the enduring relevance of musical heritage far beyond its original contexts. However, it is noted that studies would benefit from musicological expertise; perhaps this theme could stimulate new collaborations.

3.3. Core Theme A.5: Climate Change Through the Lens of Cultural Heritage

Core theme A.5 recognises that cultural heritage preserves evidence of past climate change and that climate change is a determining factor in both the loss of heritage and the creation of new heritage.

Musicological perspectives and research that connect include:

- The loss, change, or scarcity of natural materials used for instrument building. Today, deforestation, invasive species, and climate change are materially altering the characteristics and availability of natural materials around the world. Climate has strong effects on the materials of instruments, which in turn fundamentally affect the sounds that can be produced. For example, the sonic characteristics of Alpine spruce depend on the temperature of the area of growth over a period of several hundred years. Studies have already demonstrated how the specific characteristics of tonewood have been affected by climate crises in the past.
- Musical references in archival materials as documents of environmental change: Although they were not created for climate research, records such as account books, parish registers, festival documents, travelogues, and performance schedules frequently contain indirect evidence of environmental conditions and their social consequences. Changes in the timing of celebrations, interruptions of religious processions, cancelled performances, or shifts in seasonal practices reflect the impact of extreme weather, droughts, floods, epidemics, or other natural disruptions. Parish records document exceptional circumstances affecting feast days, while account books can reveal unusual expenditures linked to environmental stress. Travelogues often describe weather conditions, harvests, and local festivities, offering valuable contextual evidence. When combined with historical climatology, environmental history, archaeology, and other documentary sources, these accounts can provide insight into how communities experienced, interpreted, and adapted to environmental change through cultural practices.
- Musical practices related to specific endangered places, practices, and contexts or natural events. The disappearance of traditional hunting and harvesting practices erases the music and culture related to them for centuries. The same applies to the disappearance of forests, seashores, and reefs that are the background of site-specific, communal musical practices. An assessment of the impact of global warming on practices in the Mediterranean, for example, might lead to the discovery of changing patterns in outdoor music making. The same applies to outdoor performance venues where extreme weather conditions—from heatwaves to torrential storms—jeopardise the viability of traditional venues such as amphitheatres, open-air performance sites and coastal gathering spaces.

3.4. Core Theme B.1: Addressing the Loss and Damage of Cultural Heritage

This theme recognises the accelerating loss of cultural heritage due to the many crises the world currently faces, from violent conflict to the profound effects of climate change. Loss is inevitable; thus, this topic seeks to discover ways to manage and accept loss, determine what to save, and provide strategies for adaptation and societal resilience. The exploration of digital tools for documentation and preservation is an important theme.

- Research on lost and damaged musical heritage provides a valuable example of heritage resilience. The restoration of musical instruments, manuscripts, and performance spaces generates new research methodologies and datasets through advanced technologies and digital tools. These processes also recover traditional crafts and know-how that might otherwise disappear. By reconstructing historical techniques, materials, and repair practices, musical heritage research can help revive sustainable approaches based on durability, reuse and recycling, offering environmentally responsible alternatives to many contemporary production models. A prime example of this is [Guédelon Castle](#), which aims to reconstruct a 13th-century castle using period construction techniques, costumes, and materials including locally sourced materials such as wood and stone (all obtained locally).
- The creation of digital twins has emerged as a vital strategy for safeguarding cultural heritage. By producing accurate digital replicas of monuments, objects, and historic spaces, these tools preserve essential information that can guide restoration or even complete reconstruction following disasters, armed conflicts or other catastrophic events. The destruction of the National Museum of Brazil (Museu Nacional) by fire in 2018 in Rio de Janeiro and the loss of the vast majority of its 20 million artefacts serves as a stark reminder of the devastating consequences when such proactive preservation is neglected. The value of a digital twin became evident in the aftermath of the destruction of Notre-Dame Cathedral (Paris) in 2019. Millimeter precision reconstruction of this musical heritage space was only possible due to detailed laser scans, Building Information Modelling (BIM), and data from the entertainment industry.
- Digital modelling offers further opportunities for preserving documenting musical heritage. Three-dimensional models of instruments, virtual reconstructions of historical performance spaces, digital twins of museum objects, and computational representations of performance practices allow researchers to preserve information that extends beyond musical notation alone. As an example we can mention the project [REM@KE](#) (Synergy ERC grant), which develops new methods for reconstructing the sound, function, and embodied knowledge of historical musical instruments. Such models can document construction techniques, acoustic properties, spatial relationships, and environmental conditions, thus complementing traditional editorial methods while creating new possibilities for research, conservation, education, and public

engagement. Rather than replacing critical editions, digital models enrich them by situating musical works within their broader material, technological, and cultural contexts.

- Musicologists can draw on decades of experience to devise new strategies of documenting musical traditions in sufficient detail to make future understanding and transmission possible, without turning living traditions into static museum objects or prescribing “authentic” versions that marginalise actual practitioners. In Italy, a major contribution in this regard has been made by the Istituto Centrale per i Beni Sonori ed Audiovisivi (Roma) which holds and digitises vast collections of folk, traditional and oral music recorded in the 20th century, developing standards and protocols for audio preservation. Working with musical communities, new strategies can be devised for adaptation and social resilience.

3.5. Core Theme B.2: Cultural Heritage, Geopolitical Crises, Conflicts, and Climate Change

B.2 concerns how the threats of the contemporary world have affected the politicised use of cultural heritage for both divisive and harmonious purposes. Cultural heritage can be both a target and a weapon; it can also promote trust and well-being. The theme aims to champion cultural heritage as a catalyst for resilience and positive change in times of crisis, examine the links between heritage, crisis, and climate change, and design practical solutions for reclaiming damaged and pilfered heritage objects.

Musicologists might think about the following:

- Music has long been promoted as a resource for individual and collective resilience and as a force (or even “universal language”) that can bring people together. During crises, disasters, and armed conflicts, it supports psychological well-being by reducing stress, facilitating emotional regulation, and aiding in trauma recovery. Furthermore, music strengthens social cohesion and cultural identity, fostering solidarity and promoting dialogue across divided communities. As a powerful vehicle for peacebuilding and post-conflict reconstruction, musical heritage remains deeply connected to health and disaster relief. Musicologists have a major contribution to make in this area by providing critical and evidence-based perspectives.
- Reparative cataloguing and sharing of knowledge and sources have long been hallmarks of musicology. Musicologists and their allies (notably GLAM professionals) have played major roles in preserving, documenting, and restoring musical heritage disrupted or damaged by conflict. A prime example of this is the recent volunteer-based project [Saving Ukrainian Cultural Heritage Online](#) (SUCHO). Closer to the home of musicology, RISM and partner institutions launched a vital [initiative](#) to document and preserve Ukrainian musical heritage. It should be noted that Ukraine had itself served as a model in restitution practices, when in 2001 the country returned the [Berlin Singakademie](#) collection.

- Music has sustained communities during epidemics through chants, litanies, and devotional repertoires; it helped migrants maintain cultural identities (as seen in Italian communities across the Polish-Lithuanian Commonwealth in the 17th- and 18th-century, or displaced French Huguenot communities in the same period); it strengthened social bonds during and after wars, often through religious confraternities and collective rituals; and it provided a language for expressing shared experiences and collective memory. These historical examples provide resources for understanding the roles that music has and can play in community formation and cohesion.

3.6. Core Theme B.3: Traditional Knowledge and Practices as Resources for the Resilience of Societies

This theme focuses specifically on intangible heritage, including traditional knowledge, practices, and expressions. As such, it offers many opportunities to musicologists. The area recognises that intangible heritage is too absent from policies intended to build resilience in times of crisis and calls for urgent action to halt the loss of intangible heritage. The theme aims to explore and support minority and endangered languages, further the use of traditional knowledge and practices as resources to strengthen societal resilience and foster the active participation of local and Indigenous communities in the co-creation of resilient strategies.

- Traditional musical practices contribute to societal resilience by adapting to change while preserving their social function. Rather than remaining static, they reinterpret meanings and practices to address new cultural and social needs.
- Musicologists have much experience in connecting communities with their local musical heritage. In Poland, for example, this work has been significantly supported by institutions such as the National Institute of Music and Dance (NIMiT), which has contributed to the documentation, digitisation, and dissemination of traditional and oral music repertoires. Within the broader European context, Polish initiatives highlight the importance of combining archival preservation with active engagement in living traditions.

3.7. Core Theme B.4: The Role of Cultural Heritage in Fostering Well-Being and Quality of Life

This theme urges the active harnessing of cultural heritage to foster positive response to climate threats and seeks to develop a clear, systematic understanding of how heritage can be mobilised to enhance well-being and quality of life. It asks for evidence on how heritage contributes to well-being and seeks to insert heritage into indices and frameworks concerning quality of life. The theme also aims to create platforms and spaces to address diverse discourses and policies on well-being and

quality of life through the lens of cultural heritage. To respond to this theme, musicologists can build on a large body of research on music and well-being, as well as on cross-sectoral work on [culture and health](#). Particularly interesting here is the groundwork on this topic laid by [Culture Action Europe](#), which has gained attention from European policymakers.

Specific examples related to musicology might include:

- Historical repertoires, traditional songs, dances, and collective musical practices create opportunities for participation, intergenerational exchange, and a sense of belonging. Engaging with musical heritage—whether through attendance or practice—has been shown to reduce stress, enhance emotional well-being, and reinforce social cohesion. Musical traditions also support identity formation by connecting individuals and communities with their cultural memory and local environment; participatory musical practices promote inclusion across generations and social groups, helping to counter isolation and strengthen community networks.
- The conservation and revitalisation of historical instruments, archives, and musical traditions enrich cultural life while encouraging active engagement with heritage rather than passive consumption. In educational and healthcare contexts, musical heritage can support cognitive stimulation, emotional expression, and lifelong learning. At the societal level, access to musical heritage contributes to cultural vitality, sustainable cultural tourism, and creative economies, ultimately enhancing both individual well-being and collective quality of life.

3.8. Core Theme B.5: Cultural Heritage and Critical Thinking

This theme sees heritage as a strategic resource for critical thinking, providing a space for dialogue and mutual understanding. The aim is to use cultural heritage to raise awareness of the climate crisis and other challenges through research dissemination, to facilitate forums for discussing crises, to examine how narratives around heritage can be manipulated to spread misinformation or disinformation. The theme also seeks to investigate the links between climate activism and cultural heritage and to promote cultural diplomacy in policies, especially those concerning climate change.

Musicologists might pay attention to perspectives like these:

- Musicology offers interdisciplinary methodologies that can contribute to the development of critical thinking in relation to cultural heritage, by combining insights from cognitive sciences, psychology, neuroscience, education and the digital humanities. Musical analysis, score reading and attentive listening train observation, pattern recognition, memory, interpretation and the ability to distinguish between objective evidence and subjective perception. Listening-based approaches encourage individuals to evaluate com-

plex auditory information, recognise multiple perspectives and develop informed judgement rather than passive consumption.

- The lens of musicology on musical heritage also provides an effective framework for fostering emotional awareness, empathy and reflective thinking, all of which are essential components of critical reasoning. In educational contexts, integrating musicological methods into formal and informal learning can strengthen analytical skills, creativity and collaborative problem-solving from an early age. These competencies are increasingly valuable in contemporary societies, where the ability to critically assess information, interpret cultural diversity and engage thoughtfully with complex environments are rare and barely practiced, even if fundamental for the future society.

4. RCH: Call Structure and Integration of Priority Areas

Having explicated a number of the core themes, we will now turn to the topic of how the themes might be brought together within the context of the projected RCH calls. The RCH partnership will issue a total of seven annual calls, with the first call published in 2026. Each will highlight varying themes and priorities. The priority areas described in the ARCHE SRIA will be distributed across calls, meaning that proposals must respond to multiple priority areas and themes. Proposed projects bringing together at least three different teams from three different countries should therefore ideally link themes in a defined topic that fits the broader question posed in the call.

The calls expected within RCH found in the table below are based on the roadmap published in the ARCHE SRIA (pages 56–62). Though this roadmap is subject to change, the expectation is that the overarching themes will at least be similar, if not identical. For the first call (“Laying the foundations: risk and impact assessment and management”), the projected priority areas have already been solidified.

Calls Roadmap	Projected Priority Areas
Laying the foundations: risk and impact assessment and management (2026)	A.1, C.2, B.1, B.3
Adapting to climate and global changes	B.2, A.2, B.1
Generating innovative solutions for climate action from the cultural heritage sector	A.3, C.4, B.3, C.2, A.5

(Re)activating traditional, local and Indigenous knowledge and practices	B.3, A.5, A.4, C.5
Living in times of climate change: cultural heritage as a contributor to quality of life	A.5, C.3, B.4, C.5
Making cultural heritage a resource for a sustainable future	C.1, B.5, A.2
Organised under one of these forms or a combination of them: Exploratory call; Early career researchers call; Impact accelerator call.	

Projected Calls within Resilient Cultural Heritage

Many of these priority areas, and their potential links with musicological research, were already discussed above.

We recognise that the eventual published calls might be quite different from the projections reported here. As an exercise, we will now consider how musicology might respond to calls involving multiple thematic areas grouped around a central research topic. What follows are a number of examples of hypothetical challenges in line with the goals of RCH; we outline the challenges] and offer possible musicological responses combining several themes from the Priority Areas. These examples should *not* be read as prescriptive, but rather as inspiration for recognising musicology’s potential. Musicology’s breadth—spanning historical, ethnomusicological, organological, and performance-practice research, and engaging with tangible, intangible, and digital heritage alike—translates into a set of concrete strengths with respect to the challenges faced by cultural heritage.

4.1. Generating and Revitalising Musical Practices

Musicology does not simply study musical practices in the past or present, it also contributes to shaping their futures. For example, musicology was foundational in launching the Early Music Revival and in revitalising endangered traditions of improvised polyphony in different regions of the Mediterranean.

Challenge: Climate change poses a threat of disruption to forms of intangible heritage connected to certain times of the year during which the weather is increasingly more extreme (e.g. summer religious and popular festivals). Such practices are changing and adapting to new realities, leaving open the possibility that they will eventually be lost.

Response: Musicologists are uniquely positioned to support communities in adapting intangible heritage to ensure its preservation, fostering understandings of tradition and intangible heritage as living processes that can adapt to climate change (A.2) and other geopolitical challenges (B.2) and enlisting a range of technologies in adaptation and preservation (B.4). Cultural heritage therefore becomes not merely a set of practices to be preserved uniformly but rather a catalyst for resilience and positive change (B.2), and a reality that is shaped by climate change (A.5).

4.2. Preserving Heritage and Informing the Preservation of Heritage

Musicologists regularly work with marginalised or even fragmentary sources (e.g. music manuscripts, historical sound recordings), and have been instrumental in launching preservation efforts through their close cooperation with owners or holding institutions. Musicologists are also accustomed to thinking laterally about heritage and the past, creatively and imaginatively making use of a range of sources beyond written notation or recordings. In short, we are creative about the various ways in which heritage might be preserved.

Challenge: Climate change and geopolitical crises are serious threats to the preservation of certain forms of cultural heritage, for example through population displacements or due to lack of resources for onsite heritage conservation and preservation. This extends beyond tangible musical heritage to intangible, as well.

Response: Musicologists are accustomed to collaborative work with institutions to identify priorities for preservation (B.1, C.3). Drawing on pre-established community relationships, musicologists can assist in developing sustainable, affordable and/or crowdsourced forms of heritage preservation involving the participation of the community (A.5, B.5).

4.3. Musical and Sonic Heritage in the Creation of Social Cohesion

Musicologists are keenly attuned to the complexity of musical heritage and how it can be used for ideologically-driven purposes. For example, a musicologist is aware that a single piece of music may have different resonances depending on the period and context; in other words, we understand that meaning is not set in stone. Thus, our broad perspective can assist in developing more inclusive understandings of heritage and its place within constructions of identity and cohesion.

Challenge: Tackling major issues, whether climate change or geopolitical crises, necessitates overcoming social division and fostering cohesion within communities.

Response: Musicologists understand how musical heritage can be used to speak to different social groups and how it can be used to create a sense of cohesion or resilience in the present (B.2, B.3). More broadly, it can help to mitigate against eco-anxiety (B.4), and show how particular musical cultures might reveal aspects of climate patterns (A.2, B.4). Musicologists can bring nuance to the topic of musical identity creation and cohesion, thereby increasing the ethical situatedness of music-based social projects and furthering the prospects of true dialogue (B.5).

4.4. Flexible Engagement with Heritage and Other Disciplines

Musicology's singular capacity to articulate tangible and intangible heritage makes it naturally flexible and adaptable in heritage research. Musicologists are well-practised at interrogating different kinds of heritage and at interacting with a wide range of academic disciplines—in the humanities as well as the natural and computing sciences—as well as with non-academic practitioners and institutions such as museums, performers, and programmers. For example, early music scholars have been particularly active in working with digital humanities and computing science to develop innovative formats for musical editions and the documentation of musical performance.

Challenge: Tackling the challenges posed to European heritage necessitates a coordinated, interdisciplinary approach.

Response: The experience that musicologists bring in working across disciplinary and institutional boundaries can provide a model for collaborations that explore physical and digital accessibility (C.3), enlist Indigenous knowledge (B.3) and/or make use of new technologies and artificial intelligence (B.1).

The project pathways outlined above draw directly on the competencies and expertise of musicology within the realms of cultural heritage in a time of crisis and change. We hope to have demonstrated how deeply musicology is intertwined with the various dimensions of Resilient Cultural Heritage. Now we will move on to a second promising partnership for musicology: Virtual Worlds.

PART II – VIRTUAL WORLDS

This part examines the relationship between musicology and Virtual Worlds. It focuses on the [Virtual Worlds Partnership](#) (VWP). This European collaboration of research, industry, and public actors aims to develop virtual world technologies and applications. Section 1 introduces the VWP, its governance, funding model and Strategic Research & Innovation Agenda (SRIA). Section 2 identifies what the [VWP SRIA](#) contains and where musicology fits within its existing categories. Section 3 explores what musicology can contribute to Virtual Worlds, and vice versa. Section 4 examines the technical, ethical, organisational and environmental conditions for doing that responsibly.

1. The VWP

1.1. Genesis and Governance

1.1.1. The origin

The institutional origin of the European Partnership for Virtual Worlds lies in the European Commission's broader strategy for Virtual Worlds and [Web 4.0](#), adopted in July 2023 ([European Commission, 2023](#)). That strategy — structured around the pillars of the [Digital Decade policy programme](#) — aimed to ensure that immersive technologies developed in alignment with EU values: privacy, transparency, and inclusivity embedded by design. The goal was to position Europe as a leader in the development and governance of Virtual Worlds, preventing reliance on external actors and fostering an open, interoperable, and ethically sound digital ecosystem. Two concrete research actions under the 2025 Work Programme preceded or accompanied the Partnership's launch: the [GenAI4EU](#) Innovation Action, supporting generative AI for personalised and inclusive virtual worlds, and a Research and Innovation Action on Core Technologies for Virtual Worlds ([Digital, Industry and Space](#), p. 256), advancing multimodal interaction through optics and photonics. These actions anchor the VWP within a larger network of co-programmed partnerships, including the [AI, Data and Robotics Partnership \(ADRA\)](#), the [Big Data Value Association \(BDVA\)](#), and the [Photonics Partnership](#).

1.1.2. Partnership model

The VWP operates as a co-programmed Partnership under [Horizon Europe, Cluster 4](#)—Digital, Industry and Space. As described in the Introduction (§3), co-programmed partnerships are based on a [Memo-randum of Understanding](#) between the European Commission and an organised stakeholder consortium, with matching contributions mobilised by partners on their own responsibility. In the VWP, this means a public-private governance structure driven by an agenda co-developed between the Commission and an industry-led consortium—the [Virtual Worlds Association](#) (VWA)—which differs significantly from [RCH](#)’s model of national funding agencies. The VWA represents the European private sector active in the fields of XR (extended reality), AI (artificial intelligence), IoT (Internet of Things), and Blockchain.

1.1.3. Governance and disciplinary participation

The governing body of the VWP is the Virtual Worlds Association (VWA), an industry consortium that brings together technology companies, content creators, academic research institutes, and public services. This composition differs significantly from the RCH Partnership’s model, where national research funding agencies from 30 countries hold primary governance responsibility. In the VWP, the driving actors are technology developers, platform providers, and innovation-oriented institutions. Humanities and social science researchers—including musicologists—are not natural first-movers in this environment. Understanding this difference is strategically important: musicology must approach the VWP as an expert contributor to a technology-driven agenda, making its scientific and cultural credentials legible to actors whose primary frame of reference is innovation, scalability, and technological readiness rather than disciplinary scholarship or heritage policy.

1.1.4. Strategic positioning and implications for musicology

The VWP’s institutional positioning also reflects its intended scale of impact. The global Virtual Worlds market was estimated at approximately €27 billion in 2022 and projected to exceed €800 billion by 2030. The European Commission has framed leadership in this sector as a strategic imperative for European competitiveness, digital autonomy, and societal well-being. The VWP is therefore not a cultural initiative with digital components, but a digital-economy and technology initiative that includes culture as one of its application sectors. For musicology, this means that the language of the Partner-

ship—and the criteria by which research contributions will be assessed—belongs primarily to the vocabulary of research and technology development, human-centred design, data governance, and innovation ecosystems, rather than to the vocabulary of heritage conservation, archival scholarship, or performance practice research. As established in the Introduction of this report, the central task is strategic translation: making musicological expertise legible and compelling within a technology-development context.

1.2. Budget and Timeframe

1.2.1. Funding model and call structure

The VWP operates under the co-programmed model, in which the European Commission contributes funding through [Horizon Europe](#) calls while the industry-led consortium mobilises matching investment. Unlike co-funded partnerships where a global budget is set and distributed across joint calls over a fixed period, [co-programmed partnerships](#) distribute their funding iteratively, through successive Horizon Europe work programmes. This means that the overall budget of the VWP is not defined as a single fixed envelope, but emerges progressively through the Commission's annual or biennial funding cycles. For researchers, the practical implication is that **VWP-aligned calls appear in the regular Horizon Europe calendar**—under Cluster 4 topics—rather than as Partnership-specific joint transnational calls with national co-funding.

For musicology, the absence of a fixed global budget and the iterative funding structure of co-programmed partnerships have important practical consequences. There is no central Partnership secretariat managing an exclusive pool of funds. Instead, musicological projects need to be positioned within the standard Horizon Europe call landscape, responding to topics that align with VWP research objectives. This requires continuous monitoring of the Horizon Europe Work Programme, strategic interpretation of topic descriptions, and the capacity to assemble technically credible consortia that include technology partners alongside musicological expertise. It also requires vigilance about which calls explicitly reference cultural heritage, [arts and culture](#), or immersive experiences in order to identify the most relevant entry points for the field.

1.2.2. Technological timeframe

The temporal horizon of the VWP follows the Horizon Europe programme period (2021–2027) and its anticipated continuation (2028–2034). The [SRIA](#)—first published in June 2025 and undergoing an update as of this writing—presents a three-horizon technology roadmap aligned with this framework (VWA, 2025, Introduction). Short-term developments are projected over three to five years and focus on [extended reality \(XR\) hardware](#), accessible authoring environments, AI-driven content creation, and adaptive governance frameworks. Mid-term developments, planned for five to seven years, address advanced XR hardware integration, human-centric AI interaction, multimodal frameworks, and explainable AI for immersive environments. Long-term developments, projected over seven to ten years, concern neuromorphic computing, bio-integrated sensors, brain-computer interfaces, context-aware AI, and circular economy models for immersive hardware (VWA, 2025, “A scientific roadmap for technological developments”). This technological timeline—rather than a call-by-call roadmap—is the temporal framework in which VWP-funded research is expected to unfold.

1.3. SRIA Structure

1.3.1. Overall organisation

The Virtual Worlds SRIA, published in June 2025, is a substantial document that defines the research and innovation agenda of the VWP across four main chapters.⁴ Its structure reflects the Partnership’s dual ambition: to develop the technological foundations of Virtual Worlds and to demonstrate their transformative impact across a wide range of societal and economic sectors. Understanding this structure is a prerequisite for musicologists seeking to engage with the VWP, because arts and culture—the domain most directly relevant to the field—is one component of a much larger and predominantly technology-oriented agenda. Reading the SRIA strategically means understanding not only what Chapter 1d (Arts and Culture) says, but how it connects to the technical, socio-economic, and governance challenges addressed in the rest of the document.

4 A major update is expected in 2026. Consult the [VWP SRIA](#) page for developments.

1.3.2 Chapter 1: Application sectors

Chapter 1 of the SRIA defines seven application sectors and their associated use cases: Industry and Logistics (1a), Healthcare and Well-being (1b), Media and Entertainment (1c), Arts and Culture (1d), Education and Training (1e), Security and Defence (1f), and Cities and Public Administration (1g). Each sector is presented as a domain in which Virtual Worlds are expected to generate significant value, and each identifies a series of specific use cases that drive the associated technology development priorities. The placement of Arts and Culture as sector 1d—rather than as an appendix or illustrative example—signals that culture is treated as a full application domain within the VWP agenda. This framing is significant for musicology: it means that musical and cultural objects, practices, and institutions are not peripheral to the Partnership’s concerns but belong to a recognised sector with its own use cases, stakeholders, and innovation challenges.

1.3.3. Chapter 2: Technical challenges

Chapter 2 maps the technical challenges that cut across all seven sectors: visualisation, sensing, devices, and immersion (2a); [real-time user interaction](#) (2b); authoring and experience design (2c); standardisation and interoperability (2d); [Digital Twins](#), assets, and people (2e); and Applied Artificial Intelligence for Virtual Worlds (2f). These chapters define the underlying research problems that funded projects are expected to address. For musicology, this is the layer of the SRIA that is most technically demanding and most distant from conventional disciplinary training. It is also, however, the layer that determines whether VWP-funded research will be able to engage with music and sound in meaningful ways. Acoustic simulation, the modelling of embodied gesture and performance, the documentation of oral traditions, and the reconstruction of historical spaces all depend on technical frameworks developed in Chapter 2. Musicologists need to understand this layer in order to identify which technical challenges their expertise can help define, constrain, and evaluate.

1.3.4. Chapter 3: Socio-economic and governance challenges

Chapter 3 addresses the socio-economic outlook and challenges of Virtual Worlds: human rights, safety, participation, and societal values (3a); governance and law enforcement (3b); economics and innovation (3c); sustainability, health, and environment (3d); and trust and human oversight (3e). These themes are directly relevant to musicological participation in the VWP. Questions of community

rights over heritage representations, ethical constraints on AI-generated cultural content, governance of digital cultural assets, and the sustainability of large-scale digital infrastructure all require humanistic expertise and critical perspectives. Musicology contributes not only to what cultural content appears in Virtual Worlds, but to how its production, ownership, access, and governance should be designed.

1.3.5. Chapter 4: European research and innovation context

Chapter 4 situates the SRIA within the broader European research and innovation context, noting synergies with other partnerships and infrastructures, including ADRA, BDVA, the [Digital Research Infrastructure for the Arts and Humanities \(DARIAH\)](#), and the [European Open Science Cloud \(EOSC\)](#). These connections matter for musicology because they identify the network of infrastructures and initiatives within which VWP-funded work should be embedded.

2. Arts, Culture, and Heritage in the VWP SRIA

2.1. Arts and Culture as an Application Domain

The VWP SRIA gives arts and culture a dedicated place within its application framework. “Arts and culture” is one of the seven main sectors through which the partnership defines the uses of virtual worlds (VWA, 2025, ch. 1 and §1d). The scope of this domain is broad. The SRIA connects virtual worlds to museums, performing arts, cultural events, new media art, cultural tourism, collection and site management, inclusive game design, intangible cultural heritage, accessibility, and participatory creation. Cultural objects and practices are therefore not approached simply as content to be digitised. They are presented as areas where virtual worlds can support documentation, mediation, access, preservation, creation, participation, and new forms of public engagement. The SRIA also frames cultural actors as contributors to cross-sectoral innovation, capable of co-developing transformative practices rather than merely communicating results produced elsewhere. This framing is directly relevant to musicology. Musical performances, instruments, sound archives, festivals, concert venues, museum collections, listening spaces, and intangible musical practices already belong to the arts-and-culture domain described by the SRIA. Musicology can therefore enter the VWP agenda through

existing categories rather than by claiming an external or exceptional position. Its objects, methods, and forms of expertise already intersect with several areas identified by the partnership.

For a musicologist reading the [VWP SRIA](#) for the first time, the most important strategic recognition is this: Arts and culture in **Chapter 1d** cannot be engaged in isolation from the technical, socio-economic, and governance challenges of the SRIA as a whole. The twelve arts-and-culture use cases—ranging from XR museum experiences (1d.1) and immersive performing arts (1d.2) to [intangible cultural heritage](#) documentation (1d.12) and AI-supported cultural curation—each generate specific requirements in Chapters 2 and 3. A project on acoustic reconstruction of a historical concert hall, for example, must engage with acoustic modelling and XR hardware (2a), Digital Twin standards and interoperability (2d), trust and authenticity in AI-generated content (3e), and the governance of historical representations as cultural assets (3b). The SRIA is an integrated document that expects contributors to understand how their application domain connects to the technical and governance challenges the VWP has identified as structurally necessary to address.

2.2. Musicologically Relevant Use Cases

The VWP SRIA identifies several arts-and-culture use cases (pp. 29-35) that translate directly into musicological work: XR museum experiences, immersive performing arts, digital archiving of cultural events, embodied artistic creation, virtual and augmented cultural tourism, collection and site management, intangible cultural heritage, co-creation, and accessibility. For musicology, these use cases are best understood through five functions: documenting musical objects and sites, reconstructing musical events, analysing embodied experience, mediating musical places, and working with living practices. In what follows, we will illustrate how musicologists might approach these functions.

2.2.1. Documenting musical objects and collections

A first set of use cases concerns **musical objects and collections**. Here, the main function is documentation, conservation, and interpretation. This includes instrument collections, sound archives, manuscripts, scores, recordings, iconographic sources, and other materials held by museums, libraries, archives, or research centres. A virtual environment can make these materials accessible, but access alone does not explain their musical meaning. Users need to understand how an instrument

was played, which repertoire it was connected to, what kind of sound it produced, how a source should be read, and which evidence supports the interpretation.

Musicologists can select relevant materials, establish provenance, explain uses, situate objects historically, and build clear interpretive pathways for visitors.

2.2.2. Reconstructing performances and cultural events

A second set concerns **performances and cultural events**. Here, the main function is to document or reconstruct events that are often ephemeral. This includes concerts, festivals, operas, rehearsals, installations, experimental performances, and other musical events that disappear once they have taken place. Virtual worlds can make these events accessible again through sound, images, spatial reconstruction, programmes, production documents, testimonies, and contextual information.

Musicologists can help decide what needs to be preserved for an event to remain intelligible: the performance space, staging, technical choices, audience position, institutional setting, and cultural meaning of the performance.

2.2.3. Analysing embodied creation and immersive artistic experience

A third set concerns embodied **creation and immersive artistic experience**. Here, the main function is not heritage preservation, but the analysis and design of new modes of musical experience. This concerns gesture, improvisation, listening, sound installation, performance, and the relation between body, sound, and interface. Musicologists can help frame precise questions: how a gesture produces or transforms sound, how a performer interacts with a device, how a listener moves through a sound environment, and how immersion changes the experience of performance.

2.2.4. Mediating musical places, routes, and public mediation

A fourth set concerns **musical places, routes, and public mediation**. Here, the main function is not collection documentation, but the interpretation of place for a public. Virtual visits and augmented on-site experiences can be used for opera houses, concert halls, churches, studios, festivals, urban sound routes, or places associated with specific musicians, repertoires, or communities.

Musicologists can build historically grounded narratives, select archival material, identify meaningful listening points, explain the acoustic or social role of a place, and show why that place matters musically. The aim is not only to display a site, but to make it musically legible.

2.2.5. Engaging living musical practices and community-based heritage

A final set concerns **living musical practices and community-based heritage**. Here, the main function is to document practices without treating them as fixed objects. This is especially important for ethnomusicology and for the study of oral traditions, ritual practices, performance gestures, learning processes, and community-based music-making. Virtual worlds can help document gestures, performance situations, and forms of transmission that text, audio, or video alone cannot fully capture.

Musicologists can help define how documentation should be carried out, who should be involved, what can be made accessible, and what should remain contextualised or restricted.

3. Why Virtual Worlds Matter to Musicology, and Vice Versa

The use cases show several areas where musicology and virtual worlds meet. Virtual worlds can support our studies of musical objects, spaces, performances and practices. They can reconstruct the acoustics of a lost theatre or provide access to a digital model of a fragile instrument ([Boren 2021](#); [Postma & Katz 2016](#)). They also allow researchers to simulate a musical work in the acoustic environment for which it was composed, test ideas about embodied performance using a digital twin of a historical instrument and study how spatial conditions shape listening in historically grounded settings. Musicology, in turn, can help make these environments more historically grounded, musically meaningful and socially relevant. Musicologists can help decide what should be documented or reconstructed and how. Our knowledge of sources, historical contexts, performance practices, acoustic environments, institutions and communities can guide the design and evaluation of Virtual World projects. This expertise is relevant to several use cases in the [Arts and Culture domain of the VWP SRIA](#) (e.g. immersive performing arts, intangible heritage preservation, virtual cultural tourism and AI-supported curation). Each raises important musicological questions. What should be preserved from a performance? How does the acoustic character of a space shape musical experience? What changes when a live performance is experienced through an avatar or headset? How should an AI system distinguish between different performance traditions?

For the Virtual Worlds Partnership, musicology and organology can therefore serve as design drivers rather than only as sources of cultural content. The SRIA aims to develop human-centred, value-driven, and interoperable European virtual worlds. Achieving this requires methods that can represent intan-

gible sonic heritage, embodied expertise and historically situated practices, rather than reducing cultural heritage to a visual display. Musicology provides such methods, from source criticism and organology to performance-practice research.

This section gives examples from three research areas: 1) historical sound-space reconstruction, 2) instruments and digital twins, and 3) embodied musical experience. It then examines the uncertainties and limits involved in virtual reconstruction and suggests some first musicological questions for future research.

3.1. Historical Sound-space Reconstruction

Historical sound-space reconstruction is one of the clearest points of connection between musicology and the VWP. Its purpose is not simply to reproduce visual models of heritage buildings but to recover acoustic conditions that shaped how music was composed, performed and heard. This makes it possible to test interpretations about compositional choices, performance practice, instrument balance or listening positions in their historical acoustic setting. A virtual environment can combine architectural data, historical sources, acoustic modelling and assumptions about materials and occupancy for comparative analysis. This transforms the virtual environment from a representation of the past into a tool for studying the historical conditions of musical experience.

Three types of spaces illustrate this research potential. First, destroyed theatres can only be reconstructed through historical documentation. Plans, engravings, period descriptions, and material analysis can be used to estimate their geometry and construction materials. Acoustic simulation can then generate impulse responses for the reconstructed space. These results can be checked against preserved buildings from the same period. Performers and researchers can use the reconstruction to experience a lost performance space and test interpretive choices that scores and critical editions alone cannot resolve.

Second, active or restored theatres and opera houses draw attention to the invisibility of sonic heritage during restoration works. Changes intended to improve safety, staging or visitor capacity may also change a building's acoustic properties. These consequences are not always assessed systematically. A preventive acoustic-monitoring protocol could reduce this risk. Such a protocol would include a documented acoustic baseline before restoration, an acoustic digital twin with different occupancy

configurations, and simulations of the likely effects of proposed changes. The digital twin would then serve not only as a conservation tool but also as a means of institutional accountability.

Third, churches and ceremonial buildings show why architecture cannot be studied from their historical uses. Sacred sonic heritage is produced through the interaction of architecture, congregation, and liturgical performance. The capacious stone architecture and long reverberation times of many worship sites shape musical performance and create a collective spatial experience, which changes from day to day depending on the number of people present, the climate, etc. Music written for these spaces was often adapted to these acoustic conditions. Computational modelling after the destruction of Notre-Dame de Paris, for example, showed the importance of including the presence of a congregation during sung services, for a densely occupied nave behaves very differently from an empty one. Models that reproduce the building without its occupants may therefore recreate an acoustic environment that did not historically exist, thus rendering the sounds experienced inside unintelligible.

These three examples share the principle of contextual acoustics: sound is not a property of a physical space alone but emerges from its material and social setting. Traditional musicology has often treated the musical work as an independent object, separate from the acoustic environment in which it was performed. Virtual worlds challenge this by turning acoustics into researchable variables shaped by occupancy, materiality, spatial geometry, and historical period. They can therefore support a more situated musicology that also considers the historical listener's perspective.

Sound-space reconstruction also has value beyond academic research. Immersive environments can allow non-specialist audiences to experience a reconstructed theatre, sacred building or concert hall. This turns heritage from a static historical object into a multi-sensory experience. In universities, students can explore how spatial acoustics affect performance, hear the role of architecture and place music in its built environment. A VWP-funded project could thus produce three related outputs: a research instrument, public heritage experience and educational environment. This would contribute to Horizon's ambitions for societal impact across the full research-to-citizen pipeline, to VWP SRIA use cases 1d.1, 1d.2, 1d.7, 1d.8, 1d.12, and 1d.13, *and* to the cross-domain Education and Training sector (1e).

3.2. Instruments and Digital Twins

Musical instruments form a second important connection between musicology and the VWP. Organology studies musical instruments in their material, acoustic, mechanical and cultural dimensions. This makes it particularly relevant to the SRIA's technical priorities. Instrument conservation involves a difficult balance ([Von Steiger, Allenbach & Skamletz 2023](#)). Instruments that are left unplayed can lose parts of their sound through material stabilisation and mechanical change. Playing them, however, can cause permanent damage. Digital twins and XR reconstruction may offer another way to study and experience these instruments. For this purpose, digital twins should be more than geometric and acoustic models. They should document the research process used to reconstruct relationships between an instrument, its builders, its performers and the musical cultures in which it was used. This distinction determines whether a digital twin is merely an impressive 3D model or a multi-faceted scientific research instrument.

Two current European projects illustrate this potential. [MusicSphere](#) (ECCCH, 2025–2029; coordinated by [CERTH](#), grant no. 101233618) develops digital twins of historic organs and early keyboard instruments. It combines advanced 3D modelling, acoustic measurement, mechanical behaviour simulation and XR interface design. The project is conducting a European documentation campaign of historic organs. It began with the 1911 Walcker organ in Ilmenau, where the first acoustic measurement sessions took place in March 2026. The resulting XR interface allows users to explore and play a digital twin. This gives performers, researchers and the public access to instruments that are too fragile or distant for direct use. Researchers can test ideas about historical tuning systems, pipe-scaling conventions, mechanical-action responses and the relationship between instrument design and compositional style. MusicSphere directly relates to VWP SRIA use cases 1d.1 and 1d.8 and to the research priorities on Digital Twins (2e), Applied AI (2f), and visualisation and immersion (2a).

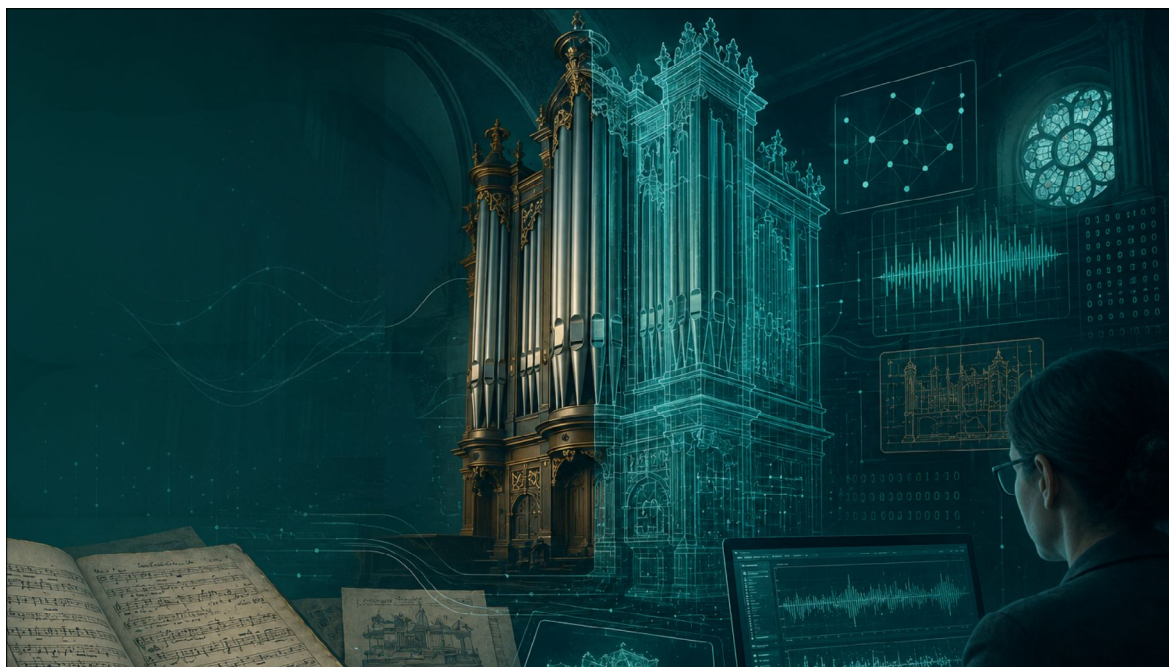


Image source: https://www.linkedin.com/posts/musicosphere_ai-culturalheritage-study-activity-7482365910025068544-Nt7u?utm_source=share&utm_medium=member_desktop&rcm=ACoAAB349vgBCxj630zfv1_oNaN-BJgYGd4euMA

[REM@KE](#) (ERC Synergy Grant 101167101, 2025–2031) addresses a related but more fundamental issue. It seeks to reconstruct not only the sound and form of an instrument but also the embodied musical knowledge that connected instruments to their players and makers. The project focuses on four historical keyboard instruments. It aims to reconstruct their sound, function and embodied knowledge and to develop methods for studying how these instruments shaped performers' bodies. This requires XR environments in which multiple performers can engage with the same digital twin. This work connects directly to SRIA's research lines on AI-assisted synthesis (2f) and explainable AI in immersive environments.

The use of AI in instrument digital twins also raises an unresolved problem. When someone plays a digital twin of a historical instrument, not every acoustic and mechanical response can be based on direct measurement. Some responses under changing playing conditions must be generated or

estimated by AI. The result is that a researcher or performer interacting with the twin cannot know, without external documentation, which aspects of its behaviour are empirically grounded and which are probabilistic inferences. This is not only a technical issue. It is an epistemological problem of the same order as source attribution in manuscript studies. The VWP SRIA's priorities around trust and human oversight (Chapter 3e) and its research lines on ethics-by-design AI (2f) provide a framework in which this problem should be addressed. Organology can provide the standards needed to assess AI-enhanced digital twins of cultural heritage. Organological digital twins could therefore become a test case for transparency in heritage-oriented AI. Such work would combine XR engineering, acoustic science and organology from the start.

3.3. Embodied Research and Musical Experience

The previous sections concerned virtual reconstructions of historical spaces and instruments. This third area asks a different question: what does musical experience do to performers, listeners and their bodies in a technologically mediated environment? The main research value of XR is not only its ability to reproduce reality. It also allows researchers to control and change specific conditions. They can vary acoustic, spatial, visual and interactive features of musical experience in ways that are difficult in a live performance. Virtual worlds can therefore become laboratories for investigating action-perception relationships that constitute musical knowledge. Musicology can help determine which questions such environments should address and how their results could be evaluated. A few use cases from the VWP SRIA illustrate this point.

Use case 1d.4 (Artistic creation for embodied research) combines three activities: 1) using XR as a medium for artistic creation; 2) using XR to document and study embodied artistic practice; 3) using artistic research to produce knowledge about embodied experience. These activities are related but not the same. They ask different questions and require different research designs. Musicology can help clarify these differences. In musicology, artistic research is not only about producing new art with new tools. It can also use artistic practice as a mode of inquiry into embodied musical knowledge that cannot be understood through score analysis or concert documentation alone. Organology can define what "historically accurate" means for instrument action, voicing and tuning. Performance-practice research provides trained performers and an interpretive vocabulary. Cognitive musicology (in the

tradition of [Schiavio](#) and [Leman](#)) supplies empirical methods for studying what performers' bodies learn through contact with a historical instrument. XR makes it possible to study these encounters on a larger scale. Multiple performers with different backgrounds can engage with the same digitally twinned instrument. Researchers can then compare how the instrument affects their movement, perception and embodied knowledge.

VWP use case 1d.2 (Performing arts in virtual spaces) raises a related question about social presence in musical performance. When a live performance is transposed into a multi-user VR environment, ensemble members and audiences may be in different physical locations and interact through avatars. This changes the spatial and social signals on which musical communication depends. Latency, avatar fidelity, spatial audio, and the lack of a shared physical space can all affect the very precise timing required for ensemble performance. The SRIA mainly presents these as engineering problems. Musicology can also treat them as research questions about musical co-presence. Which parts of a shared social and acoustic environment do performers need to maintain common rhythm and expression? Current XR platforms were not designed to answer this question. Musicologists should therefore help design the research protocols, rather than only evaluating the results afterwards.

Use case 1d.12 (Documenting and preserving intangible cultural heritage) raises further questions. Volumetric capture uses several cameras and depth sensors to record a performer's full body in three-dimensional motion. It can document performance practices that cannot be fully represented through notation, audio or ordinary video. While the SRIA presents volumetric capture as a solution, ethnomusicology and performance practice research identify it as a method with significant limitations.

It records the geometry of bodily movement, but not necessarily the acoustic feedback between performer and instrument. Nor does it record the tactile qualities of the instrument, the performer's internal experience of sound production or the social and ritual context that gives the performance practice meaning. A volumetric capture should therefore not be treated as a complete record of a cultural practice. This distinction between a document and a practice is one that musicology and ethnomusicology can help maintain. It affects how documentation projects under 1d.12 should be designed, evaluated and preserved.

3.4. Uncertainty, Epistemology, and the Limits of Reconstruction

All three research areas face a shared methodological challenge: how to represent, communicate, and work productively with the uncertainty involved in reconstructing the past. A sound-space reconstruction cannot recover the “true” sound of a historical hall. An instrument digital twin must reproduce behaviours that cannot fully be determined through measurement. A volumetric capture records bodily movement but not the knowledge contained in a practice. This uncertainty is not a deficiency to be minimised by more sophisticated technology. It is a basic condition of historical research. Virtual world projects should make uncertainty visible rather than hide it.

Several dimensions of this challenge are relevant to VWP project design. One of them is **provenance transparency**. A virtual reconstruction should clearly distinguish between information drawn from primary sources, results produced through acoustic or computational modelling and elements that remain unknown. Musicology already applies this form of source criticism. Virtual world heritage projects should also include it in their interfaces and metadata. A second is **uncertainty modelling**: the formalisation of degrees of historical confidence as a computational and visual parameter. This is an emerging research area at the intersection of musicology and computational social science. Initial approaches have been developed for critical editions and for estimating absence in musicological collections; extending these methods to the dynamic environment of a virtual reconstruction is an open research problem of direct relevance to the SRIA’s governance priorities on trust and human oversight. Finally, the **vocabulary** of reconstruction itself requires clarification. Reconstruction, reimagination, reiteration and speculation are not the same. Nor are plausibility, probability and certainty. These are necessary to protect the research validity of heritage digital twins. Without shared definitions, virtual world projects may present an uncertain historical interpretation as established fact. This can undermine both scholarly credibility and public trust.

Virtual worlds thus matter to musicology because they support situated, multisensory, occupancy-aware, and hypothesis-driven research. Musicology matters to the VWP because it provides methods of source criticism, performance-practice research, and organological assessment. These methods are needed to design and evaluate reliable representations of musical heritage.

3.5. Towards a Research Agenda

The following questions relate to VWP use cases 1d.2, 1d.4 and 1d.12. They are not fully addressed by the current SRIA and require combined expertise from musicology, organology, performance-practice research, ethnomusicology and cognitive science. As such, they represent the research agenda that musicology is in a position to contribute.

On instrument action and embodied knowledge (1d.4, 1d.8)

- Does a digitally-twinned historical keyboard instrument sustain the action-perception loop through which a trained performer accesses historically informed playing technique or does it disrupt it?
- How do performers' embodied responses to digital twins differ between performers trained on modern instruments and those trained on historical instruments—and what do these differences reveal about the relationship between instrument design and performance style?
- Can XR environments support the *learning* of historical techniques rather than only demonstrating them? If so, which haptic and kinaesthetic features are required?

On social presence in musical performance (1d.2)

- Under what conditions does musical communication between performers in a virtual space remain expressive? What happens to that communication when one performer is replaced by an AI agent?
- How does the acoustic environment of a virtual performance space (its reverberation time, spatial diffusion, directional projection) affect the embodied musical decisions of performers within it?
- Do audiences in a virtual concert space experience the music differently depending on whether they are present as passive spectators or active co-creators, and what are the musical, not merely social, consequences of this difference?

On volumetric capture and the limits of documentation (1d.12)

- What can volumetric capture of a living musical practice represent that audio-video documentation cannot—and what does it still fail to represent?
- How should XR platforms design the interface between a volumetric record and the theoretical knowledge framework of the practice it documents, so that users engage with the practice's epistemology rather than only its audiovisual trace?
- What are the community rights implications of volumetric capture of traditional musical practices, and how should consent frameworks address the gap between documented form and living practice?

4. Technical, Ethical, and Environmental Challenges

The previous section showed what musicology and virtual worlds can contribute to each other. Realising this potential, however, requires more than relevant research questions. The VWP SRIA identifies several barriers to participation and long-term development. For musicology, these concern technical infrastructures and interoperability, funding and maintenance, skills and access, collaboration, rights and ethics, and environmental sustainability. This section examines these conditions in more detail.

4.1. Technical Infrastructure, Interoperability, and Standards

The development of the Virtual Worlds partnership offers new perspectives for cross-disciplinary data integration, which should fundamentally include musicology. However, this is only possible if musicological research practices and standards accommodate VWP requirements. It is therefore crucial to factor these integrative perspectives into the development of musicological standards and when adapting existing standards from external fields. While musicology has historically been a highly text-driven discipline relying on historical texts and musical scores as primary sources, a significant amount of research now focuses on performance-related materials. This includes not just the musical performances themselves, but also the environments in which they occur, such as concert venues, opera houses, and churches. Digital transformations have created new opportunities to unite previously disconnected areas of musicological research. For instance, bibliographic databases can now link directly to digital scholarly editions rather than relying solely on textual citations. Similarly, connecting editorial initiatives to performance-oriented research projects allows for richer, more integrated forms of navigation, querying, and analysis.

Virtual worlds depend on different systems and types of data working together. A virtual performance, for example, may combine sound, a 3D stage, motion capture, and interaction with an online audience. This requires reliable real-time interaction, low latency, stable networks, and compatible hardware and software. These requirements help explain why large-scale XR is more common in major theatres and productions than across the wider performing arts sector. Smaller organisations face particular challenges because they often have fewer technical staff and less capacity to maintain complex systems.

To support these developments, research communities have invested considerable effort in creating sustainable and interoperable standards. The availability of shared standards is critical, as is the application of the [FAIR](#) principles, which aim to make data Findable, Accessible, Interoperable, and Reusable, and the [CARE](#) principles, which emphasise Collective benefit, Authority to control, Responsibility, and Ethics.

At the level of data representation and semantic interoperability, musicology relies on domain-specific standards such as the [Music Encoding Initiative \(MEI\)](#) for representing musical sources, while integration with broader cultural heritage infrastructures may involve frameworks such as the ISO-standardised CIDOC Conceptual Reference Model ([CIDOC CRM](#)). The central challenge is not to balance these approaches, but to establish meaningful mappings between them so that musicologically-specific information is preserved while remaining interoperable with data from other cultural heritage domains.

Comparable interoperability challenges arise at the level of computational musicology tools. Libraries such as [music21](#), [partitura](#), and [DiMCAT](#) are developed for the representation, processing, and analysis of symbolic musical data, although their specific purposes differ. For audio-based analysis, libraries such as [librosa](#) and [Essentia](#) provide signal-processing, feature extraction, and other functionality for music information retrieval (MIR). A continuing challenge is to connect symbolic and audio-based workflows with other modalities, including text, video, motion-capture data, and contextual metadata, as these resources often rely on different data models, temporal structures, and analytical assumptions.

The VWP SRIA identifies similar problems across museums, heritage management, and the performing arts: collection systems, digital assets, and platforms often remain disconnected. Cultural organisations also often rely on custom-built XR systems developed for a single institution or project. These systems may work well in their original setting but can be difficult to reuse, connect to other systems, or adapt when technologies change. This can leave institutions with stand-alone pilots that cannot be maintained or preserved. Publicly funded exhibitions and performances may even disappear when their software or platforms are no longer supported. Such challenges are also present in music research, which draws on scores, recordings, instruments, archives, collection databases, 3D models, and data about movement, acoustics, and performance spaces. These materials are often

held by different organisations and stored in systems that cannot easily exchange data. Standards, interoperability, and long-term preservation must therefore be considered from the start.

A key question is how musicological data can be integrated into wider virtual world ecosystems in ways that benefit both musicological research and the development of culturally meaningful virtual environments. Structured data—including bibliographic records, authority data, encoded scores, and metadata—can provide a semantic layer through which musical sources, people, places, events, and digital assets are connected. The value of structured data lies not only in presenting documents for human consultation, but also in enabling systems to identify relationships among heterogeneous information resources. Data integration and connection could support new ways of navigating, contextualising, analysing, experiencing, and creating musical knowledge within virtual worlds.

One promising frontier is building connections between text-based musicological data and organology. Virtual or XR musical instruments have a natural fit in VWP (SRIA 2a.16: Multimodal haptic design). For these to leverage their full potential, traditional musicological practices must be extended to make sustainable connections. This should include 2D/3D music iconography datasets (see [The Database developed by Association RIdIM](#)), music instrument modelling data (see [Innovative 3D models of historical instruments protect and promote rare instruments to new audiences](#)), and the modelling of human perception and body movements—such as for dance research (SRIA 2a.16; 2b.12, Understanding of Human Perception; 2e.14, Behavioural modelling).

Furthermore, VWP capabilities for sound integration (SRIA 2a.17, Spatial and adaptive sound design) offer another natural fit. However, significant work remains to improve real-time 3D spatial audio, and musicological researchers are well-positioned to help fill these technical gaps. Ultimately, supporting the integration of musicological research within emerging VWP ecosystems requires the musicological community to gain an in-depth knowledge of VWP platforms. Understanding their technical architecture, data modelling approaches, and interoperability features is an essential step toward clearly identifying future interaction and integration possibilities.

4.2. The Acoustic Question

“The acoustic question” concerns not only musical sound but also its interaction with space, movement, and performance. Because musical sound is ephemeral, researchers must reconstruct it from

incomplete and heterogeneous evidence, including scores, images, instruments, and oral testimony, each of which preserves some aspects while omitting others. Compared with visual and symbolic sources, methods for modelling historical acoustic phenomena remain less developed. These challenges are directly relevant to the VWP SRIA priorities on multimodality, semantic modelling, and knowledge graphs, which may help connect sound, text, image, and contextual data while making the limits of historical knowledge explicit.

4.2.1. Reconstruction limits

Building on the epistemological framework established in §3.4., the following paragraphs identify the specific technical and acoustic limitations of virtual reconstruction for musicology. Particularly for sounds in history, the example of acoustic/mechanical recordings highlights numerous technological and conceptual boundaries. Digital reconstruction of these artefacts provides not a logically authentic reclamation, but a distinct iteration of a musical document that reflects a performance event ([Neumann, 2025](#)). The technological fingerprints resulting from modern cleanings of Enrico Caruso singing “E lucevan le stelle” or reconfigurations to pair with a modern orchestra do not constitute researcher engagement with Caruso performing, but various kinds of technological and conceptual afterlives enabled by the evolution of the musical technosphere.

Virtual (re-)construction of spaces and instruments of music-making carries its own technical and conceptual limitations. The governing question is not “How did it sound?” but “How could it have sounded?”, with plausibility rather than certainty as the operative criterion. This framing opens productive territory for counterfactual historical modelling: hypothesising, for example, how cataclysmic events like natural disasters or conflict have shaped musical creation and reception due to the destruction or alteration of acoustic environments. In musicological virtual worlds, such counterfactual approaches have not yet been systematically attempted and represent a significant research frontier.

Organological considerations also highlight limitations and possibilities. In one direction, virtual worlds could enable anachronistic pairings between musicians and developments in instrument design, thereby addressing the temporal limitations encountered by historical figures. Pursuits could include questions like: How would J.S. Bach have interacted with the 19th century trend of building pipe organs to mirror orchestral soundscapes (especially the reed division advances achieved by

Aristide Cavaillé-Coll)? Or, what uses might Josquin have envisioned for a theremin? Alternatively, modelling of historical instruments now lost—similar to how numerous studies have examined Stradivarius instruments ([Nagyvary et al., 2006](#); [Sedighi et al. 2016](#); [Stoel & Borman, 2008](#))—offers unique inroads to partnering with materials science experts for reconstructing plausible instruments. Moreover, virtual worlds can assist in imagining how historical listeners might have perceived or responded psychologically to various musical events, though always with the caveat that these are modern innovations and more closely aligned to notions of being inspired or informed by historical artefacts than to being fully faithful representations, given that there are “no original listeners”. ([Schubert, 1994](#))

Despite present technical limitations, virtual worlds constitute an exciting area of musicological research and musical experience. However, a shared conceptual framework is imperative for musicologists and developers to maintain logical consistency within and across domains regarding relationships between performance as an act and the various documents related to it. Key terms include: reconstruction vs. reimagination vs. reiteration, conceptual enframement, conceptual distance, plausibility vs. probability vs. certainty, historicity, anachronism vs. atemporality, and contextual dissonance.

4.2.2. Uncertainty modelling

Knowledge of the past is inherently ambiguous and uncertain to varying degrees—a condition that opens creative and methodological spaces rather than simply limiting research. In the context of this report, the specific challenge is computational: how to formalise and model uncertainty so that it can be communicated to users of virtual environments and integrated into quantitative research frameworks. Yet quantitative methods might seem far removed from the work of many musicologists. While rediscovering “lost” works of the past (particularly if attached to the name of a “great” composer) still makes headlines for musicology, it might seem impossible to be able to estimate just what has been lost. How can we know what we don’t know?

Knowing how much is lost is prerequisite for knowing what has been lost, and serves as a basis for reconstruction efforts either of individual pieces/works/objects or entire traditions. Recent scholarship in other fields has made some progress in this direction. Adapting methods from the [Computational Social Sciences](#) could help to steer research efforts and resources in a more consistent and fair way.

Some initial approaches to modelling uncertainty in musicological contexts have been developed, for example regarding the practice of critical editions and the estimation of absence in musicological collections ([Moss et al., 2025](#)). As noted in §3.4., such modelling expresses humanistic scepticism towards purely data-centred research in a consistent and formalised manner ([Tucker, 2004](#)). These approaches remain challenging—requiring engagement with new statistical frameworks—but are also catalysts for interdisciplinary collaboration between musicology and the computational sciences.

Regardless of systems, models, and tools that can enable virtual worlds for musicological engagement, a broader question governs musicological thinking and is thus imperative: “so what?”. In other words, clearly defined benefits for musicology and society more broadly considered are necessary. These aims are best defined within the context of partnerships, based on shared needs and capabilities, and with a vision for future extensibility.

4.3. Rights, Ethics, and Community Control

A primary challenge is avoiding techno-solutionism—the assumption that technology alone can resolve complex cultural phenomena. Digitising sound recordings (alongside their conceptual relation to music-making acts), documenting living traditions, and managing AI-generated content require navigating intricate legal and ethical frameworks regarding consent and community rights. Accessing, reusing, sharing, and transmitting diverse source media carries significant legal and ethical responsibilities along these axes.

As we have highlighted in previous reports ([Vendrix & Ahrendt, eds. 2025](#); [Vendrix & Ahrendt, eds. 2026a](#)), scholars navigating these legal landscapes—particularly around copyright—frequently encounter structural barriers. Researchers generally lack specialised legal training and struggle to find experts willing or able to provide concrete counsel. Furthermore, university legal departments typically focus on national, internal institutional processes rather than offering actionable project guidance. These issues are compounded by the fragmentation of international legal systems, though centralised coordination at the European level would alleviate some of this pressure. Currently, national initiatives have begun filling the gap; for example, Germany’s [National Research Data Infrastructure \(NFDI\)](#)—specifically its [NFDI4Culture](#) sub-consortium dedicated to tangible and intangible cultural assets—offers a dedicated legal helpdesk to assist researchers.

Nevertheless, many core questions remain unaddressed as lawmakers struggle to adapt existing legal frameworks to the realities of artificial intelligence:

- Is AI-generated music considered cultural heritage?
- How should music content be preserved, stored, and made accessible?
- Who holds the intellectual property rights, and what are the best methodologies to research it?

These critical research gaps are central to ongoing debates in the music information retrieval and legal communities (see [Holzapfel et al., 2018](#); [Stober & Dornis, 2026](#)). While data frameworks like the FAIR and CARE principles offer robust, project-level modelling to address some of these ethical and structural concerns ([Neumann et al., 2024](#)), their formal adoption by policy and lawmakers remains an open question.

4.4. Funding, Skills, and Equitable Participation

Virtual worlds research is expensive. Developing and maintaining virtual environments requires specialist equipment, software, technical staff, strong network connections, and secure data storage. Music-related applications may add further costs through spatial audio, motion capture, 3D scanning, licensing fees, and immersive performance environments. Many cultural organisations therefore depend on custom-built XR tools or external developers. These solutions may meet the needs of one institution but remain costly to adapt, scale, and maintain. Funding is often concentrated on the development of an initial prototype. It may not cover later updates, preservation, maintenance, or transfer to new technologies. Smaller institutions are particularly affected because they often have fewer technical staff and less capacity to maintain custom systems. Public funding should therefore consider the full project lifecycle, from development and use to maintenance, preservation, and long-term access. Researchers and institutions also have unequal opportunities to participate in virtual world research.

This digital divide concerns not only access to technology but also the quality of digital infrastructure, digital skills, knowledge of relevant projects, and experience with European funding. Large universities and national organisations are more likely to have specialist laboratories, technical expertise, and funding support. Smaller archives, conservatoires, ensembles, and early-career researchers may struggle to identify relevant initiatives or meet the technical requirements for participation. These

inequalities may also affect smaller or specialised areas of musical heritage, including early music, regional traditions, and intangible heritage. Researchers and institutions working in these areas may need additional technical knowledge, funding support, and access to shared facilities to participate meaningfully. Without such support, virtual worlds research risks concentrating resources and visibility among institutions that are already well positioned.

4.5. Partnerships and Governance

Meaningful participation also depends on forming the right partnerships. Musicologists may want to explore new methods and reach wider audiences, while virtual world teams may want to create richer and more meaningful experiences. However, these communities often work in different networks, use different terminology, and follow different research and funding programmes. A virtual world team may recognise that music could add value to a project but not know which researchers to involve or which questions to ask. Musicologists, in turn, may see the potential of virtual worlds but not know which technical, design, heritage, or industry partners they need. As a result, music may be added late in a project or not included at all, rather than helping to shape the project from the start.

Musicologists should therefore participate when research questions, methods, data models, and evaluation criteria are defined. This requires stronger connections between musicology, cultural institutions, technology developers, designers, acoustic researchers, and virtual world platforms. It also requires support for finding partners and translating concepts between these communities. Because much cutting-edge virtual world development takes place in the private sector, sustained academic participation and public governance are essential. Dependence on closed platforms and proprietary formats can restrict interoperability, create vendor lock-in, and threaten long-term access to cultural resources. Research institutions should therefore contribute to open protocols, transparent standards, and preservation mechanisms while participating in the governance of emerging technical ecosystems.

4.6. Sustainability and Environmental Footprint

Technical sustainability is closely connected to environmental sustainability. Musicology remains a relatively small and disparate field, in which researchers often pursue individual questions through small projects. Limited time and funding can lead teams to develop separate solutions instead of con-

necting their work to shared standards and infrastructures. In the worst cases, project outputs disappear when funding or technical support ends. In other cases, researchers complete the work of integration later, sometimes in their own time.

Too often, digital approaches are still dismissed as a methodological fashion rather than a paradigmatic shift in how musicologists work, obstructing the implementation of common structures. Additionally, infrastructure requirements vary drastically depending on the modalities involved: text-based metadata, symbolic score encoding, image facsimiles, or multi-terabyte audio performance recordings. Storage and retrieval pose major challenges for long-term preservation and public access as the field increasingly embraces the multimodal nature of its sources (see the special collection on "[Multimodal Music Information Retrieval](#)"; Vatulkin et al., 2025–26).

While music has always been commercialised, today it is generated and distributed at an unprecedented scale by both human and artificial creators. Should "musical AI slop" be preserved? Rather than abdicating scholarly responsibility, we could collaborate with tech companies to develop ethical, historically conscious music AI systems. Doing so expands creative roles while limiting the wasteful exploration of rapidly changing startup applications. Such infrastructures could reduce their ecological impact by building on existing technologies from broader cultural fields, using consolidated music foundation models ([Ma et al., 2024](#); see VWP §2f.12 Semantic AI and Knowledge Graphs and Knowledge Modelling and §2f.13 Adaptation and Specialisation of Foundation Models), and providing open public access to collaborative music practices. A prime example is the musicological ORGANS knowledge graph, embedded in the [GRAPHIA platform](#) and created within the [European Polifonia project](#), which contains data on approximately 2000 historic Dutch organs extracted from the Dutch Organ Encyclopedia.

This shifting production landscape raises vital new questions for safeguarding cultural heritage when music consumption happens on corporate territory, like TikTok music challenges. Can public platforms be created that genuinely attract users, and can private actors be incentivised or coerced to provide open API access to their music data?

A critical imperative for the discipline is connecting digital innovation to ecological accountability, bringing rendering demands, cloud costs, hardware waste, and "green-by-design" standards into direct dialogue with broader climate concerns. Regarding climate change, a vast portion of our phys-

ical musical heritage is endangered by rising temperatures and weather variability. Historical scores, instruments, and sites require constant environments, yet expensive climate-control equipment is often unavailable or non-functional. Furthermore, climate-induced migration will displace music practitioners, sources, and practices. What digital infrastructures must be built to trace and archive mobile heritage? What new kinds of heritage will emerge from these enforced encounters? Addressing how to prevent or diminish this loss relates directly to VWP SRIA 2d.19 Environmentally sustainable standards and interoperability frameworks.

Virtual world projects should also connect their content to trusted repositories, open formats, and sustainable preservation infrastructures. Emergency initiatives such as [Saving Ukrainian Cultural Heritage Online \(SUCHO\)](#) demonstrate the importance of coordinated, open, and distributed action when digital cultural heritage is threatened by war. However, long-term preservation must extend beyond any individual project or platform.

Together, these challenges and their potential responses show that musicology does not need to reinvent itself to participate in the VWP. The practical task is to improve technical connections, provide sustainable funding, widen access to skills and infrastructure, and build partnerships in which musicological expertise helps shape projects from the start. These conditions are necessary if isolated pilots are to become shared and lasting resources.

CONCLUDING THOUGHTS

This document has shown how musicology can find itself within two emerging European Partnerships. Both RCH and VWP offer unique opportunities for the kinds of work musicology (writ large) has already been performing. They also challenge us to think differently about our work, to see how and in what ways the contributions of our discipline can be mobilised in broader, cross-disciplinary initiatives. We stress that these are not the only partnerships that may eventually be relevant to our field. But we must start somewhere. Partnerships will be an essential feature of the European research landscape in years to come, meaning that visibility and participation will be crucial to the future of our work. We hope that the pathways we have outlined here will encourage musicologists and colleagues in allied fields to go forth boldly and partner up.



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