Creating a Linked Open Data Ecosystem for the Performing Arts (LODEPA)

Beat Estermann

1 Introduction

*Semantic web**[1] technologies provide us with the tools to connect and interlink data on a large scale, making it possible to break through existing data silos and to interact with data maintained on different systems as if the data came from one and the same database. Yet, *linked data** is not only about putting a new technology to use, but even more so about creating a shared vision and developing a collaborative spirit among partners that hitherto have hardly been aware of each other. By some interesting twist of fate, we have found ourselves in the role of seeking to achieve exactly this with regard to the various stakeholders of the performing arts sector – a sector, which in some parts has a rather local or regional focus, but in other parts is clearly international in scope.

Thus, we have seen various efforts and initiatives to create an international linked data ecosystem for the performing arts that relies both on *Wikidata** and the classical linked data approach. Throughout a variety of projects, several components of such an ecosystem have been put in place. Yet, so far, none of the existing initiatives has managed to rally a critical mass of stakeholders to sustain the further development and long-term maintenance of such a data ecosystem at the international level. The present article contributes towards this goal by setting out what may become a shared vision across the sector. We thereby draw on first-hand experience in the context of linked open data projects in various segments of the performing arts value network, involving production and presenting companies, archival institutions, educational and research institutions, and the free online encyclopedia Wikipedia.

Based on a thorough analysis of the key stakeholders of a linked data ecosystem for the performing arts and their usage scenarios, we have identified areas where cooperation around data would be particularly beneficial. As implementing linked data on a larger scale is a tedious task that requires a prolonged effort from a variety of stakeholders, we are paying particular attention to the question of how best to bootstrap the data ecosystem and to ensure its long-term sustainability.

The present article is structured as follows: Section 2 lays out the vision of a linked data ecosystem and sheds light on its present state of implementation. Section 3 provides an overview of key stakeholders and usage scenarios as well as stakeholders' needs in terms of data pertaining to the performing arts. Section 4 addresses the question of how best to bootstrap the linked data ecosystem for the performing arts by realizing quick wins and by progressively addressing the issues that are key for ensuring the long-term sustainability of the ecosystem. We conclude the article by summarizing the most important findings and by sketching out the next steps. For the technical terms used throughout the article – highlighted in italics and marked with an asterisk when they are first introduced – the glossary on page 23 provides further explanation.

2 Vision and Current State of Implementation

In this section, the vision of the Linked Open Data Ecosystem for the Performing Arts is described. Furthermore, we are taking stock of its current state of implementation.

ISSN 2421-2679

2.1 A distributed knowledge base for the performing arts

The vision of a *linked open data* ecosystem essentially consists in a distributed knowledge base for the performing arts, based on linked data technology. Figure 1 gives an overview of the architecture of such a linked open data ecosystem. The architecture is made up of different architectural layers, as can be seen in Figure 1.

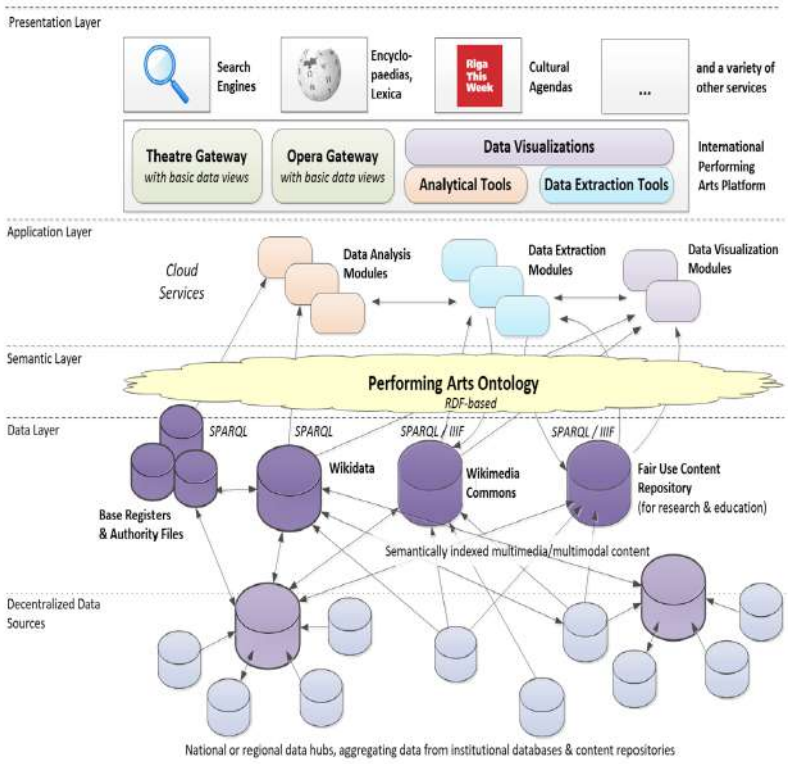

Fig. 1 *Architecture of the Linked Open Data Ecosystem for the Performing Arts.*

Represented at the bottom is the **data layer**, which consists of a distributed database for the performing arts based on linked data technology, comprised of both data platforms through which structured data is made available, and content repositories through which media files (text, image, audio, video, 3D models) are provided. The content repositories are expected to comply with the *IIIF** standard, while the structured data is provided through *SPARQL** endpoints.

The data platforms include *base registers** and *authority files** (e.g. *ISNI**, *VIAF**, etc.), which serve as common registers of named entities. For the time being it remains open whether the distributed database will primarily rely on a few centralized and highly integrated databases, which aggregate data from many different sources, or on the contrary, on many highly decentralized, but inter-connected databases, maintained by individual institutions. While some of these databases take the form of simple triple stores through which data is made available as linked open data, others take the form of community platforms which allow for collaborative data curation, such as Wikidata.

While the structured data is by default made available as open data to facilitate the inter-linking of the various databases, a substantial amount of digital content related to the performing arts is covered by copyright. It is therefore up to the copyright holders and the maintainers of collections to decide whether they want to make the content available under a free copyright license or in some other form of open access regime, or whether they prefer to restrict the access to specific users or user types (e.g. education and research).

Displayed right above the data layer is the **semantic layer**. It consists of *ontologies*, sometimes also referred to as data models, pertaining in some way or the other to the field of the performing arts. Along with shared sets of named entities (authority files or base registers), commonly used ontologies represent the shared language that provides the linkages between different datasets within the linked data cloud. Ontologies may be provided as classical standalone *RDF** data models, such as FRBRoo (Doerr et al. 2008), EBU Core, or schema.org, and/or they may be implemented and collaboratively maintained within Wikidata.

Next comes the **application layer**, consisting of various cloud services tailored to the needs of some of the "power users" within the international linked open data ecosystem for the performing arts. Examples for such cloud services are data extraction tools for data

ISSN 2421-2679

publishers (e.g. helping them to semi-automatically extract metadata from media files), analytical tools for researchers, or data visualization tools for users interested in creating their own tailor-made data visualizations. These services are typically provided according to the "software as a service" model and may be integrated into various offers targeted at end users (cf. presentation layer). As outlined above, some of the data platforms and content repositories may take the form of online collaboration and/or crowdsourcing platforms; in this case, they extend into the application layer, providing tools and services that go well beyond providing data and content.

The **presentation layer** heading the schematic structure displayed in Figure 1 finally consists of a myriad of end user services that all draw, at least to some extent, on the elements of the three other layers – by exploiting or aggregating data from various data providers, by using shared ontologies, and/or by making use of cloud services. Thanks to the clear separation of the data layer and the presentation layer, various gateways and services may provide access to the shared data infrastructure. A gateway or a service can be conceived of as a single point of access to a subset of the platform ecosystem, tailored to the needs and expectations of a specific user segment or facilitating a certain task (e.g. searching for upcoming performances). In some cases, users simply act as consumers; in others, they take the role of "prosumers," engaging on crowdsourcing platforms and in collaboration spaces that allow them to make their own contributions to the international linked open data ecosystem for the performing arts.

2.2 Current state of implementation

Several base registers and authority files relevant for the performing arts have been made available as linked open data or can be queried through an *API**, such as the Virtual International Authority File (VIAF) or the International Standard Name Identifier (ISNI), which are important resources when it comes to identifying persons and organizations. As Vrandecic and Krötzsch (2014) note, Wikidata is developing into a global aggregator of authority files by providing links to a variety of such resources. In contrast to VIAF and ISNI, it is wider in scope, relies on crowdsourcing, and is free for anyone to edit. An important reference source for music albums, musical works and performers is MusicBrainz, another community project relying on crowdsourcing. Further reference sources that are of interest in the context of the performing arts are the Internet Movie Database (IMDb) for actors, Songkick for concerts, and Discogs as an alternative to MusicBrainz for performers.

When it comes to the actual data, linked data publication in the area of the performing arts is still in a pilot phase. So far, only a small share of performing arts related data is available as linked open data. Examples of databases that contain linked open data about performing arts productions or performance events include the DOREMUS project (Doremus 2019) (approx. 445'000 performance events[2]), AusStage (AusStage 2019) (approx. 65'000 productions), the Carnegie Hall Performance History (GitHub 2019) (approx. 50'000 performance events), the Database of the Flanders Arts Institute (1993-2018), published on Wikidata (approx. 12'000 productions), the Artsdata.ca Knowledge Graph (approx. 1'400 productions), and the Repertoire of Schauspielhaus Zürich (1938-1968), published on Wikidata (approx. 700 productions). The databases of the Swiss Archive of the Performing Arts (approx. 60'000 productions), and the Austrian performing arts database Theadok (approx. 30'000 productions) are currently in the process of being published as linked open data; similar efforts are under way elsewhere.

Based on these first pilot datasets, data modelling issues should be addressed systematically in order to harmonize data modelling practices. As could be demonstrated in the case of Wikidata, many critical data modelling issues remain to be resolved (Wikidata 2019). Similar issues are to be expected whenever several databases are to be integrated and/or exploited in combination with each other.

Applications making use of the existing linked open data in the area of the performing arts are still few and far between. Examples include Culture Creates' Footlight tool, which scrapes performance data from producers' and presenters' websites and makes it available as linked

ISSN 2421-2679

open data in the context of the Canadian Artsdata.ca Knowledge Graph in order to improve the pertinence of search results and recommendations provided by intelligent personal assistants (Saumier-Finch 2019). Another example are Wikidata-powered infoboxes on Wikipedia, e.g. for theatre venues, which are currently being implemented following the methodology set out by Fontenelle & Estermann (2019). There have been efforts to link existing databases to Wikidata and to other base registers and authority files, enriching them with additional data, yet there is still hardly any federation taking place, where applications draw on data from various triple stores as if the data came from a single data source.

3 Usage Scenarios and Requirements of Key Stakeholders

When it comes to setting up a data ecosystem, it is important to know its key stakeholders and how they would eventually benefit – and contribute – to the shared ecosystem. The value created for its various stakeholders are the *raison d'être* of any data ecosystem and the key to its long-term sustainability. To identify the key stakeholders of the Linked Open Data Ecosystem for the Performing Arts, we started off by mapping the performing arts value network as it appears from the literature. We then identified the various key stakeholders' usage scenarios and requirements in terms of data, which allowed us to sketch out the common data core of the linked open data ecosystem for the performing arts.

3.1 Mapping the performing arts value network

The key stakeholders of the International Knowledge Base for the Performing Arts are to a large extent identical with the ones that have been identified by various authors who have attempted to map what they termed the **"performing arts value chain"** (Preece 2005), the **"creative value cycle"** (Daschko 2011), or the **"performing arts value network"** (Bonet/Schargorodsky 2018). As Madudovà (2017) notes, the different types of models used to represent the arts sector have all their pluses and minuses, but more importantly, they influence how the sector and the interactions of its various members are perceived. The Performing Arts Management Value Chain (PAVC) was introduced by Preece (2005) as a decision-making tool for the management of collaborative ventures among organizations of the performing arts sector. The focus is on the generic activities of the performing arts organization. In their "creative value cycle", Statistics

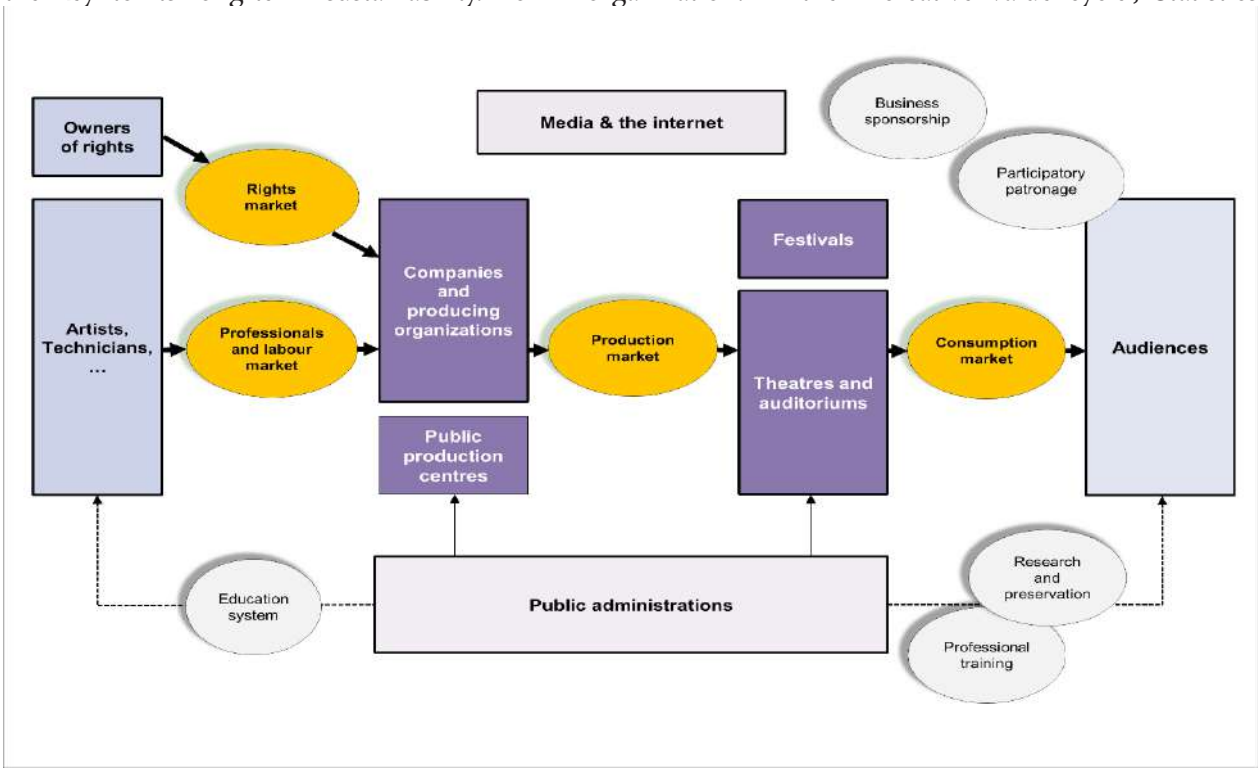

Fig. 2 *Performing Arts Value Network* (based on Bonet/Schargorodsky, 2018: 45)

ISSN 2421-2679

Canada (Daschko 2011) also rely on a linear model, but they recognize the importance of arts consumption (the demand side) as well as the cyclical nature of the creative chain, acknowledging that yesterday's productions and their "use" serve as inputs for today's creation processes. They also highlight the transformative nature of the Internet with regard to the creative value chain, pointing to various trends, such as the individualization of offers, the re-purposing of cultural products, as well as the increased ability of consumers to become creators of cultural products. Taking the performing arts value chain as a starting point, Bonet & Schargorodsky (2018) further expanded it to include related activities, such as education, research, as well as heritage conservation, which form additional sociocultural cycles around the primary value chain. The resulting model, which they termed "Performing Arts System" (see Fig. 2), is a value network, comprising several value chains and cycles.

In contrast to earlier models, Bonet and Schargorodsky's model identifies the markets where the different agents of the performing arts value chain meet to carry out their transactions, distinguishing between a "consumption market", a "production market", a "rights market", as well as a "professionals and labour market". The authors of the model also recognize the mediating role of the media on several of these markets, and the important role played by research and training as well as by the creative spaces provided by universities in developing the profession and in shaping new trends. And finally, their model incorporates cultural policy instruments and other public intervention mechanisms (including the legal framework) that have an influence on the activities of the various stakeholders.

In addition to the four "markets" identified by Bonet & Schargorodsky, there is a further arena where individuals exchange information about their performing arts experiences, thereby building-up social and cultural capital. Cha et al. (2014) point to the important role of social media interaction as a complementary activity to on-site performing arts consumption when it comes to shaping cultural meanings and facilitating social interactions around cultural experiences. As they influence people's cultural tastes as well as the choices they make in terms of performing arts consumption, social media play an important role in electronic word-of-mouth. Like in other markets for experience goods (Litvin et al. 2008; Zhang et al. 2010; Ye et al. 2011), consumer-generated reviews can be expected to have a significant impact on business performance in the performing arts consumption market (cf. Hausmann / Poellmann 2013).

3.2 From performing arts professionals to statistical services: how key stakeholders may utilize a knowledge base for the performing arts

Taking the aforementioned models as a starting point and complementing them with information drawn from industry classification systems (United Nations 2008, Eurostat 2008, Statistics Canada 2017), twenty key stakeholder groups were identified (see Table 1).

Stakeholder Groups of the Primary Value Chain of the Performing Arts	Additional Stakeholder Groups
Performing arts professionals	Media professionals, bloggers, podcasters
Personal theatrical or artistic agents or agencies	Tourist boards (territorial marketing)
Casting agencies	People providing information to tourists
Performing arts production companies	Search engines and computer-based personal assistants
Performing arts presenters (and promoters)	Educators and learners
Providers of diffusion platforms	Researchers
Operators of arts facilities	Lexicographers
Writers, composers (rights owners, partly represented by collecting societies)	Heritage institutions
Theatre, concert goers	Private collectors
Online consumers of performing arts	Statistical services

Table 1. *Key Stakeholder Groups of the Linked Open Data Ecosystem for the Performing Arts.*

For each of these stakeholder groups, possible usage and contribution scenarios were described, along with indications as to what kind of data they require and may potentially contribute (a few examples are provided in appendixes 10.1 and 10.2; see Estermann & Julien 2019 for further details). These high-level usage scenarios were described by drawing on information collected in the course of several linked open data projects in various segments of the performing arts value network, involving production and presenting companies, archival institutions, educational and research institutions, and the free online encyclopedia Wikipedia. Missing information was gathered by consulting several experts in the field. The

ISSN 2421-2679

different usage scenarios can serve as a basis for further research into user requirements in view of the development of concrete service offerings and should be further refined and validated as the Linked Open Data Ecosystem for the Performing Arts is being deployed.

For the purpose of simplification, the different usage scenarios were grouped according to the seven categories "Production", "Presentation & Promotion", "Coverage and Re-use", "Live Audiences", "Online Consumption", "Heritage", as well as "Research and Education" as detailed below:

Production: Usage scenarios related to production comprise the activities required to create a new performing arts production, such as selection and adaptation of the (literary, choreographic, musical) work; getting inspiration from earlier performances (e.g. by consulting an archive); acquisition of the performing rights; selection and hiring of artistic and technical personnel; finding a presenter and providing them with the relevant information about the artists, the work, and the performing arts production to be provided to the public at large; as well as acquiring relevant information about the venue(s).

Presentation & Promotion: Usage scenarios related to presentation & promotion comprise the activities required to present a performing arts production to an audience, such as programming; acquisition of performing arts productions; finding and renting adequate venues; as well as marketing & sales, including the provision of short previews and trailers.

Coverage & Re-use: Usage scenarios related to (media) coverage & reuse comprise the activities required to cover performing arts in a variety of media, such as writing previews, reviews, or other news articles related to the performing arts; assembling cultural agendas; writing encyclopedic articles; contributing content on social media; or providing search and retrieval services for such content.

Live Audiences: Usage scenarios of live audiences comprise the exploration of performing arts offerings; the purchase of tickets and/or subscriptions; the search for information about the venue and its surroundings; and the sharing of their impressions and opinions with other interested people in offline and online settings.

Online Consumption: Usage scenarios in the area of online consumption comprise the activities related to the consumption of music, of digital recordings of live performances and of information related to the performing arts. Online consumption of recordings is an important means to discover artists and collectives whose shows or concerts people may eventually want to attend.

Heritage: Heritage usage scenarios comprise the activities related to taking stock, preserving, digitizing, organizing, describing, providing access to, and mediating information and cultural artefacts related to the performing arts.

Research & Education: Usage scenarios related to research & education comprise a variety of activities related to the generation, description, and diffusion of knowledge and skills related to the performing arts.

3.3 Integrated view of stakeholder requirements regarding data coverage

Based on the usage scenarios of the various key stakeholder groups and the Data Model for the Swiss Performing Arts Platform (Estermann/Schneeberger, 2017), an overview of stakeholder requirements regarding data coverage was established (see the overview table in appendix 10.2).

Note that some of the usage scenarios in the areas of production, presentation, promotion, (media) coverage, re-use, and live audiences require access to (quasi-) real time data, while the timeliness criterion is of little relevance for the other usage scenarios. By putting the different requirements in relation to each other, the information required by most stakeholder groups alike could be identified. The respective data can be considered as the common data core of the linked open data ecosystem for the performing arts. This common data core mainly comprises information about the

ISSN 2421-2679

performing arts events (individual performances, performing arts productions, and super-events, such as festivals) as well as information about the literary, musical, and choreographic works the performances are based on. For either of these classes, multiple attributes are of interest to a variety of stakeholders: Whose work is/was performed by whom where and when in which language? What is the genre of the work? Its origin? How was the performance received by the critics and the audience? Virtually all stakeholder groups are also interested in some minimal information about the people and organizations involved in the performances and about the venues where the performances are taking/took place.

Apart from the information required by all categories of stakeholders, there is other data that is of interest only to a few stakeholder groups. The overview table can thus serve as a guide to identify potential areas of cooperation between individual stakeholder groups, pointing to latent synergies in the area of data management that may make it worthwhile to interlink or to merge existing databases.

4 Bootstrapping the Linked Open Data Ecosystem

Building up the Linked Open Data Ecosystem for the Performing Arts as it has been envisioned will be a long and challenging process. Many different stakeholders will need to change the way they think about data and collaboration, various elements of the common infrastructure still need to be developed and deployed, and new governance structures need to be agreed upon and implemented. In order to encourage and sustain initial efforts, it is crucial to focus them on realizing quick wins and to progressively address the issues that are key to ensuring the long-term sustainability of the ecosystem. In this section we draw on the insights gathered through several pilot projects and workshops with practitioners to suggest activities that are likely to lead to quick-wins and to identify fields where further coordination and research are needed in order to achieve the vision set out.

When it comes to bootstrapping the Linked Open Data Ecosystem for the Performing Arts, there are two promising avenues that are complementary to each other. On the one hand, the knowledge base can be built up by piecing together information about the past, based on the data held by heritage institutions or the performance history of individual organizations. This approach has been pursued in most cases of linked open data publication mentioned above. On the other hand, the knowledge base can be built up by tapping into the performing arts value chain, aggregating data about current and future performing events. This approach is being pursued in the case of the Artsdata.ca Knowledge Graph. An earlier example is Operabase (Operabase 2019), which has been pursuing this approach since 1996, resulting in an international performance history database for opera covering over 20 years. Unfortunately, large parts of this database are proprietary and therefore cannot readily be integrated into an international knowledge base founded on the principles of linked open data. Eventually, all sustained efforts to systematically collect data about upcoming performing events will result in a historical database. And no matter whether data collection is geared towards inventorying future performances or towards documenting past events, it is useful to start out from larger, well-maintained existing databases that contain data about works, venues, persons, and organizations involved in performing arts productions. Furthermore, collective efforts to aggregate data should be driven by flexible usage scenarios that yield incremental benefits, with a focus on low-hanging fruits.

Regarding archival usage scenarios, there are several low-hanging fruits that could be aimed for and will primarily benefit the users of archives and documentation centers, which include researchers, educators, as well as artists. Thus, during two workshops with representatives of theatre archives and documentation centers in 2018 and 2019, the following areas were identified where quick-wins could be expected:

- Provide a high-level overview of what material can be found in the various archives and documentation centers. On which platform to realize this still needs to be clarified.
- Facilitate a first search for archival material by creating a “Worldcat” for

ISSN 2421-2679

theatre – a central finding aid with pointers to archival materials with direct references to entries in the institutions' online catalogues and, to the extent possible, to the digital documents themselves. As has been demonstrated in the course of a pilot project involving three major libraries in Switzerland (Estermann 2019), this can be achieved by enriching Wikidata with the relevant data and by extending the search functionalities on existing online library catalogues by a graph-based search drawing on Wikidata. It thereby does not matter where the respective archival fonds are located – a search for a given person or organization will bring up pointers to all relevant resources, provided that they are properly referenced in Wikidata.

- Improve the interlinking between existing archival databases by referring to the same named entities. Use Wikidata in a complementary fashion where other authority files lack the necessary coverage.
- Complement the data held by a given archive with data obtained from third party sources. Obvious sources of such data are Wikidata or long-established authority files, such as *GND**. Further valuable sources may become accessible as more and more institutions provide their data in an interoperable format.
- Use anniversaries as an occasion to systematically process and publish the data in a specific area (e.g. performance history of a specific theatre company, of an artist, etc.). Anniversaries are a good occasion to attract public attention and to obtain extra funding; at the same time, coherent, systematically curated data corpuses are particularly attractive for researchers.
- Set up a European version of the Artsdata.ca database, initially in the form of a small pilot that demonstrates the potential of cooperating across institutional and national boundaries. It is important to have an attractive showcase to get further institutions on board and to convince them of the benefits of pooling their databases and maintaining them in a collaborative manner.

Low-hanging fruits in the area of coverage and re-use comprise the use of Wikidata-driven infoboxes in a variety of Wikipedia articles (e.g. articles on musical and dramatic works, artists, venues, arts organizations, heritage institutions, etc.). In 2019, a project was started to systematically enhance the data on Wikidata and to create such infoboxes in various language versions of Wikipedia (Fontenelle/Estermann 2019); this project is currently being extended to also cover performing arts venues. In addition to creating Wikidata-powered infoboxes, it is also possible to complement Wikipedia articles by adding Wikidata-powered lists, provided that the data on Wikidata is complete. In the context of Wikipedia, Wikidata has the function of a central repository for structured data, which will tremendously lower the efforts needed for data maintenance, once the data has been pooled across the different language versions.

In the area of presentation & promotion, quick wins can be achieved by exposing data about current and future performances in a format that allows search engines and intelligent personal assistants to interpret and to aggregate the information more easily. This is the approach currently pursued by the Canadian start-up company Culture Creates (Saumier-Finch 2019). It is complemented by efforts undertaken by RIDEAU, one of the most important players on the French-Canadian production market, which through its platform Scène Pro aims to integrate and facilitate several operations such as showcase application, event registration, and block-booking. Their aim is to reduce manual data population into different systems and to enable the re-use of core data across several business processes (Estermann/Julien 2019).

Whatever usage scenario is pursued first, the hen-and-egg problem of linked open data publication and consumption needs to be overcome (Estermann 2018). A flourishing linked data ecosystem requires attractive applications running on high-quality data. However, without complete and high-quality data, even the best application is not that great, while incentives to improve the data basis are lacking in the absence of a widely used application. The focus therefore needs to be laid on the creation of concrete applications linked to viable business models, which allow to incrementally build up

ISSN 2421-2679

the Linked Open Data Ecosystem for the Performing Arts. It is thereby crucial to create added value for those stakeholders who are expected to make an additional effort to contribute or to enhance performing arts related data.

Given the concept and the current state of implementation of the Linked Open Data Ecosystem for the Performing Arts, there are several areas where further research and/or clarification are needed. For one, the requirements regarding the *ontology** and the actual data contained in the knowledge base should be further elaborated in view of specific use cases served by concrete applications. The knowledge base could then be evaluated and further developed with concrete competency questions in mind (cf. Ren et al. 2014). Further efforts should also be put into developing and describing (novel) business models relying on the use of the knowledge base. It should be analyzed to what extent the key players of the performing arts value network will be able to economically sustain their contributions to the common knowledge base in the long run. For this purpose, it will be important to differentiate between one-time investments (sunk costs that can be covered by a one-time project) on one hand, and the cost for regular contributions of new data and continuous data maintenance on the other hand. As Langeveld et al. (2014) note, there are competing and converging interests among the stakeholders of the performing arts value network. In some cases, data sharing will be beneficial to all players, in others, some players will have an incentive to withhold data due to competitive dynamics. When tapping into the performing arts value chain to build up the Linked Open Data Ecosystem for the Performing Arts, it is therefore important to understand these dynamics and to gain insights into what types of cooperation would be facilitated by increased data sharing/pooling. Also, there should be a data governance framework detailing who is expected to share what type of data with whom. Some data may best be shared only between the parties to a specific transaction or on a particular market. In a similar vein, it should be clarified who is expected to have the authority over which data/information, including personal information. There will be a need to balance personal, commercial, and public interests. To maintain a healthy data ecosystem, it will be necessary to source statements, to track data provenance and to critically assess sources of information. When it comes to balancing various interests, political, legal and ethical issues will need to be considered (Estermann et al. 2018). Regarding data governance at an institutional level, organizations will need to develop a policy as to whether and how to integrate data gathered through crowdsourcing back into their authoritative databases (cf. Zeinstra 2019). Processes will need to be put in place to keep partly overlapping databases in sync. Before publishing linked data on a larger scale, a variety of data modelling issues need to be resolved. Lack of harmonization will lead to interoperability issues later, which will render data maintenance and data use costlier. In a similar vein, it should be clarified which *reification** approach to choose. Some sort of reification will be needed to represent triangular relationships between entities (e.g. in the case of character roles that are defined by a literary work and played by an actor in the context of a specific performing arts production). Reification will also be required when it comes to sourcing statements and to implementing a version history for individual statements. Lack of harmonization in this area will also lead to interoperability issues. And looking into the future, opportunities to use machine-learning approaches in combination with a knowledge base should be explored when it comes to datafying and indexing existing documents related to the performing arts (e.g. by semi-automatically extracting data from PDF documents; semi-automatically tagging persons or characters in photographs; automatically segmenting and indexing audio or video recordings; etc.).

Conclusion

While various elements of the Linked Open Data Ecosystem for the Performing Arts have already been put in place, which is the case with large parts of the shared ontology as well as several pilot implementations, many challenges still lie ahead. To tackle them, the advisory committee of the Canadian Arts Presenting Association's Linked Digital Future Initiative (Linked Digital Future 2019) has made five recommendations

ISSN 2421-2679

in view of the further implementation of the initiative (Estermann/Julien 2019), which, *mutatis mutandis*, can be applied in view of the further development of an international Linked Open Data Ecosystem for the Performing Arts. We are thus concluding this article with an adapted version of these recommendations which may guide the activities of the various stakeholders of the performing arts value network across the globe:

Immediate focus should be placed on publishing data as linked open data. To do so, data about past, current and future events should be ingested into a common knowledge graph, such as Artsdata.ca, or made available through interoperable data systems. Particular effort should be put into publishing base registers, authority files, and controlled vocabularies, as they facilitate the interlinking of databases.

Wikidata and databases following the classical approach to publishing linked open data are complementary; efforts should therefore be undertaken to contribute to the population of Wikidata with performing arts related data. Wikidata is particularly well suited for publishing data in areas where it is unclear who would be the "natural" authority on a global scale, where there is a high potential for enhancing data through crowdsourcing approaches (including community or expert sourcing), where data is likely to be reused in the context of Wikipedia, and/or where international coordination to ensure semantic interoperability of the data is unlikely to take place outside Wikidata.

A data governance framework needs to be developed in cooperation with representatives from across the arts sector in order to establish who is able to share what type of data with whom, and who will have authority over which data/information. The governance framework needs to address technical, ethical and business aspects.

Further research is needed to better understand **user requirements with regard to the adoption of linked open data practices in service offerings**. Stakeholders who are expected to make an additional effort to contribute or enhance performing arts related data should know why they are doing so and for whom. Collective efforts to aggregate data should be driven by flexible usage scenarios that yield incremental benefits to users, with a focus on low-hanging fruit.

Further effort is required to develop and describe novel **business models that leverage and maintain a well-functioning linked open data ecosystem**. It is essential to evaluate the long-term economic sustainability for individual contributions to the common knowledge graph by key players in the performing arts value network. Whereas one-time investments may be funded through individual project grants, recurring costs should be shouldered by service providers as part of their core business and by the immediate beneficiaries of the services provided. Their funders and sponsors need to be made aware of the long-term benefits of maintaining a common knowledge graph, both in terms of efficiency gains within the performing arts value network and in terms of improved visibility of the arts sector's offerings.

Acknowledgements

The conceptual work leading up to this article is the result of several projects that have been pursued by the Bern University of Applied Sciences over the past seven years in various constellations. Various partners, colleagues and clients have introduced me to different sections of the performing arts value network, and several of them had – independently from each other – developed visions of an international knowledge base of the performing arts that are very similar to the one set out in this article. Thereby, I am particularly indebted to:

- Christian Schneeberger, Swiss Archive of the Performing Arts, Bern, Switzerland
- Birk Weiberg, Swiss Archive of the Performing Arts, Bern, Switzerland
- Vassilis Katsouros, Athena Research and Innovation Centre, Athens, Greece
- Donatella Gavrilovich, University of Rome "Tor Vergata", Rome, Italy
- Adrian Gschwend, Zazuko GmbH, Biel/Bienne, Switzerland
- Julia Beck, Specialised Information Services Performing Arts, Frankfurt, Germany
- Laura Möckli, Bern University of the Arts, Bern,

Switzerland
- Thomas Gartmann, Bern University of the Arts, Bern, Switzerland
- Frédéric Julien, CAPACOA, Ottawa, Canada
- Gregory Saumier-Finch, Culture Creates, Montreal, Canada.

My gratitude also goes to the members of the advisory committee of the Canadian Arts Presenting Association's Linked Digital Future Initiative, who critically accompanied our work over the past year, and who have suggested the name "Linked Open Data Ecosystem for the Performing Arts (LODEPA)":

- Jean-Robert Bisaillon, iconoclaste musique inc. - metaD – TgiT, Montreal, Canada
- Clément Laberge, independent consultant, Québec, Canada
- Margaret Lam, BeMused Network, Toronto, Canada
- Tammy Lee, Culture Creates, Montreal, Canada
- Mariel Marshall, StagePage, Toronto, Canada
- Marie-Pier Pilote, RIDEAU, Montreal, Canada.

Furthermore, I would like to thank the participants of the workshops held at the Conference of the German Theatre Research Society in fall 2018 in Düsseldorf and during the ENICPA Round Table in fall 2019 in Prague for their helpful inputs. My special thanks also go to the following people who provided valuable feedback to earlier versions of this article:

- Jenny Fewster, AusStage, Adelaide, Australia
- Klaus Illmayer, University of Vienna, Austria
- Andy Mabbett, Freelancer and Wikidataist, Birmingham, United Kingdom
- Bart Magnus, Packed, Gent, Belgium
- Tom Ruette, Flanders Arts Institute, Brussels, Belgium.

And last, but not least, I would like to thank my colleague, Flurina Wäspi, for her help in shortening and finalizing the article.

Bibliography

Bellini, Pierfrancesco - Nesi, Paolo, *Modeling performing arts metadata and relationships in content service for institutions*, «Multimedia Systems», vol. 21, n. 5, October 2015: 427-449.

Bonet, Lluis, - Schargorodsky, Héctor, *Theatre management: models and strategies for cultural venues,* Kunnskapsverket, Elverum 2018.

Cha, Min-Kyung - Kweon, Sang-Hee - Choi, Yoon-Jung - Won, Young-A - Kim, Hyun Joo, "A Research on Value Chain Structure of the Performing Arts Consumers' Social Media Usage-Application of Means-End Chain Theory and Involvement", *Intelligent Technologies for Interactive Entertainment,* Eds. Reidsma Dennis, Lecture Notes of the Institute for Computer Sciences, Social Informatics and Telecommunications Engineering, vol. 136, Springer, Cham 2014: 1-11.

Doerr, Martin - Bekiari, Chryssoula - LeBoeuf, Patrick - Bibliothèque nationale de France, "FRBRoo, a conceptual model for performing arts", *Annual Conference of CIDOC,* Athens, 2008.

Doerr, Martin - Gradmann, Stefan - Hennicke, Steffen - Isaac, Antoine - Meghini, Carlo - Van de Sompel, Herbert, "The europeana data model (edm)", *World Library and Information Congress 76th IFLA general conference and assembly,* August 2010.

Estermann, Beat, *How Wikidata is Solving Its Chicken-or-Egg-Problem in the Field of Cultural Heritage, SocietyByte*, 2018, https://www.societybyte.swiss/2018/11/ 07/ how-wikidata-is-solving-its-chicken-or-egg-problem-in-the-field-of-cultural-heritage/, online (last accessed 19/11/2019).

Estermann, Beat - Julien, Frédéric, *A Linked Digital Future for the Performing Arts: Leveraging Synergies along the Value Chain, Digital technologies and the arts,* Canadian Arts Presenting Association (CAPACOA) in cooperation with the Bern University of Applied Sciences, 2019.

Estermann, Beat - Fraefel, Marianne - Neuroni, Alessia - Vogel, Jürgen, *Conceptualizing a national data infrastructure for Switzerland,* «Information Polity», vol. 23, n. 1, 2018: 43-65.

Estermann, Beat - Schneeberger, Christian, *Data Model for the Swiss Performing Arts Platform,* Draft Version 0.51, Bern University of Applied Sciences, 2017.

Fontenelle, Giovanna - Estermann, Beat, *An International Knowledge Base for All Heritage Institutions, SocietyByte, July 2019* (part 1), https://www.societybyte.swiss/2019/07/04/ an-international-knowledge-base-for-all-heritage-institutions-part-1/, online (last accessed 19/11/2019).

Fontenelle, Giovanna - Estermann, Beat, *An International Knowledge Base for All Heritage*

ISSN 2421-2679

Institutions, SocietyByte, July 2019 (part 2), https://www.societybyte.swiss/2019/07/05/an-international-knowledge-base-for-all-heritage-institutions-part-2/, online (last accessed 19/11/2019).

Hausmann, Andrea - Poellmann, Lorenz, *Using social media for arts marketing: theoretical analysis and empirical insights for performing arts organizations,* «International Review on Public and Nonprofit Marketing», vol. 10, n. 2, 2013: 143-161.

Langeveld, Cees - Belme, Dora - Koppenberg, Tessa, *Collaboration and integration in performing arts. Enlarging financial, artistic and social value by doing it collectively: a qualitative study in the Netherlands,* Erasmus University Rotterdam, 2014.

Litvin, Stephen - Goldsmith, Ronald E. - Pan, Bing, *Electronic word-of-mouth in hospitality and tourism management,* «Tourism management», vol. 29 n. 3, 2008: 458 - 468.

Madudová, Emilia, *Creative industries value chain: The value chain logic in supply chain relationships,* «Marketing and Branding Research», vol. 4, n. 3, July 2017: 227- 235.

Preece, Stephen, *The performing arts value chain,* «International Journal of Arts Management», vol. 8, n. 1, 2005: 21-32.

Ren, Yuan - Parvizi, Artemis - Mellish, Chris - Pan, Jeff Z. - Van Deemter, Kees - Stevens, Robert, "Towards competency question-driven ontology authoring, European Semantic Web Conference", *The Semantic Web: Trends and Challenges,* Eds. Presutti, Valentina – D'Amato, Claudia – Gandon, Fabien L. – D'Aquin, Mathieu, Lecture Notes in Computer Science, vol. 8465, Springer, Cham, 2014: 752-767.

Riva, Pat - Doerr, Martin - Zumer, Maja, "FRBRoo: enabling a common view of information from memory institutions", in *World Library and Information Congress: 74th IFLA General Confrence and Council,* 2008.

Saumier-Finch, Gregory, *How art institutions can manage their metadata, SocietyByte,* June 2019, https://www.societybyte.swiss/2019/06/27/how-art-institutions-can-manage-their-metadata/, online (last accessed 19/11/2019).

United Nations, *International Standard Industrial Classification of All Economic Activities (ISIC),* Department of Economic and Social Affairs, Statistics Division, series M, no. 4, 2008.

Vrandecic, Denny - Krötzsch, Markus, *Wikidata: a free collaborative knowledge base,* «Communications of the ACM», vol. 57, n. 10, 2014: 78-85.

Ye, Qiang - Law, Rob - Gu, Bin - Chen, Wei, *The influence of user-generated content on traveler behavior: An empirical investigation on the effects of e-word-of-mouth to hotel online bookings,* «Computers in Human Behavior», vol. 27, n. 2, 2011: 634-639.

Zeinstra, Maarten, *Research report - Returning commons community metadata additions and corrections to their source,* IP Squared, March 2019.

Zhang, Julie - Ye, Qiang - Law, Rob - Li, Yijun, *The impact of e-word-of-mouth on the online popularity of restaurants: A comparison of consumer reviews and editor reviews,* «International Journal of Hospitality Management», vol. 29, n. 4, 2010: 694-700.

Sitography

AusStage, 2019, https://www.ausstage.edu.au/pages/learn/contribute/how-to/search_rdf.html, web (last accessed 19/11/2019)

Beat Estermann, 18.11.2019, "WD Hackdays 2019", *Wikidata*, https://www.wikidata.org/wiki/User:Beat_Estermann/WD_Hackdays_2019, web (last accessed 19/11/2019)

Doremus, http://data.doremus.org/, web (last accessed 19/11/2019)

GitHub, 2019 "Carnegie Hall Linked Data", https://github.com/CarnegieHall/linked-data#carnegie-hall-performance-history-as-linked-open-data, web (last accessed 19/11/2019)

Linked Digital Future, 2019, https://linkeddigitalfuture.ca/, web (last accessed 19/11/2019)

Marla Waltman Daschko, "Conceptual Framework for Culture Statistics 2011", *Statistics Canada*, 2011, https://www150.statcan.gc.ca/n1/pub/87-542-x/87-542-x2011001-eng.htm, web (last accessed 28/11/2019).

"NACE Rev. 2, Statistical classification of economic activities in the European Community", Eurostat, 2008, https://ec.europa.eu/eurostat/documents/3859598/5902521/KS-RA-07-015-EN.PDF, web (last accessed 19/11/2019).

"North American Industry Classification System (NAICS) Canada 2017 Version 3.0", *Statistics Canada*, https://www.statcan.gc.ca/eng/subjects/standard/ naics/2017/v3/index, web (last accessed 19/11/2019).

Operabase, 2019, https://www.operabase.com/en, web (last accessed 19/11/2019)

Wikidata, 2019, "Wikidata:WikiProject Performing arts/Data structure/Data modelling issues", https://www.wikidata.org/wiki/Wikidata:WikiProject_Performing_arts/Data_structure/Data_modelling_issues, web (last accessed 19/11/2019)

ISSN 2421-2679

Appendix

Glossary

Authority file	An authority file (or base register) contains a list of named entities which many data publishers link against. The term "authority file" is widely used within the heritage sector.
API	An "Application Programming Interface" is an interface between an application software and an application platform, through which all services are provided.
Base register	A base register (or authority file) contains a list of named entities which many data publishers link against. The term "base register" is widely used in the government sector and often refers to a register that is maintained by a public authority under a specific legal mandate.
GND	The "Gemeinsame Normdatei" (Integrated Authority File) is an international authority file for personal names, subject headings and corporate bodies. It is used for documentation in libraries and increasingly also by other types of heritage institutions. The GND is managed by the German National Library in cooperation with various regional library networks in German-speaking Europe and other partners.
HTTP	"Hypertext Transfer Protocol", an application protocol for distributed, collaborative, and hypermedia information systems; it provides the foundation of data communication for the World Wide Web.
IIIF	The International Image Interoperability Framework (IIIF) defines application programming interfaces that provide a standardized method for describing and delivering images over the web. Similarly to the linked data approach, this standard supports a decentralized platform architecture where content is made available by various servers from where it can be dynamically integrated into various online services provided by clients. While IIIF programming interfaces for image content have existed for several years, the IIIF standard for audiovisual content is currently under development.
ISNI	"International Standard Name Identifier" refers to a unique, global, cross-domain, standard, persistent identifier for a person or an organization involved in the production and exploitation of creative content. The development of the ISNI register is mainly driven by libraries, rights management societies, stakeholders of the book supply chain, aggregators and service suppliers.
Linked Data	"Linked Data" is structured data which is interlinked with other data so it becomes more useful through semantic queries. It builds upon standard Web technologies such as HTTP, RDF and URIs. The term has been coined by Tim Berners-Lee, director of the World Wide Web Consortium (W3C) in a 2006 design note about the Semantic Web project. Linked data may also be open data, in which case it is usually described as "Linked Open Data" (LOD).
Ontology	An ontology (sometimes also referred to as a data model or conceptual model) is a shared language that is used to represent aspects of the world in form of data. An ontology typically consist of classes and properties for which definitions are provided as well as rules how the classes and properties may be combined among each other.
Open Data	"Open Data" is data that is freely available to everyone to use and republish as they wish, without restrictions from copyright, patents or other mechanisms of control.
RDF	"Resource Description Framework", a family of W3C specifications used for the formal representation and exchange of linked data.
Reification	Reification in knowledge representation is the process of turning a statement into an object. Reification involves the representation of factual assertions that are referred to by other assertions. It is required to further qualify individual statements, e.g. to indicate their source or the period of their validity.
Semantic Web	The Semantic Web is an extension of the World Wide Web through standards set by the World Wide Web Consortium (W3C). The goal of the Semantic Web is to make Internet data machine-readable. To enable the encoding of semantics with the data, technologies such as Resource Description Framework (RDF) and Web Ontology Language (OWL) are used. The Semantic Web provides a common framework that allows data to be shared and reused across application, enterprise, and community boundaries.
SPARQL	"Simple Protocol and RDF Query Language" is the language used to define queries to a datastore of linked data. A standard API that can be queried using SPARQL is called a "SPARQL endpoint".
URI	A "Uniform Resource Identifier" is a string of characters used to identify names or resources on the Internet.
VIAF	The "Virtual International Authority File" is an international authority file resulting from a joint project of several national libraries to interlink their national authority files. Since 2012, the service is operated by the Online Computer Library Center (OCLC).
W3C	The "World Wide Web Consortium" is the main international standards organization for the World Wide Web.
Wikidata	Wikidata is a collaboratively edited knowledge base hosted by the Wikimedia Foundation and maintained by an online community which anybody can join. It runs on the MediaWiki software and uses the Wikibase extension to store structured data. The software provides the necessary online collaboration features, such as user management, version history, watchlists, discussion pages, etc. The data is provided free of copyright and can be queried through a SPARQL endpoint. One of the main purposes of Wikidata is to serve as a repository for the structured data used in the context of the free online encyclopaedia Wikipedia.

ISSN 2421-2679

Usage scenarios of key stakeholders

Source: Estermann & Julien 2019, pp. 25ff.

Example 1: Performing arts professionals

Who are performing arts professionals and what are their interests?

Performing arts professionals offer their services vis-à-vis producing organizations – either as freelancers or as employees (professional and labor market). Many of today's artists rely on web documentation to have references with whom they have performed, etc. Furthermore, stage directors, set designers, dramaturges, choreographers, conductors, and performers are interested in consulting documentation about earlier productions as a source of inspiration. Pointers to material held by institutions in their region is helpful; immediate online access is a plus.

Usage scenario:

In a linked digital future, performing arts professionals have the possibility to curate the information about themselves on dedicated platforms and/or on Wikidata / Wikimedia Commons from where it can be included in further offerings along the performing arts value chain by production companies and by presenters / promoters. Thereby, the various claims made can be backed up with data from reliable sources that are made available online on a permanent basis. Conversely, performing arts professionals can gain an immediate overview of the complete performance history of various artists, production companies, venues, composers, playwrights, etc. Thanks to the fact that the finding aids of performing arts archives and documentation centres contain references to the International Knowledge Base for the Performing Arts, it is easy to locate artefacts documenting specific performances and to retrieve information about their whereabouts, their conditions of access, and their digitization status.

Example 2: Performing arts production companies

Who are performing arts production companies and what are their interests?

Representatives of producing organizations or of individual artists who produce their own concerts/shows list their concerts/shows on various online platforms where presenters can access information about them. They also submit applications for showcase or contact events where presenters seek to find tour-ready performances for their festivals or series/seasons (production market). One of their goals is to sell the shows to presenters and to provide them with the necessary information intended for the public at large. Some Performing arts production companies play the role of presenters themselves and self-present their productions to the public (consumption market), in which case their use of data is very similar to that of performing arts presenters (see below). *Their requirements related to the professional and labor market have not been covered yet.*

Usage scenario:

In a linked digital future, online platforms catering to the production market are largely interoperable thanks to the use of the same data model and the publication of most of the data about artists and their concerts/shows as linked open data (at the exception of sensitive personal data and commercially sensitive data). Similarly, public information about producing and presenting organizations is shared as linked open data and made available in the context of the International Knowledge Base for the Performing Arts. In this way, the same data needs to be entered only once and can be managed in one place and be propagated to other platforms, including platforms targeted at the public at large. Furthermore, interlinking with other publicly available information is facilitated (e.g. Wikipedia articles about artists, data about the classical repertoire, etc.). Furthermore, by ensuring that every artist, every concert/show, every venue, etc. is attributed its own unique identifier, these resources become "addressable" by anyone in the world, which greatly facilitates the aggregation of information about them.

Example 3: Theatre/concert goers

Who are theatre/concert goers and what are their interests?

Theatre/concert goers are interested in receiving location-sensitive, up-to-date and complete information about performing arts experiences in areas and for time periods of their choice whenever they require them

ISSN 2421-2679

(several months ahead of the performance or a couple of hours beforehand). They typically appreciate photos and video previews of the performances and are interested in content mediation (by journalists, by domain experts), in reviews or ratings by other theatre/concert goers and require easy access to transaction services for the (online) purchase of tickets. During or after the show, some theatre/concert goers like to share their photos and impressions on social media and to interact with others who have attended the same or similar concerts/shows. There is nowadays a continuum between live spectatorship and consuming additional material about the show online.

Usage scenario:
In a linked digital future, theatre/concert goers have ubiquitous, up-to-date access to information about performing arts experiences in their area. Thanks to the publication of relevant data as linked open data by producing organizations and presenters/promoters, search engines and computer-based personal assistants have immediate access to geo-located, timely, and up-to-date information about performing arts experiences. Thanks to the appropriate interlinking of reviews and online discussions with the information about the actual production, it is easy for theatre/concert goers to navigate between reviews, online discussions, information about upcoming performances, and the corresponding online ticket stores. Furthermore, when sharing their photos and impressions concerning their performing arts experience, theatre/concert goers can tag them with the unique identifier of their concert/show. This makes it easier for others to retrieve further information about the concert/show in question and possibly purchase a ticket themselves. Also, it facilitates the online exchange among spectators of the same show/concert and fosters electronic word-of-mouth.

Example 4: Heritage institutions

What are heritage institutions and what are their interests?
Heritage institutions with performing arts related holdings are interested in managing some of their data in collaboration with other institutions to use synergies and to avoid duplication of effort. They may also want to use crowdsourcing approaches to complement their data. For digitization and preservation planning as well as for purposes of rights clearance, heritage institutions require access to information that allow them to contextualize their collection items and to establish their rarity or uniqueness as well as their rights situation. To offer an attractive service to their users, heritage institutions need to provide powerful and user-friendly finding aids as well as online-access to digitized/digital collections in their thematic area (both to their own and to thematically related collections). Among their main users are researchers, educators and learners, performing arts professionals, content re-users, such as media professionals or lexicographers, as well as members of the interested public.

Usage scenario:
In a linked digital future, heritage institutions avoid duplication of effort by collaboratively curating data that concerns several of them (e.g. data about persons, artist collectives, organizations, venues, and maybe even performing arts productions that are referenced in their catalogues or finding aids) and use crowdsourcing approaches to complement their data. By seamlessly connecting their finding aids with the knowledge graph curated by artists, production companies, presenters, and private collectors they are able to eliminate a series of work steps related to media breaks. This leaves them more resources to focus on the curation of the data for which they are the recognized authority and to digitize data and content from the past. By systematically sharing data with other institutions, they can focus their digitization activities on the most relevant holdings in terms of rarity and uniqueness. Thanks to the International Knowledge Base for the Performing Arts, heritage institutions can offer an attractive service to their users, providing them with a powerful finding aid to locate documents both from their own holdings and from third parties, with the possibility of filtering search results according to a variety of criteria.

ISSN 2421-2679

Stakeholder requirements regarding data coverage

Source: Estermann & Julien 2019, pp. 41ff.

Type of Data (Classes and Attributes)	Production	Presentation & Promotion	Coverage & Re-use	Live Audiences	Online Consumption	Heritage	Research & Education
Performing Arts Production							
title	x	x	x	x	x	x	x
genre	x	x	x	x	x	x	x
work(s) performed, set list	x	x	x	x	x	x	x
production company	x	x	x	x	x	x	x
venue(s)	x	x	x	x	x	x	x
first performance location	x	x	x	x	x	x	x
first performance date	x	x	x	x	x	x	x
premiere type	x	x	x	x	x	x	x
number of representations	x	x					
people in key roles of the production process (stage director, conductor, choreographer, set designer, costume designer, dramaturge, translator, adaptor)	x	x	x	x	x	x	x
people in key roles of the performance (cast, musicians)	x	x	x	x	x	x	x
technical staff	x	x					
presenting organization	x	x					
representative image(s), promotional teasers/trailers	x	x	x	x	x		
technical rider	x	x					
textual description (for promotional purposes)	*x*	*x*		*x*			
pointers to artefacts documenting the production process (including information about the documents' rights status)			x			x	x
pointers to artefacts documenting the performance(s) (recordings, stage photographs) (including information about the artefacts' rights status)	x		x		x	x	x
pointers to artefacts documenting the reception of the performance(s) (reviews, audience statistics, etc.)	x	x	x	x	x	x	x
pointers to previews and reviews of the performance(s) in the media (including blogs and social media)		x		x			
Individual Performance							
people in key roles of the performance if they vary along the production (substitutes, guest appearances, guest conductor)	x	x	x	x	x	x	x
venue if it varies along the production (e.g. concert tours, touring theatre productions)	x	x	x	x	x	x	x
date and time	x	x	x	x	x	x	x
pointer to super-event (e.g. festival)	x	x	x	x	x	x	x

Type of Data (Classes and Attributes)	Production	Presentation & Promotion	Coverage & Re-use	Live Audiences	Online Consumption	Heritage	Research & Education
available tickets (including pricing information)		x		x			
presenting organization	x	x					
Festival (or other type of super-event)							
date and time	**x**	**x**	**x**	**x**	**x**	**x**	**x**
place	**x**	**x**	**x**	**x**	**x**	**x**	**x**
pointers to individual performances	**x**	**x**	**x**	**x**	**x**	**x**	**x**
artistic director	x	x	x			x	x
available tickets (including pricing information)		x		x			
venues	x	x		x			
Literary, musical, choreographic work (serving as a basis for a performing arts production)							
title	**x**	**x**	**x**	**x**	**x**	**x**	**x**
genre	**x**	**x**	**x**	**x**	**x**	**x**	**x**
creator(s) (or information about the origin of a work where no individual creator(s) are known)	**x**	**x**	**x**	**x**	**x**	**x**	**x**
other key contributors (translator, adaptor)	**x**	**x**	**x**	**x**	**x**	**x**	**x**
date of creation / publication	**x**	**x**	**x**	**x**	**x**	**x**	**x**
place of creation / publication	**x**	**x**	**x**	**x**	**x**	**x**	**x**
language of content (if applicable)	**x**	**x**	**x**	**x**	**x**	**x**	**x**
publisher	x	x	x		x	x	x
rightsholders	x		x			(x)	(x)
licensing information	x		x			x	x
purchase information regarding performing rights	x						
purchase information regarding publication rights			x			(x)	(x)
digitization status						(x)	x
pointer to analogue copy	x				x	x	x
pointer to digital copy	x			x	x	x	x
representative image(s)		x	x	x			
Recording of a live performance							
conditions of access	x	x			x	x	x
licensing information			x			x	x
Performing Arts Professional (performing artists, stage directors, choreographers, etc.)							
name (given name(s), family name, patronymic where applicable)	**x**	**x**	**x**	**x**	**x**	**x**	**x**
aliases or stage names (where applicable)	**x**	**x**	**x**	**x**	**x**	**x**	**x**
occupation (including voice type for singers, instruments for instrumentalists, performing languages of actors)	**x**	**x**	**x**	**x**	**x**	**x**	**x**
birth date	x	x		x		x	x
place of birth		x	x				

ISSN 2421-2679

Type of Data (Classes and Attributes)	Production	Presentation & Promotion	Coverage & Re-use	Live Audiences	Online Consumption	Heritage	Research & Education
place of education	x	x	x			x	x
place of residence	x	x	x				
date of death	x				x	x	x
place of death			x				
professional contact details (manager, agent)	x						
availability (including repertoire)	x						
hiring conditions	x						
representative photograph (including information about the rights status of the photograph)	x	x	x			x	
short biography	**x**	**x**	**x**	**x**	**x**	**x**	**x**
Performing Artists' Collective							
name	**x**	**x**	**x**	**x**	**x**	**x**	**x**
registered office	(x)	x				x	
date of creation						x	x
members (founding members, currently active members, past members)	(x)	(x)				(x)	(x)
contact details (manager, agent)	x						
availability (including repertoire)	x						
hiring conditions	x						
representative photograph (including information about the rights status of the photograph)		x	x	x		x	
Production Company							
name	**x**	**x**	**x**	**x**	**x**	**x**	**x**
registered office	x					x	
date of creation						x	
president of the board	x						
artistic director	x	x				x	x
key artistic staff members	x					x	
artists' collectives that are part of the production company (e.g. theatre troupe, symphonic orchestra, choir, etc.)	x					x	
administrative director	x						
contact details, agent/representative information	x	x					
job openings, conditions	x						
Presenting Organization, Promoter							
name		x					
contact details		x					
conditions		x					
Professional Association							
name	?	?				x	
registered office	?	?				x	
date of creation						x	
president						x	
members	?	?				x	

ISSN 2421-2679

Type of Data (Classes and Attributes)	Production	Presentation & Promotion	Coverage & Re-use	Live Audiences	Online Consumption	Heritage	Research & Education
Venue							
name	**x**	**x**	**x**	**x**	**x**	**x**	**x**
location	x	x	x	x		x	x
date of creation						x	x
owner/manager		x				x	
transformations (history)						x	x
equipment (e.g. sound system, etc.)	x	x					x
seating / space capacities	x	x					x
availability		x					
rental conditions		x					
accessibility		x		x			
transportation options		x		x			
information about restaurants, bars, cafés near the venue				x			
Heritage Institution							
name	x		x			x	x
physical location	x		x			x	x
date of creation							
contact details	x		x			x	x
fonds / collections	x		x			x	x
Fonds / Collection							
name	x		x			x	x
period of creation						x	x
originator						x	x
curator(s)						x	x
coverage (thematic, temporal, geographic)	x		x			x	x
conditions of access	x		x			x	x
internal structure (fonds, series, files)						x	
pointers to digital documents	x		x			x	x
Individual Artifact (documenting the creation, representation, or reception of a production/performance, the life or work of an artist, etc.; recordings of live performances see above)							
designation	x		x			x	x
date and context of creation			(x)			(x)	(x)
date and context of use	x		x			x	x
preservation information						x	x
conditions of access	x					x	x
rightsholder			x			x	x
licensing information			x			x	x
digitization status			x			x	x
pointer to a digital copy	x		x			x	x

Notes

1. The marked with an asterisk Glossary, in appendix to this article.
2. The figures reflect the current situation as of November 2019; not all databases clearly distinguish between performing arts productions (i.e. a run of quasi-identical performances) and individual performance events