

CESEM and the Digital Revolution

1. Embracing the Digital Revolution

The recent digital revolution has provided a glimpse into the future, offering unprecedented opportunities for transformation in several fields. Over the past two decades, the Centre for Music Studies (CESEM) has contributed to the rise of Digital Musicology in several ways. Recognizing early on the potential of digital tools, CESEM leveraged them to store and transform music, to assist in its creation (in composition and performance), and make music and related information accessible in various formats. This forward-thinking approach has significantly contributed to expanding knowledge in both music and musicology.

2. Development and Digital Initiatives

From digitising campaigns undertaken since the 1990s to the recent development of a computer tool that integrates digital encoding of early music and optical music recognition “OMR” (2023-),¹ CESEM has long explored different routes in the vast domain of Digital Musicology. Among the most significant outputs of CESEM’s investment in Digital Musicology are several databases,² digital editions,³ audio and video recordings of music performances (live and studio),⁴ and websites with research outputs that include structured data and publications.⁵

3. Expanding Reach and Facing Challenges

These varied outputs have increased CESEM’s international projection, ensuring that its research reaches a broad and heterogeneous audience worldwide. However, the investment in digital tools and resources brought a new set of unforeseen challenges. Being a pioneer in the use and adoption of digital resources for research, CESEM experienced both the excitement of the new digital possibilities and issues in need of resolution. Challenges included a pressing need for expanded storage capacity and reliance on specialised, costly human resources for technical management and combating digital obsolescence.

4. The Impact of Digital Transformation on Research

The rapid improvement of digital techniques over the past twenty years has influenced all aspects of music research—from accessing the objects of study (physical objects, digital editions, images, recordings, multimedia, etc.) to transforming them into digital surrogates. The digital revolution has shaped research methodologies and outcomes, enabling the analysis of large data sets that were previously either impossible to use, or greatly time-consuming to investigate. While the advantages of the digital revolution far outweigh its challenges, our researchers have had to adapt by acquiring new skills to effectively create, manage, and reuse digital resources. This has involved, for example, learning best practices for digitising mediaeval manuscripts and fragments, navigating copyright issues related to images of music from libraries and archives, and adhering to data privacy regulations for video

¹ [ECHOES MEI Analyser](#).

² Inter alia, “[PEM](#) - Portuguese Early Music Database”, “[MARCMUS](#) - Music paper and handwriting studies in Portugal (18th and 19th centuries)”, “[PASEV](#) - Patrimonialization of Évora's Soundscape (1540-1910)” the “[Archive of Iberian Polyphony](#)”.

³ [Lost&Found](#): Analysing and reconstructing sixteenth-century Portuguese polyphony”.

⁴ [Performance e Contexto](#)

⁵ [Portfolios](#), [Reverbdata](#).

recordings of infants in our music laboratory. Our researchers have been making a conscious effort to stay informed about the latest national and international policies and trends in data management.

5. Commitment to Open Access and Data Management

CESEM is committed to pursuing an **open access** policy for its research outputs. It adheres to the data management [guidelines](#) set forth by the Faculty of Social and Human Sciences of NOVA University. CESEM actively supports and encourages researchers to adopt the **F.A.I.R. principles**⁶ for data sharing, ensuring the long term accessibility of its digital resources. These principles guide the design of our databases, their integration with similar projects, and the terminologies used for data cataloguing. Examples include the *Portuguese Early Music Database (PEM)*, which follows the cataloguing principles of the *Cantus Database*,⁷ and contributions to the European [Bernstein Project - Memory of Paper](#) through the [MARCMUS](#) and [MARCOSMUS](#) databases. Moreover, some of CESEM's research data is available through [ROSSIO](#), a digital infrastructure developed at NOVA University that serves as the Portuguese section of [DARIAH – Digital Research Infrastructure for the Arts and Humanities](#).

6. Managing Digital Obsolescence and Technical Challenges

In the past, CESEM has encountered issues of digital obsolescence, which required urgent resolution through the migration of data to newer platforms. This process has sometimes led to challenges with data compatibility and functionality, particularly in highly structured databases like PEM, which rely on complex metadata systems. Such situations can occur unexpectedly, as seen with the abrupt [discontinuation](#) of the widely popular music notation software “Finale” in August 2024.

7. Data Management Planning for Long-term Accessibility

To address these concerns, CESEM encourages its researchers to develop a "Data Management Plan" (DMP) to ensure the long-term accessibility of digital resources.⁸ Researchers are advised to consult with our technical experts when proposing new projects involving digital data. CESEM's technical team has developed a knowledge base over the years to navigate any potential challenges effectively.

8. Training and Interdisciplinary Collaboration

CESEM's expertise in digital matters, developed through extensive first-hand work in digital musicology, is now being passed on to the next generation of musicologists. Young scholars are trained in data input, quality control, and actively engage in discussions about the development and the future of our digital resources. Emphasising interdisciplinary teamwork, CESEM has involved specialists like computer engineers and software programmers in projects such as *MARCMUS* and [Echoes from the Past: Unveiling a Lost Soundscape with Digital Analysis](#). The latter involved two software programmers and a postdoctoral researcher in music technology working closely with musicologists.

9. International Collaborations and Conferences

⁶ <https://www.go-fair.org/fair-principles/>

⁷ Both PEM and the Cantus Database are founding members of the “[Cantus Index](#)”, a system that ensures interoperability among participating projects. Using unique “Cantus IDs”, this system links multiple mediaeval music databases, allowing users to search chant texts and melodies across all partner databases. Launched in 2012 with PEM as founding member, the Cantus Index now connects 19 projects across Europe and North America, with more joining each year.

⁸ [ARGOS](#) is our suggested tool because it is also accepted for Horizon Europe projects and DMPs can be published on Zenodo from there.

CESEM remains engaged with the latest advancements in digital scholarship through collaborations with international projects like [DACT](#) (*Digital Chant Analysis and Transmission*, [SIMSSA](#) (*Single Interface for Music Score Searching and Analysis project*), [Cantus Ultimus](#), and the [Bernstein Project - The Memory of Paper](#). CESEM's members participate in important conferences in the area of Digital Musicology⁹ and co-organize some of them, such as “Digital Libraries for Musicology” (Stellenbosch, South Africa 2024, and Seoul, South Korea, 2025). The international conference “[Digital Technologies Applied to Music Research: Methodologies, Projects and Challenges](#)” organized at CESEM (June, 2024) attracted international attention and participation. Furthermore, two CESEM researchers sat on the board of the [Music Encoding Initiative](#).

10. Future of Digital Infrastructure

At CESEM, we believe the future of databases and digital infrastructures lies in the development of large, interconnected repositories that enable data interoperability and exchange. Efforts are underway to create a multi-domain platform integrating databases such as those of Mafra (in development) and [Vila Viçosa/Casa de Bragança](#). The new repository will feature a unified back office (on Drupal), shared terminology and various front-end interfaces. This integrated resource, in addition to enhancing our capacity for data exchange with the broader web, will also reduce costs associated with platform upgrades, which typically occur every five years.

11. Building a Digital Iberian Portal

In the area of early music, CESEM is exploring joint funding opportunities with Spanish repositories to build a digital infrastructure. This will enable data integration into a new Iberian digital portal, creating a comprehensive virtual library that consolidates music scores and metadata previously dispersed across local repositories.

12. Commitment to Ethical Digital Practices

CESEM is dedicated to creating a digital environment that is innovative, accessible, and compliant with legal frameworks. As we continue to develop and expand our digital infrastructures, we prioritise the protection of sensitive data and the ethical sharing of resources. This means rigorously adhering to both national and international data protection regulations, such as the [GDPR](#), while promoting open access to our research outputs.

13. Leading the Way in Digital Musicology

We are dedicated to maintaining a balance between openness and security, ensuring that our digital platforms foster collaboration and knowledge sharing, while safeguarding the privacy and rights of all stakeholders involved. By creating a space that respects both the technical and legal standards for data management, we aim to build a sustainable, trustworthy environment where digital resources are responsibly curated and preserved for future generations.

This ongoing effort reflects CESEM's broader mission to lead by example in the field of digital musicology, setting a standard for transparency, security, and innovation in the digital humanities.

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⁹ Among others [Music Encoding Conference](#), the “[Text Encoding Initiative Conference](#)”, “II International Symposium of the Musical Analysis Commission of the Spanish Society of Musicology [SICAM 2024](#)” etc.