CONNECTING THE WORLDS OF MUSIC WITH A DIGITAL REPOSITORY FOR COLLABORATIVE RESEARCH, EDUCATION AND CONTENT DISSEMINATION

H. Caixinha, S. Caixinha
University of Aveiro (PORTUGAL)

Abstract

As science and research shift to an increasingly open access paradigm, researchers face new challenges [1]. From technology-enhanced learning environments and its underlying Web 2.0 technologies and platforms arise new possibilities for a Research 2.0 approach with open and collaborative processes that promote researcher engagement and productivity [2]. Breaking old research “data silos” and harnessing collective intelligence, shared platforms allow new practices and concurrent tasks related with data collection and results dissemination, thus reorganizing science through a multidisciplinary effort and beyond institutional constraints [3]–[5]. This case study focusses on a participatory and collaborative approach (involving all stakeholders) developed for the planning and development of a digital repository connecting two research projects, “Our music, our world” and “Euterpe unveiled”. The website of “Our music, our world” project provides a digital laboratory for the collaboration of researchers, amateur musicians, local groups, and the general public aiming to respond to their specific needs and interests. Alongside a researchers’ dashboard for collaborative management of collected media/data in the repository, the website disseminates that media/data as research results and educational contents on local music in Portugal. With an underlying open access approach (safeguarding copyright issues), it distributes contents such as photographs, videos, sound recordings, musical and non-musical manuscripts. It also offers multiple contents’ exploration itineraries following the “worlds of music” (brass bands, amateur choirs, folk groups, popular orchestras), the localities where people live (based on administrative cartography), music events (festivities, concerts, rehearsals) and the individuals (composers, conductors, musicians). The interaction with those itineraries can be made through thematic filtered web pages, online maps and multimedia storytelling approaches fostering richer and deeper learning experiences [6]. In the case of “Euterpe unveiled” project, a relevant part of its contents includes musical scores (manuscripts and published materials). For this type of contents, it is important to ensure that the users of the repository, as well as general users of scores in open access, can conduct searches according to varied criteria: composers’ data, work titles, work dates (composition, première, subsequent performances or recordings), musical genres and, most importantly, instrument/voice combinations. Standard library cataloguing formats, such as UNIMARC, are not always fully adequate in the case of contents that overlap library, archive and museum contexts [7]. In addition, practical issues pertaining to user adaptability should be considered, enabling performers to conduct searches according to the work's characteristics and to apply search criteria that can address specific combinations, following a hierarchy from general to specific instrumental/vocal categories. Within this paper, the repository’s planning stage will be detailed and interconnected to ongoing development efforts. By that, and with the aid of generic web site analytic indicators the repository’s current status and its future development guidelines will be outlined.

Keywords: Digital Repository, Research, Education, Content, Music.

1 INTRODUCTION

In a world driven by technology, many realities are shifting, and new paradigms arise. As Tim O’Reilly [8] stated in its seminal article - What Is Web 2.0, back in 2005, the Web 2.0 became a platform, spanning all connected devices with a permanent and ubiquitous access to that network. With that paradigm came multiple online services developed and integrated with the use of standards. Services that presented a growing usability, lowering the needed user’s literacy levels on Information and Communication Technologies (ICT). These services/applications with rich and evolving features [9] allowed an increasingly profounder customization, done by the users, and personalization, done by the services. Together with a set of social features that promoted the interaction and collaboration among users, and content publishing features that promoted the publish, share and reuse of User Generated Content (UGC), online communities (of practice) [10], appeared and thrived. The rise of a
collective intelligence within these communities was potentiated inducing, at a wider and global level, the rise of a Network(ed) society [11], [12].

The new technological-enhanced environments for (almost) all daily life aspects, including learning and researching permitted new practices and support for its users. From the Web 2.0 and its social features the concept of Research 2.0 arise [13]. A new paradigm that broke old research “data silos” using unified/common repositories. Based on open and collaborative processes for data collection, storage and reuse, that encourages interaction and collaboration among researchers. Research 2.0 workflows disseminate its data and deliverables in an increasingly open access approach, widening the exposure of the researchers’ work and profile to peers and the general public. Thus, fostering the engagement and productivity of researchers within multidisciplinary teams and/or within larger communities [1]–[5].

The Instituto de Etnomusicologia - Centro de Estudos em Música e Dança (INET-md) (http://www.inetmd.pt), is a Portuguese interdisciplinary research unit with a branch at the Department of Communication and Art (DeCA) of the University of Aveiro (UA). Being a research unit with many projects that perform heavy data collection tasks, the multiple repositories created to store that data (many in the form of multimedia assets), were posing severe organizational and scientific issues. To solve those issues and to implement modern Research 2.0 practices among its researchers, the development of a unified/common digital repository seemed the right option to take.

2 DEVELOPMENT

Based in preliminary work done in database development for research projects like Music In-Between (http://musicanomeio.web.ua.pt/) from 2010, the common digital repository concept was outlined and developed to support multidisciplinary teams at INET-md, from different research projects, with investigators scattered around Portugal and in some Portuguese speaking foreign countries. That unified repository connects different worlds of music revealing distinct (but complementary), research perspectives, gathering collected data and promoting its share, reuse and dissemination, through related websites, with researchers, stakeholders and the general public.

2.1 Different worlds of music

Nowadays the repository’s connected worlds of music match the research focus of 3 projects as depicted in the following sections. Although the connection is more developed in the first two, the third one – Ecomusic, is undergoing its initial integration stages but due to the implications brought to the repository structure and related websites is already worth mentioning under a present/future development perspective.

2.1.1 Our music, our world: Musical associations, wind bands and local communities (1880-2018) [https://anossamusica.web.ua.pt]

This project addresses the musical practice voluntarily developed in musical associations and communities. Focusing on wind bands, choirs, and folk groups, institutions that only now attract academic interest despite their important role in the lives of Portuguese people. The research explores: The contribution to artistic, educational, professional, cultural and economic development of studied communities; Generation of creativity; and the interconnection of communities and its identities (places, points of conflict, public spaces and local soundscape). The project questions the contexts in which musical practice is constructed as a cognitive and social practice, the underlying rational and its recipients. Approaching the connections established with instituted powers, ideologies, propaganda, media (press, radio and television), the culture of leisure, new venues for musical performance and changes that affected musical practice and consumption. To provide an interdisciplinary approach to musical practice and concepts such as ‘art’ and ‘culture’ in the context of musical associations, the project’s team includes researchers from the fields of ethnomusicology, cultural studies, performance studies, educational sciences, sciences of information and communication, and archive and patrimony studies. Preliminary work allowed the identification of selected musical associations/communities, thus facilitating access to their private sources and collections [14].
2.1.2 Euterpe unveiled: Women in Portuguese musical creation and interpretation during the 20th and 21st centuries [http://euterpe.web.ua.pt]

Focusing on musical creation and interpretation by women in Portugal during the 20th and 21st centuries (from 1910, with the rise of the republican regime to present time). A period that began with suffragist claims and a growing involvement of women in professional artistic production, and continued from 1928, with a dictatorial regime, which privileged autocratic cultural policies, and specific frameworks for women’s artistic contribution. From 1974 with a revolution that restored democracy, new ideological approaches to artistic production were introduced. Diversity and an open impact of feminist ideologies were assimilated, directly influencing the musical composition and interpretation. In conjunction with certain hegemonic discourses and constructs that have traditionally limited women’s involvement with some types of musical activities, the lack of musical scores and recordings, would allow a deeper knowledge of women’s compositions and performances. The research explores: The interactions between domestic and professional contexts in musical production, focusing on gender-biased patterns in creation and interpretation during the republican period and the dictatorial regime; The collection, systematization and notation of musical work and associated materials (letters, texts, recordings, press materials) from paradigmatic women composers, studying also their activity in the light of gender ideologies and contemporary critic discourses; And new developments in composition and performance, with collaborative approaches for creation and their relation with feminine storytelling and gendered constructs [15].


The project, initiated in August 2018, analyses and discusses the renewed operability of Portuguese Musical Folklore (PMF) in the 21st century, for reframing, invigorating and taking on a new social, political and economic role, both in local contexts and in the media, the global markets of World Music and the Web. Contributing to understand the role of that tradition in the construction of sustainable creative communities, in the market of cultural/entertainment industries and the local impact of the proclamation of Intangible Cultural Heritage of Humanity, the policies of safeguarding PMF, and cultural tourism. It also encourages a discussion about musical heritage and creativity that engages tradition bearers, young musicians and creators, researchers, business people, and policy makers. The multidisciplinary research team will develop an interdisciplinary approach and articulate fieldwork methodologies with technology-enhanced collaborative research practices [16].

2.2 Digital repository

From the analysis of gathered data by the different projects, a systematization was made defining the typology of the future repository’s multimedia assets. They were organized in the following types: Photo; Video; Non-musical audio file; Musical audio file; Musical related printed material; Musical score; Monography; Periodic; Mail/Letter; Programme, invitation, poster; and Other document. All the assets should be directly linked to and contextualized by: Key players/protagonists; Institutions/groups/bands; and musical events. The repository design process was conducted through a participatory and collaborative approaches, including researchers with archival expertise and other stakeholders that provided (and still do), important contributions.

The asset’s descriptors schemas developed for the repository, were based in standard formats like UNIMARC (https://www.ifla.org/unimarc) and in metadata schemas, like the ones proposed by the Dublin Core Metadata Initiative (http://dublincore.org/). But since the mentioned assets overlapped library, archive and museum contexts, the adoption of these standards became more complex [7], thus inducing the creation of new schemas that are being updated in successive revisions to support evolving projects’ requirements and researchers’ needs. A common core of descriptors, departing from the requirements of Our music, our world project, was defined and subsequent specific descriptors’ sets were added for each new project to be integrated into the repository.

For the Euterpe unveiled project a relevant part of its assets includes musical scores. With this type of content, it’s crucial that researchers and website users can search and retrieve assets according to varied criteria: Composers’ data; Work titles; Important dates (composition, première, subsequent performances or recordings); Musical genres; and, most instrument/voice combinations. This is decisive to allow those musical scores to be used, shared, played and recorded. The project includes other types of materials that can support and inform performing activities, namely annotated scores or manuscripts, recordings, letters and programmes with information about venues and performers. This
type of materials is extremely useful for performers, as it can function as a basis of information for the construction of a performance, namely addressing cases in which there is a lack of sources or missing performance details. This information should be crosschecked, through the repository, with all the information pertaining to scores and composers [15].

As a central component of the repository deployment, a relational database was built, within a Database Management System (DBMS) - MariaDB (https://mariadb.org/), an open source project forked from the MySQL DBMS (https://www.mysql.com/). Hosted at the UA’s DBMS servers cluster, this database’s entity-relationship diagram, as seen in Fig.1, was built around the Multimedia file (Asset) entity with its common core descriptor’s set and associated project’s specific descriptors’ sets. With these descriptors (in the form of database entities/tables fields), each asset is described under a predefined metadata schema defined accordingly to each asset type – regarding for example: title, description, authorship, ownership, keywording, date, features and other details. Circling the asset entity are related entities – Individuals, Institutions/groups and Events that contextualize each asset. All these entities are geolocated to allow their search and retrieval within interactive maps viewports in related websites, and they also have relationships with the research projects collections, where they will show up, and with the researcher responsible for their introduction in the database.

Due to the evolutive nature of those descriptors’ sets, in order to accommodate new project’s requirements and researchers needs, they undergo periodic revisions. In a later one to safeguard specific copyright issues with an asset collection, visibility/availability and scope dissemination descriptors were introduced. A similar revision will be made to extend and complete the Euterpe unveiled specific descriptor’s set for the instrumental/vocal categories typology. Detailing the Institutions/groups entity, each record in it, is classified according to a typology scheme with bands, choirs, orchestras, folklore groups, “tunas” and their related 75 subtypes. In the Individuals entity a similar scheme exists but focused on the roles played by each individuality – Performer/Music, Critic/Reviewer, Composer, Ethnographer, Maestro, etc. The multimedia files associated with each asset are stored, mostly in the storage cluster at UA where the needed backup and maintenance is performed by the UA’s ICT support service at Serviços de Tecnologias da Informação e Comunicação (STIC), but since the (web) servers used aren’t real streaming media servers, that lead to a recent use of 3rd-party video repositories like YouTube (https://www.youtube.com) and Vimeo (https://vimeo.com). In those external platforms, longer duration video files are stored and integrated in the repository, through available embedded client-side HTML5 video players, as seen in Fig. 2.
Apart from the repository database and multimedia file storage, several websites have been developed, as seen on Fig. 3.

Within those websites and with a restricted access to researchers, several dashboards allows to list, search, share and manage (create, read, update and delete) assets in the database, with its associated files and descriptors, and related individuals, institutions/groups and events. The specific descriptors and files of these related entities can also be managed by each researcher if they possess the needed privileges based on pre-established user roles such as - Administrator, Project researcher, Institutional user, Fellow researcher, Student, Other Users, etc. The dashboards, seen in Fig. 4, were developed from scratch using open source languages and frameworks – HTML, CSS, JavaScript, Bootstrap (https://getbootstrap.com/) and PHP.
A future social layer, supported in Web 2.0 services/tools, will enhance these dashboards with a set of features dealing with the interaction between researchers about their assets and practices. It will allow: to discuss within teams and with other peers; follow the activities and assets of those peers; comment; review; and select favourite assets, creating a more collaborative environment, that potentiates the socialization, engagement and productivity in a Research 2.0 approach.

Public websites, as seen in Fig. 5, were deployed for each integrated project to establish custom-tailored dissemination channels for the repository content according to each project’s scope and expected deliverables and target audiences. They were developed with the beforementioned open source languages and frameworks or, as in the case of project Euterpe unveiled, using a publishing platform like Wordpress (https://wordpress.org/), various plugins to extend the website’s features list, a theme for the website’s interface design (tweaked with some minor CSS customizations).

To tailor these dissemination channels, thus creating sub-websites inside the main project’s website, specific criteria were used. From the partnerships established with the São Pedro do Sul, Mangularde, Idanha-a-Nova and Palmela municipalities, several sub-websites with a geographical scope were created disseminating assets, individuals, institutions/groups and events, based in their geolocation descriptors. Additionally, with these descriptors, multiple interactive maps are being embedded in the project’s websites, as seen in Fig. 6, allowing a geographic exploration of certain types/subtypes of institutions, groups, bands, etc. These maps were based on the OpenStreetMap cartography (https://www.openstreetmap.org), and the Leaflet (https://leafletjs.com/), open source JavaScript framework.
Sub-websites with a thematic scope were developed from asset's keyword descriptors, individual's role descriptors, institutions/groups typology/sub-typology descriptors and events, proposing different exploration paths for the repository's content: “Worlds of music” (brass bands, amateur choirs, folk groups, popular orchestras); Events (festivities, concerts, rehearsals); Individuals (composers, conductors, musicians); Institutions/groups; and Musical practices. Also, under this thematic scope, and resulting from a recent agreement with the Palmela's municipality, a sub-website with an interactive storytelling approach is being developed using an open source JavaScript framework like Odyssey (https://cartodb.github.io/odyssey.js/). Under the theme “Palmela é musical!”, this framework will allow to combine maps and multimedia assets in a geolocated interactive narrative, fostering richer and deeper learning experiences.

For the latest project - Ecomusic, a similar scenario, in terms of website and sub-websites, is planned, although a development from scratch versus one that uses platforms as Wordpress, is still being assessed. Apart from these websites, the project's deliverables will comprise a multidimensional interactive map of PMF practices, showcasing the social practices, contexts, and the dynamics generated in Portugal. This map will provide first-hand accounts and experience-based information and knowledge from folklore group members. A mobile app will be developed, targeting cultural tourists. With a full integration with the common digital repository, the app will complement the websites. Its features and assets, giving these tourists, real time geolocated multimedia information, within a “what's near me” paradigm, about practices and events, especially the ones already listed as, or in the process of becoming, patrimony [16].

3 RESULTS

Through this common digital repository (and associated websites), developed with a participatory approach by numerous stakeholders, several isolated archives and databases in use at the research unit INET-md were unified, thus optimizing fieldwork data collection, its management and subsequent dissemination and share/reuse by participating projects, offering a body of research for future research contexts/projects and the general public. Distributed (in time and space), practices are being supported among the different research teams. As seen on Fig. 7, the deliverables dissemination is being deployed by custom tailored sub-websites: to researchers’ and partners’ intents; thematic and geographic scopes; or interactive storytelling approaches. And bonds with researched communities and studied geographical areas were reinforced.
As specified by indicators collected on the 6\textsuperscript{th} of May 2019, 70 researchers (from the integrated projects), had an active account at the repository. In its database 12444 records (multimedia assets) pointed to nearly 13500 multimedia files stored at the UA’s servers (occupying more than 110GB of disk space) or at the 3\textsuperscript{rd}-party video repositories like YouTube and Vimeo. Those files comprised not only the actual multimedia assets but also the photos associated with the individuals, institutions/groups and events linked with the mentioned assets. In terms of multimedia assets and its typology, as seen in Table 1, the following distribution was found:

\textbf{Table 1. Multimedia assets in the repository by typology (data from 6\textsuperscript{th} of May 2019).}

<table>
<thead>
<tr>
<th>Type</th>
<th>#</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photos</td>
<td>1364</td>
</tr>
<tr>
<td>Videos</td>
<td>967</td>
</tr>
<tr>
<td>Non-musical audio files</td>
<td>3</td>
</tr>
<tr>
<td>Musical audio files</td>
<td>523</td>
</tr>
<tr>
<td>Musical related printed materials</td>
<td>553</td>
</tr>
<tr>
<td>Musical scores</td>
<td>3200</td>
</tr>
<tr>
<td>Monographies</td>
<td>95</td>
</tr>
<tr>
<td>Periodics</td>
<td>3042</td>
</tr>
<tr>
<td>Mail Letters</td>
<td>254</td>
</tr>
<tr>
<td>Programmes, invitations, posters</td>
<td>1399</td>
</tr>
<tr>
<td>Other documents</td>
<td>1044</td>
</tr>
</tbody>
</table>

Additionally, to those multimedia assets, descriptive or biographical records exist in the repository for 3726 individuals (key players/protagonists in the worlds of music encompassed by the projects), 2595 musical institutions/groups and 2149 musical events. All this data, inserted into the repository by the researchers, undergoes a regular optimization process aiming to filter and remove errors, duplicates and other inconsistencies. And to prevent and minimize such occurrences, a set of how-to guides are
being prepared for distribution among researchers of the 2 already integrated projects (Our music, our world and Euterpe unveiled) and the one being integrated (Ecomusic).

4 CONCLUSIONS

With a digital repository nearly completing 4 years of development and use, some conclusions can be outlined. Not only repository indicators and related website analytics indicators, but also the researchers’ feedback reveal a digital infrastructure that’s being increasingly incorporated in their daily research routines. New collaborative practices and a culture of sharing and dissemination are growing among those researchers. The common digital repository connecting different worlds of music, breaking “data silos” is becoming a major hub for knowledge creation and for new research opportunities that feed directly on its multimedia assets and related data. As time goes by more researchers, projects, institutions and municipalities are adopting the repository and establishing new partnership agreements widening its reach and scope, revealing relevant metrics for the research unit INET-md. As a digital repository that disseminates its multimedia assets among the general public and promotes the use and reuse of those assets, a special care should be taken with copyright and privacy issues. Beyond the beforementioned database descriptors that restrict and control the dissemination of each asset, licencing schemas, as Creative Commons - https://creativecommons.org/, are being evaluated. Work is being done on the Our Music, Our World storytelling sub-websites specifically in the one themed around the concept “Palmela é Música!” as it will support the Palmela’s municipality application to the UNESCO Cities of Music Network (https://citiesofmusic.net/).

Upon the completion of that storytelling sub-website the development will focus on the social layer, a crucial update to the researchers’ dashboards features list, enhancing the openness and collaborative nature of that online working environment (targeting a true Research 2.0 approach). And within a short to medium term timespan the development efforts will also be focused on the database upgrade (dealing with its entities, relations and descriptors’ sets) to fully accommodate the Euterpe unveiled project’s multimedia assets collection, management and use. Consequently, major changes will occur in the related websites – from the restricted researchers’ dashboard to the public website or other future sub-websites. In parallel and until the end of 2019, with the aid of some undergraduate students and junior researchers, the Ecomusic project will undergo its full integration within the digital repository.

Regarding this project, major implementation work will be done in some of its expected deliverables – namely the mobile app, for different dissemination approaches targeting new audiences, and the multidimensional interactive map of PMF practices, an essential tool to knowledge sharing and knowledge creation by other researchers and the general public.

In November 2018, with the start at INET-md of a new project – xperimus: Experimentation in music in Portuguese culture: History, contexts and practices in the 20th and 21st centuries [17], its requirements, in terms of repository and multimedia assets, will be analysed to determine a future integration plan. Finally and in a long term effort to enhance the repository’s interoperability with other archive/cataloguing platforms at the UA (e.g. a Collective Access platform at, http://museu.ua.pt/), a migration and/or replication workflow for the descriptors’ sets will be outlined and implemented on most of the repository’s multimedia assets, allowing their search and retrieval in other platforms’ catalogues.

ACKNOWLEDGEMENTS

The development of the digital repository was made possible, since 2015 within the scope of various research projects, by the financial support of the following funding bodies:

**Our music, our world: Musical associations, wind bands, and local communities (1880-2018)**

Funding body: FCT - Fundação para a Ciência e a Tecnologia [PTDC/CPC-MMU/5720/2014]

**Euterpe unveiled: Women in Portuguese musical creation and interpretation during the 20th and 21st centuries**

Funding body: FCT - Fundação para a Ciência e a Tecnologia [PTDC/CPC-MMU/3559/2014]

**Ecomusic - Sustainable practices: a study of the pos-folklorism in Portugal in the 21st century**

1845
REFERENCES


