The Italian Theatres and Archives Registry, the IDOS_ARTS

Research Centre and the HYPERSTAGE knowledge base for reconstructing theatrical productions

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Abstract : The article presents three projects launched in 2022 that focus on applying new technologies to the performing arts and cultural heritage for their safeguarding, enhancement, and dissemination of knowledge. The first is the RADATMAS project (Registry of Digital, Physical and Analogue Archives of Performing Arts and Theatres of Macerata), which serves as a case study for the creation of a census and new metadata schemes for theatre archives and their contents. The second project focuses on the 'International Digital Open Space on the Performing and Visual Arts Cultural Heritage' Research Centre (IDOS_ARTS). I proposed establishing this centre to foster coordination and collaboration between research groups at an international level, creating mutually beneficial partnerships. The third project is HYPERSTAGE, which is an open knowledge base for the semantic reconstruction of theatrical performances. It achieves this by harvesting and processing resources from the new Italian network of theatrical digital archives. The presentation covers the conception, the new methodology for organising data and the innovative structure of the ontology.

Keywords : Theatres and archives census; IDOS_ARTS; HYPERSTAGE; innovative ontology.

1 Introduction

In 2022 I conceived and launched three different projects, focused on the application of new technologies to the Performing Arts Cultural Heritage for its safeguarding, enhancement and knowledge dissemination. They are the result of a long path of study, research and work developed by attending international working groups and based on my dual knowledge and skills as a theatre historian but above all as an art historian.

The art historians deal with architectural models, urban planning and artefacts (e.g. paintings, sculptures, applied arts, etc.). As regard the artefact, they analyze the material, technique, and style, comparing it with others from the same historical period and/or different eras to study the expressive form and decode the content. They reconstruct its impact and historical meaning, recreating the social, political, cultural and artistic context in which it was produced.

From the art historians' point of view, a theatrical production is a complex monumental work of art, because it is made up of a huge amount of different nature elements (stage sketches, costumes, photos, scores, text, videos, actors, singers, directors, choreographers, etc.). The challenge is to organize and manage in simple and correct way the enormous heterogeneity of materials and documents and, at the same time, to design specific metadata schemas to analyze and logically connect them to each other, in order to reconstruct the theatrical event lost unity as a total work of art. Regarding the census project of theatres and archives in the Macerata area, as well as the international research centre project, I also applied the same methodological approach.

The present article explores the methodological research, analysis, data processing and results achieved in these three project challenges.

2 Italian Theatres and Archives Registry: a case study

In 2021, the DARIAH-EU Theatralia Work Group launched the idea to create the *International Theatrical Registry* (Papaki, 2021). I proposed extending the census to European theatre archives, which preserve documents and materials related both to the buildings and to theatrical productions. This project required the selection of a common methodology and criteria for the collection, analysis, processing, and compilation of digital data, as well as for the creation of an appropriate computational model of knowledge and description. Within the framework of the international meetings, organized remotely by WG Theatralia, I proposed a limited pilot study (case study) in a small urban context in Italy to facilitate both the census of existing active theatres and their related archives, as well as the collection of data. The choice fell on the city of Macerata and its area, located in the Marche region, which is characterized by: « […] a theatrical "density" relative to the population and the number of municipalities that is unparalleled in Italy and perhaps worldwide » (Latini 2024:178).

In February 2022, the RADATMAS project (Registry of Digital, Physical, and Analog Archives of Performing Arts and Theatres of Macerata) was launched with a small grant from the University of Rome "Tor Vergata." I organized the project in two preliminary phases. The first was focused on the census of Macerata and its fifty-five municipalities' theatres and their archives through the harvesting of data and historical-critical information, simultaneously cross-checking them with metadata held by the Ministry and the Marche Region. The second phase focused on the methodology for the gathering data organization and processing.

In Italy, there is no unified registry of all theatrical venues and public and private archives related to the performing arts, as no systematic national census has ever

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been conducted, only partial and incomplete surveys. Regarding theatre buildings, the Italian Ministry of Culture (MIC) has placed under its protection only those of "particular historical and artistic interest", disregarding all those venues adapted for theatrical events that still currently host live performances. The Teatro di Monte San Martino, for example, is missing from both the list of theatres of the Marche Region and that of the Province of Macerata. In the General Catalogue of Cultural Heritage, it is recorded as an architectural historical monument of Sixteenth century, without any mention of its current function as a theatre venue. RADTMAS census identified and catalogued it. For this reason, surveying theatre buildings has been a complex task, requiring a meticulous territory "sieving" to detect theatrical venues presence not properly reported by MIC.

The census of theatre archives turned out to be an even more challenging task. The Teatro Giuseppe Piermarini archive in Matelica, for example, preserves materials and documents dating from the nineteenth to the late twentieth century. In 1995, due to the restoration works on the building, there was a transfer of theatre ownership to the Municipality of Matelica. The Municipality of Matelica made the decision to relocate the theatre archive to its municipal archive, where the keeping of administrative records and correspondence is still ongoing. However, there has been a loss of the theatrical productions' documentation. The first phase of the project was completed in 2022.

RADTMAS census registered forty-one buildings and thirty-one theatre archives, compared to twenty-three theatres, three fonds, and one archival complex recorded by the Marche Region and the MIC[1] The results achieved, although limited to this case study, should be considered an initial experimentation with all the critical issues that will need to be addressed and resolved.

The second phase concerned the procedure to be adopted for the organization and standardization of the collected data in the Macerata census of theatres, their physical, analog, and digital archives, as well as the materials and documents contained therein. The question of adopting new methodological criteria for the metadata schema design therefore arose.

As for the metadata schema on the theatres census, we analyzed the results of international research and selected the classification table 'WikiProject Cultural Venues'[2] designed by Beat Estermann at the Bern University of Applied Sciences and his international team, who aim to expand and validate model for populating performing arts

[1] In 2020 MIC launched on SIUSA platform (Unified Information System for Archival Superintendencias) the database *Gli Archivi dello Spettacolo* (Performing Arts Archives), wich contains all archival fonds considered of notable historical interest, subdivided by regions and provinces. As regards "Macerata and its area" on SIUSA platform, the following is listed: "1 archival complex (Arianna Sartoria teatrale, Corridona); 8 producing entities (of which one is the aforementioned sartoria; two are individuals with archives located in other regions; two correspond to the archive of the Società Teatrale di Treia and that of the Teatro Comunale di Treia, which has been considered as two separate units due to a transfer of ownership; the last is the archive of the Teatro Lirico di Spoleto, which is located in Umbria); 1 custodian entity, namely the Archivio di Stato di Pesaro e Urbino, which is in another Marche province": https://siusa-archivi.cultura.gov.it/cgibin/siusa/pagina.pl?RicFrmRicSemplice=macerata\&imageField.x=8\&imageField.y=11\&RicVM=ricercasemplice\&RicProgetto=spettacolo\&RicLin=\&RicDimF=.

[2] https://www.wikidata.org/wiki/Wikidata:WikiProject_Cultural_venues

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related items in Wikidata (Estermann and Julien, 2019). Of course, we've reworked the Wiki classification table to suit our needs.

The general table "Data Collection Table for Theatres and Archives" [Figure 1] was divided into columns to order and describe in nutshell the metadata concerning each theatre surveyed according to the following categories: Name of the theatre; Country; Region; Province; Municipality; Address and Geographic Coordinates (for geolocation); Contacts; General Information (year of construction, year of most recent building restoration, architect, type of layout, currently active and/or inactive structure); Data (ownership, management, physical and analog historical archive, archive location, digital archive, research notes); Useful links.

Nome Teatro	Nazione	Regione	Provincia	Comune	Indirizzo e Coordinate	Contatti	Generalità	Dati	Link utili
Anfiteatro Romano Parco Archeologico Urbs Salvia	Italia	Marche	Macerata	Urbisaglia	**Indirizzo**: SS78, Contrada Anfiteatro, 62010, Urbisaglia, (MC) **Coordinate Geografiche**: 43.20105890505653, 13.387116966719 43	Contatti Comune Settore II° Urbanistica, edilizia, patrimonio, servizio trasporti e mense scolastiche Telefono: +0733512605 Email: ufficiotecnico@comune.urbisaglia.mc.it E-mail Pec: comune.urbisaglia.mc@legalmail.it (PEC)	•**Anno di costruzione**: 81 a.C. •**Anno dell'ultimo restauro**: - •**Architetto**: - •**Tipo di sala**: antico anfiteatro romano •**Struttura attualmente attiva**: Si	•**Proprietà dello stabile**: Proprietà demaniale in quanto scavo archeologico. •**Gestione**: Comune di Urbisaglia, Società Meridiana, AMAT •**Archivio storico analogico**: Si, solo atti di carteggio •**Location Archivio**: Archivio del Comune di Urbisaglia •**Archivio digitale**: No **Note di ricerca**:	**Musei di Urbisaglia**: http://www.urbisaglia.com/?page_id=2663#:~:text=Costruito%20fuori%20dalla%20cinta%20muraria,nel%20Museo%20Archeologico%20di%20Urbisaglia
Arena Gigli	Italia	Marche	Macerata	Porto Recanati	**Indirizzo**: Piazza Fratelli Brancondi, 1, 62010, Porto Recanati (MC) **Coordinate Geografiche**: 43.453049371786754, 13.588412382072873	Contatti del Comune di Porto Recanati, servizio Cultura: +39 0 71 759 971	•**Anno di costruzione**: XIII secolo •**Anno dell'ultimo restauro**: 2000 •**Architetto**: - •**Tipo di sala**: arena all'aperto •**Struttura attualmente attiva**: Si	•**Proprietà dello stabile**: Comune di Porto Recanati •**Gestione**: Comune di Porto Recanati, vari affittuari della struttura e AMAT •**Archivio storico analogico**: No, non tenendosi affatto uno storico delle attività all'interno dell'arena •**Location Archivio**: - •**Archivio digitale**: No **Note di ricerca**:	**Valle del Pensare**: http://www.valledelpensare.it/it/punto-di-interesse/poi/castello-svevo-116/
Arena Teatro Sferisterio	Italia	Marche	Macerata	Macerata	**Indirizzo**: Piazza Nazario Sauro, 62100, Macerata (MC) **Coordinate Geografiche**: 43.298671137497664, 13.455867783919151	Associazione arena Sferisterio : Teatro di Tradizione Via Santa Maria della Porta, 65 (62100) Macerata T. (+39) 0733 261334 info@sferisterio.it	sferisterio@pec.it	•**Anno di costruzione**: 1829 •**Anno dell'ultimo restauro**: 1990 •**Architetto**: Ireneo Aleandri •**Tipo di sala**: arena all'aperto, con gradinata rialzata, due ordini di palchi e balconata •**Struttura attualmente attiva**: Si	•**Proprietà dello stabile**: Comune di Macerata •**Gestione**: Comune di Macerata e Associazione "Arena Sferisterio" •**Archivio storico analogico**: Si, l'Arena Sferisterio possiede un archivio amministrativo e fotografico relativo alle attività svolte a partire dal 1965 in occasione della Stagione Lirica oltra ai relativi manifesti delle varie stagioni. •**Location Archivio**: Biblioteca Comunale Mozzi Borghetti •**Archivio digitale**: L'Associazione "Arena Sferisterio" ha digitalizzato alcuni dei materiali d'archivio per renderli pubblici nel sito dell'arena sferisterio. **Note di ricerca**:	**Sito Arena Teatro Sferisterio**: https://www.sferisterio.it/

Figure 1: The first sheet "Data Collection Table for Theatres and Archives of Macerata and its area". (Detail). 2022.

According to my methodological conception, based on the need to contextualize the collected data, I created historical-critical sheets for each theatre with architectural, artistic and cultural information, accompanied by illustrations. Of course, this highlights the complexity of this type of information that is impossible to reduce the essential: how to solve this issue?

To this is added another consideration concerning the organization of data: how to connect the metadata scheme of a theatre to own archive or to the archives of companies related to its theatre production?

So, the next phase involved designing a metadata scheme to organize data and information about the theatre's archives and warehouses, as well as those of the archives of public or private companies working on the theatrical event production (e.g., theatre tailoring).

To test the new classification model, two cataloguing sheets were designed. The first "Data Sheet of Historical Theatre Archive" concerns the organization of data on the warehouse, historical archive and digital archive of the Teatro Piermarini in Matelica (MC) [Figure 2]. The second "Data Sheet of Theatrical Tailoring Archive" relates to the archive and warehouse of the private company Sartoria Teatrale Arianna in Corridonia (MC). The metadata include: the name and address of the theatre or

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company; the historical archive; the storage area containing large-scale artistic and historical items such as set designs, stage equipment, or costumes; and the presence of a digital archive, specifying whether it is for internal consultation only or publicly accessible.

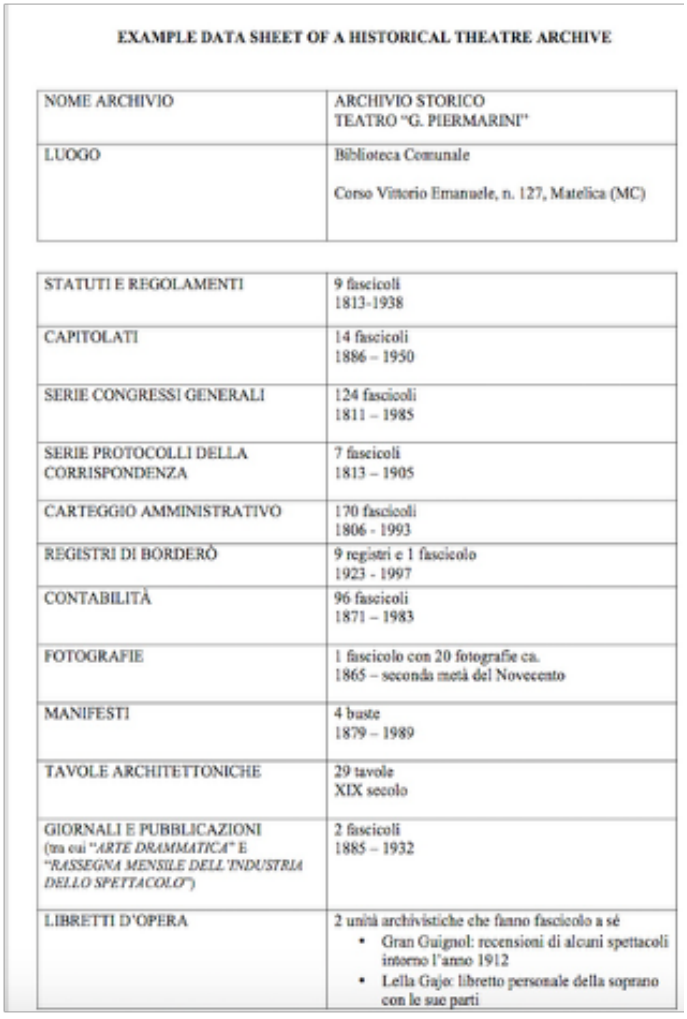
TABELLA PER LA CLASSIFICAZIONE E CATALOGAZIONE DI UN BENE STORICO ARTISTICO

LOCANDINA	Locandina in carta blu, affissa per la rappresentazione di "*Messalina*" di Pietro Cossa, messa in atto 20 settembre 1870 al teatro di Matelica.
NUMERO DI INVENTARIO	L'unità archivistica non ha un proprio numero di inventario. È identificata tramite le coordinate del fascicolo in cui è inserito. Busta 50 – fascicolo 1 L'unità viene identificata come "Messalina – 1879".
NUMERO DELLA SCHEDA DI CATALOGAZIONE	L'unità archivistica non ha una scheda di catalogazione propria.
NUMERO IDENTIFICATIVO PER L'OGGETTO DIGITALIZZATO	L'unità archivistica non è stata ancora sottoposta a digitalizzazione.
AUTORE	Locandina realizzata dalla Tipografia Pignotti.
DATAZIONE	1879
MATERIA E TECNICA	Litografia su carta blu
MISURE	65x48 cm
MATERIALE	Carta
SOGGETTO	Locandina per "Messalina" di Pietro Cossa, commedia storica in un prologo, sei atti ed in versi. Penultima recita della stagione. Spettacolo fuori abbonamento.
AUTORE DELL'OPERA	Pietro Cossa
LUOGO DELLA RAPPRESENTAZIONE	Teatro Condominiale – Matelica
DATA	20 settembre 1879, ore 8

Figure 2: Data Sheet of Historical Theatre Archive of the Teatro Piermarini. Matelica (MC)

Regarding the preserved materials, I had planned to create technical sheets for each document and artefact. Unfortunately, the project's timeline — expected to be completed within a year — did not allow for this. Nonetheless, a trial technical sheet was created for a theatre poster. This is because it represents a particular type of theatrical document. The data from the poster for the tragedy *Messalina*, by Pietro Cossa staged at the Teatro Piermarini in Matelica in 1879, was extracted and organized in the "Data sheet of a Poster" [Figure 3].

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EXAMPLE DATA SHEET OF A HISTORICAL THEATRE ARCHIVE

NOME ARCHIVIO	ARCHIVIO STORICO TEATRO "G. PIERMARINI"
LUOGO	Biblioteca Comunale Corso Vittorio Emanuele, n. 127, Matelica (MC)

STATUTI E REGOLAMENTI	9 fascicoli 1813-1938
CAPITOLATI	14 fascicoli 1886 – 1950
SERIE CONGRESSI GENERALI	124 fascicoli 1811 – 1985
SERIE PROTOCOLLI DELLA CORRISPONDENZA	7 fascicoli 1813 – 1905
CARTEGGIO AMMINISTRATIVO	170 fascicoli 1806 - 1993
REGISTRI DI BORDERÒ	9 registri e 1 fascicolo 1923 - 1997
CONTABILITÀ	96 fascicoli 1871 – 1983
FOTOGRAFIE	1 fascicolo con 20 fotografie ca. 1865 – seconda metà del Novecento
MANIFESTI	4 buste 1879 – 1989
TAVOLE ARCHITETTONICHE	29 tavole XIX secolo
GIORNALI E PUBBLICAZIONI (tra cui "*ARTE DRAMMATICA*" E "*RASSEGNA MENSILE DELL'INDUSTRIA DELLO SPETTACOLO*")	2 fascicoli 1885 – 1932
LIBRETTI D'OPERA	2 unità archivistiche che fanno fascicolo a sé • Gran Guignol: recensioni di alcuni spettacoli intorno l'anno 1912 • Lella Gajo: libretto personale della soprano con le sue parti

Figure 3: Data Sheet of a Poster. Poster for the tragedy *Messalina*, by Pietro Cossa. Teatro Piermarini. Matelica.1879.

Recognizing the complexity of the work to be done, I invited Professor Roberto Basili of the Department of Enterprise Engineering at the University of Rome "Tor Vergata" to join the RADATMAS project. We discussed the need to create a database in which to store and organize all the data and information collected on the theatres and archives of Macerata, entrusting the design of Entity–Relationship diagrams [Figure 4] intended to clarify processes and relationships among entities to Elisa Passone, who is studying for a PhD in Data Science under my supervision.

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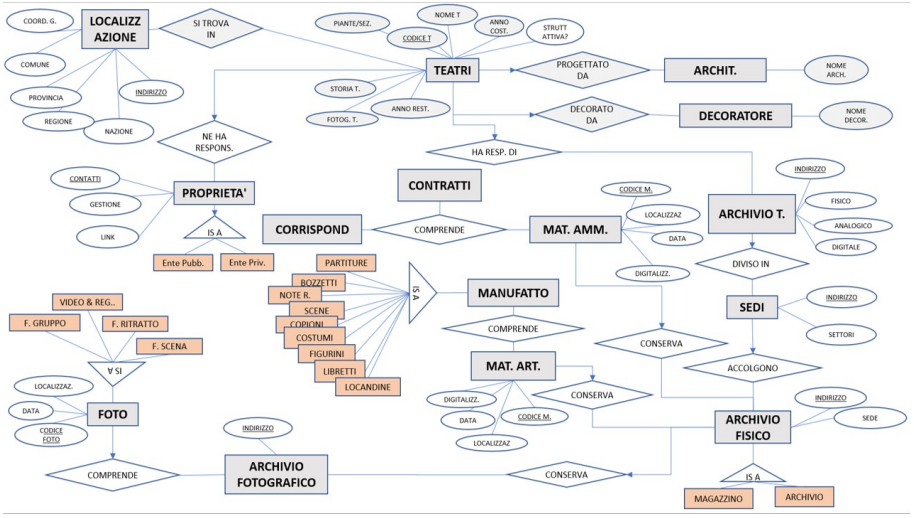


Figure 4: Design of Entity–Relationship diagrams, designed by Elisa Passone.

In 2023 she designed ArTBase (*Archive and Theatre Database*), aimed at creating the first database containing historical, artistic, and cultural data and information on theatre buildings and their archives in Italy. ArTBase now includes, organizes, and processes the metadata, documents, and materials gathered during the RADATMAS project, along with additional data collected by Passone on other Italian theatres and archives. The Artbase Project evolved into a complex form with the adaptation of Llama to the database, enabling natural language interrogation and an interactive interface[3]

3 IDOS_ARTS research centre

Since 2012 I have been involved in international projects focused on the application of new technologies in the Performing arts domain.

As an expert in Russian-Soviet theatre and art, from 2014 to 2016 I had the opportunity to work on the design of a virtual museum, dedicated to the actress Vera Komissarzhevskaya, in collaboration with IT experts from the Department of Computer Graphics of ITMO University of St. Petersburg (Gavrilovich-Smolin 2017: 157-164). This opportunity allowed me to familiarize myself with the tools, methodologies and products of their research, and most importantly, to witness the collaboration between humanists and computer scientists. In 2015, this team used stage and costume sketches, stage photographs, the director's acting notes, recordings of the actors' voices and music to reconstruct the historical staging of Lermontov's tragedy 'Maskarad', which was directed by Vsevolod Meyerhold in 1917[4] Following the discovery of Chekhov's drama 'The Seagull' script, which had lain hidden for over a century, it was possible to meticulously recreate the historic premiere scene by scene,

[3] https://www-2024.idos-arts.eu/2025/03/24/artchat-project/.
[4] https://www.vr-lab.com/projects/interactive-and-immersive-theater.

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visualizing the evolution of the acting in two dimensions. A Website dedicated to this project presents all the documents and materials used[5] Since 2014, Russian computer graphics experts have also created apps to involve spectators during rehearsals and to record their emotions during performances. The products of this research are still available on the Internet, but to find them you need to know that they exist.

Through participating in working groups comprising different institutions and nationalities, I realized that projects similar to those already completed were sometimes developed due to a lack of awareness of previous work. I also noticed that the focus was mainly on controlling vocabularies, standards, text analysis, creative processes, reception, and so on, while the problem of analyzing and processing metadata schemes relating to digital objects was neglected. These schemes pose many problems due to their quantity and heterogeneity.

I guess this is probably down to the art historians not being there all the time. Nevertheless, the interconnections between art and theatre are numerous in the performing arts domain.

For this reason, I came up with the idea of designing something that does not yet exist: the *International Digital Open Space on the Performing and Visual Arts Cultural Heritage* (IDOS*ARTS) Interinstitutional and Interuniversity Research Centre, which was established in July 2024 and is made up of leading experts in the field of researching the application of new technologies to the performing and visual arts worldwide[6]

'International' refers to the complete and inclusive global opening of all research conducted in the field of performing and visual arts, in both Western and Eastern contexts. 'Open space' refers to an open, collaborative and equal meeting place between the hard and soft sciences. It is based on the best practices of open access and open data and adheres to the principles of open science with regard to the exchange and usability of know-how and research results.

The IDOS_ARTS Research Centre aspires to establish coordination and collaboration between research groups at the international level, fostering mutually beneficial partnerships. It seeks to serve as a community platform for archiving, disseminating and enhancing research products and ongoing projects. Additionally, the Centre aims to facilitate network connections between Italian and foreign institutions, fostering collaborative research activities. Furthermore, the Centre plans and coordinates shared projects through the integration of diverse professional competencies, methodological approaches and disciplinary perspectives. The IDOS_ARTS will be officially launched in the framework of the II Global Congress on 'Digital Innovation in the Visual and Performing Arts', which will be held in Rome in November 2025.

[5] https://ch.itmo.ru/seagull/reconstruction/act-1.

[6] Information on governance, mission, activities, projects and news, as well as membership, is available on the Website: https://www-2024.idos-arts.eu/.

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4 Using data, artefacts and documents to recreate theatrical performances

The idea of creating an innovative model of knowledge base for theatre production was born from considerations and studies[7], which in April 2013 I had the opportunity to present during the *International Conference on Information Technologies for Performing Arts, Media Access and Entertainment*, organized within the ECLAP project (European Collected Library of Artistic Performance, 2010-2013) in Porto (Portugal).

My speech revolved around three fundamental points: the definition of 'theatrical production' as a complex cultural asset, a new methodological approach and the focus on the needs of the user (Gavrilovich 2013: 39-49). The argumented thesis is that theatrical events must be considered as total works of art, composed of different elements that cannot be dismembered from the whole and catalogued as independent documents and materials.

The tangible traces of the intangible theatrical performance (e.g. director's notes, scripts, scores, stage sketches, costumes, photographs, letters, etc.) are usually preserved and ordered by type in different places. The specialist in the field (e.g. art historian, costume historian) analyses each artefact as if it were a product, endowed with certain characteristics and independent of the context for which it was created. For example, experts study and catalogue the stage costume as if it were a garment and the costume sketch as like a high couture dress maquette. On the contrary, a costume embodies the character's visual identity, while a sketch often includes indications for the actor's posture, makeup, and gesture. Cataloguing these elements separately disrupts the cohesion and interpretative richness of the performance. The concept of indissoluble unity (costume and performer) in the creation of the character that the actor plays on stage is clearly perceived both by the audience and by the actor himself.

Charlie Chaplin's creation of the Little Tramp in 1914 demonstrates how costume alone can activate character identity and audience recognition. « I had no idea of the character – Chaplin wrote – But the moment I was dressed the clothes and the make-up made me feel the person he was. I walked on to the stage, he was born » (Robinson 2012: 99). The costume-character lives in the collective imagination regardless of the actor who played it. The audience associates and remembers the costume-character with the production as a whole—whether theatre, dance, or cinema. Therefore, spectators, costume designers, or researchers seeking information about a stage costume in a digital archive are not satisfied by a technical data sheet that only lists metadata related to the garment.

In 2010, the Italian Ministry of Culture introduced the first digital technical sheet for metadata relating to an ancient and contemporary garment, called VEAC sheet. Although it includes exhaustive metadata regarding the stage costume's physical condition, materials and decorations, there is no basic metadata related to the theatrical context, such as the theatre, director, actors, costume and set designer, etc.

[7] I presented the analysis of ontology existing models dedicated to performing arts (State of the Art) with relevant bibliography in two articles (Gavrilovich 2017: 28-39) and (Gavrilovich 2020: 57-70).

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Furthermore, the digital archives of different institutions that own and preserve materials and documents relating to the same theatrical performance are usually not connected to each other. As a result, there is no connection between the metadata of a costume and, for example, that of the costume sketch from which it was created.

This disconnection is comparable to the 'estrangement effect', whereby theatrical artefacts are decontextualized and interpreted outside of their performative function.

5 The Performance Knowledge Base Prototype

Based on the above, I began developing a proposal for a new, structured ontological model. This model would allow the theatrical event to be reconstructed in its historical and social context, using the collected information and documents. I had the idea of designing this pioneering model with a search engine for "theatrical production" to enable everybody to search and find the event X Y with all the metadata on the Internet. The purpose was twofold: on the one hand, to enable users to quickly find all the information they were looking for using 'search paths' based on logic rather than 'keywords'; and on the other hand, to make the materials immediately available for reading or downloading in digital format.

Between 2014 and 2015, I collaborated with a team of Performing Arts graduate students at the University of Rome "Tor Vergata" to define cataloguing rules and data aggregation strategies that emphasized the interdependence of documents and contributors. The new ontology was designed by setting up the logic of the search engine operation. This was done in order to identify a criterion for collecting and arranging all heterogeneous data. All metadata relating to the documentation of a theatrical event (e.g. stage sketches, costumes, texts, libretti, music and videos) and its contributors (e.g. directors, actors, dancers, choreographers and set and costume designers) must be considered as part of the event as a whole.

The main problem was how to aggregate the huge amount of heterogeneous data. In the Performing Arts domain, I realized that the usual methodological approach of IT specialists was not effective, so I proposed an alternative method of organizing the data according to the three fundamental phases of a theatrical production: conception, staging and after-staging documentation [Figure 5].

Despite lacking formal training in computer science and receiving no support from IT professionals, we produced a structured list typologies of theatrical artefacts [Figures 6 and 7], created basic graphics, and produced a PowerPoint presentation. The PowerPoint presentation allowed me to visualize the product and simulate how it would work on the Web, acting as the front end for the user. We had designed the new ontology, which we later called the Performance Knowledge Base (PKB), without realizing what we had done.

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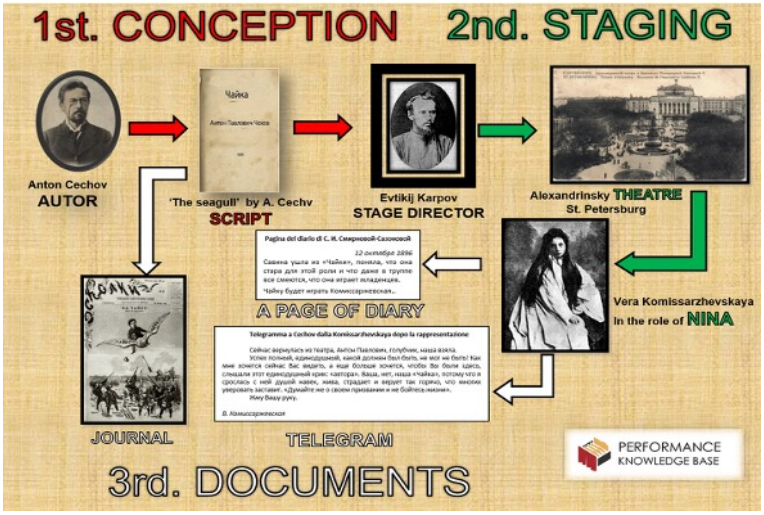


Figure 5: Method of the data organizing according to the three fundamental phases of a theatrical production. 2014.



Figure 6: Structered list typologies of theatrical artefacts.

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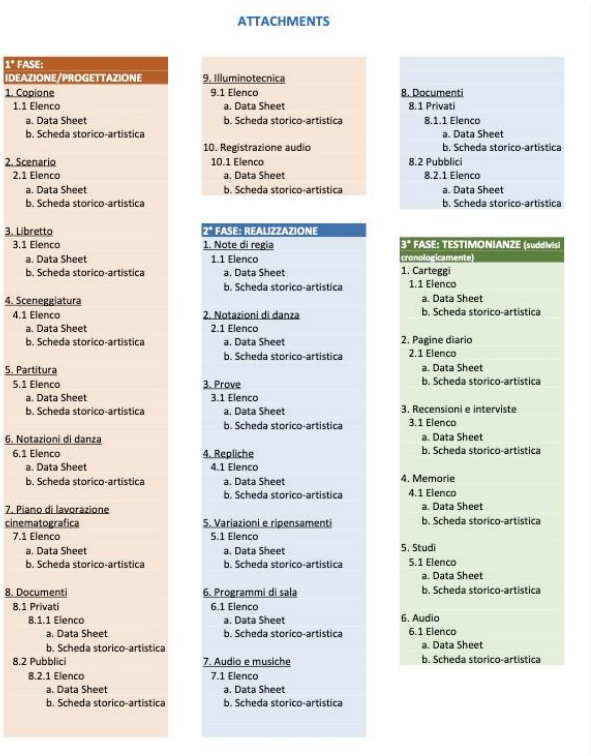


Figure 7: Structered list typologies of theatrical artefacts.

Since 2015, I have shared this proposed knowledge base model with the international research groups I collaborate with and received positive feedback.

In February 2022, Beat Estermann from Bern University of Applied Sciences asked me to send him my latest documentation regarding the PKB. He was particularly interested in the list and typology of artefacts related to the performing arts, as well as my mock-ups for the discovery service. The *WikiProject Performing arts/Typologies/Artefacts Documenting Activities Related to the Performing Arts* created by a group of Estermann students in collaboration with the LOPEDA team, as you can see, is a table which collects the artefacts in the three phases according to my conception.

6 From the PKB prototype to the HYPERSTAGE open knowledge base

Based on the PKB ontology conception and methodology, I developed the *HYPERSTAGE: an Open Knowledge base for the semantic reconstruction of theatrical performances through the harvesting and processing resources from the New Italian Network of theatrical digital archives* project, winning the PRIN competition in 2023, sup-

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ported by the Italian Ministry of Universities (MUR) and funded by the European Union's NextGenerationEU programme[8].

Hyperstage is built on a network of decentralized, interconnected databases of theatrical archive partners (Teatro alla Scala in Milan, Teatro Stabile in Turin, Teatro Olimpico in Vicenza, Fondazione Romaeuropa and National Institute of Ancient Drama in Syracuse). This architecture enables the seamless linking, thereby avoiding language-based interoperability issues.

Hyperstage connects these digital archives on a shared platform, preserving the original metadata and enhancing interoperability in accordance with the principles of Open Science. This approach enables the semantic reconstruction of theatrical events by enriching metadata with innovative ontological relationships.

The innovative 'Hyperstage' knowledge base model [Figure 8] combines a bottom-up Wikibase.cloud ontology for organizing and enhancing metadata with an integrated PKB taxonomy based on three categories: conception, staging and post-production documentation. The framework's allowance for automatic aggregation of each digital object associated with the theatrical production into one of these specified phases is a key feature. The project aims to transcend the traditional limits of theatrical data models through a system of ontological hierarchical relationships to trace the evolutionary path of works and identify influences and connections between different productions.

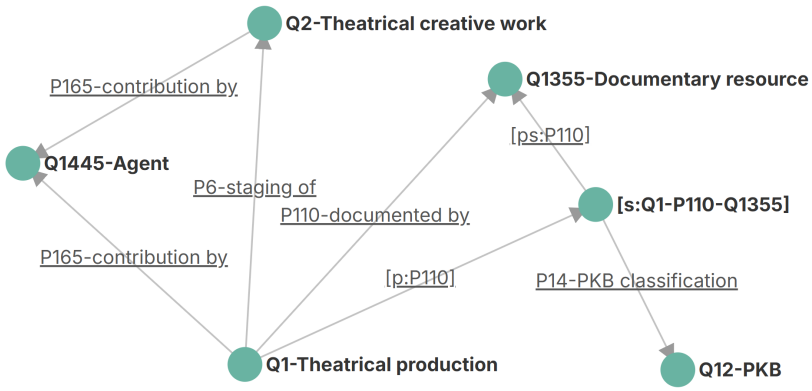


Figure 8: This graph, designed by Valeria Paraninfi, project research fellow, illustrates the Hyperstage ontological structure. This illustration only shows the main entities that structure the ontology. The entities total around 1,500 items, distinguished by the letter Q, and the properties total 166 items, distinguished by the letter P, which define the type of relationship between the elements.

[8]The member institutions of Hyperstage project are: University of Rome "Tor Vergata", University of Bologna, Academy of Fine Arts of Venice, IT Logos-ri association of Florence and Consortium GARR of Rome.

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Concerning the construction of Hyperstage ontology, we chose Wikibase Cloud because it is possible to model the ontology as we are creating it. Wikibase.cloud underpins the backend management (data input and archiving) of the Hyperstage project. This application leverages both SPARQL and Wikibase API for interaction with the Hyperstage Wikibase instance. Notably, Wikibase facilitates collaborative ontology development (essential due to the lack of a standardized international ontology) and participation in network of specialized Wikibase instances and Wikidata. This enables co-creation of a global, open, and free Linked Open Data knowledge graph.

7 'PKB' taxonomy of Hyperstage

Hyperstage introduces a significant innovation to the Wiki realm: the PKB classification[9].

This classification was mapped into an ontological model expressed in RDF format and made queryable *via* SPARQL queries. Thanks to the alphanumeric codes attributed to each digital object, it is possible to trace the object's quality — whether image, video, multimedia file, or document — sorted according to conception, staging, and post-staging documentation phases. Each digital object of an event is automatically classified into one of the three theatrical production phases according to its type *via* the PKb code.

Thus, the PKB classification solves, on the one hand, the problem of the huge amount of digital objects and documents, because it applies a logical criterion in accordance with the temporal scansion of the conception / staging / after staging documentation phases of the event. On the other hand, the PKB classification manages the heterogeneity of documents and digital materials, identifying a common determinant for assembling and organizing them into two large sectors, which I have called "Pictures" and "Attachments". The first group includes all digital objects characterized by images; the second group includes those characterized by text. In doubtful cases, for example a playbill with text and image, the criterion to follow is the relevance of one compared to the other.

8 How is the PKB code structured?

An alphanumeric code is assigned to each specific type of digital resource, allowing for the unique identification of the resource type.

BRAND – MACROCATEGORY-PHASE – TYPE – SUBTYPE 1/2/3

PKB – 0 PICTURES. 1 Conception – 00 Scene. 0100 Scene Sketches

PKB is the acronym to facilitate brand identification and to reduce ambiguity.

'01' The next two digits identify the MACRO CATEGORY and PHASE in which the digital object was produced:

[9] As a reminder of the original project, we attributed the name PKB to the Hyperstage classification of digital objects.

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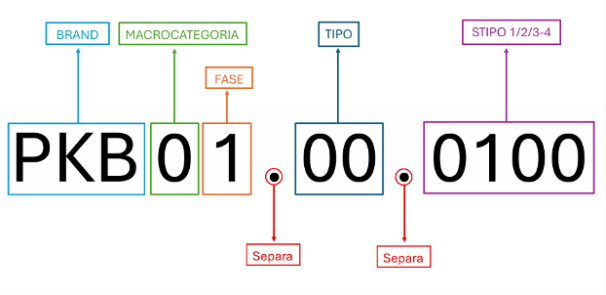


Figure 9: PKB code example

- 01 (PICTURES, conception and design)
- 02 (PICTURES, staging)
- 03 (PICTURES, after staging documentations)
- 11 (ATTACHMENTS, conception and design)
- 12 (ATTACHMENTS, staging)
- 13 (ATTACHMENTS, after staging documentations)

'00' The following two digits, delimited by the dot, identify the TYPE: scenes, costumes, characters, props, video recordings, photos, playbills etc.

'0100' The next four digits indicate SUBTYPE1, SUBTYPE2 and SUBTYPE3. The two digits of SUBTYPE1 allow values ranging from 00 to 99. To maintain a wider range of numbers and allow the possible addition of entries/qualifiers, we decided not to add the dot to indicate the subtypes.

In this way Hyperstage facilitates the user's research, who finds already organized documents and materials. Furthermore, the user can compare images within the ontology by displaying two images side-by-side, thanks to the International Image Interoperability Framework program. The Hyperstage added value lies precisely in its ability to connect digital resources. Users can explore specific theatrical productions and observe how the associated resources evolve over time. For example, they can trace the modifications made to costumes between performances or the scenographic variations.

9 The Hyperstage hierarchical model of theatrical works

A significant issue emerged during the bottom-up development process of the Hyperstage ontology: conflation, or the merging of conceptually distinct entities. This introduces semantic ambiguities that compromise the ontology's usability and interoperability. Failure to distinguish between conceptually distinct entities leads to a loss of stability of the ontological model. Essentially, double or triple concepts are combined into a single entity (property or element). To prevent conflation and ambiguity, Hyperstage uses a hierarchical model of theatrical works [Figure 10].

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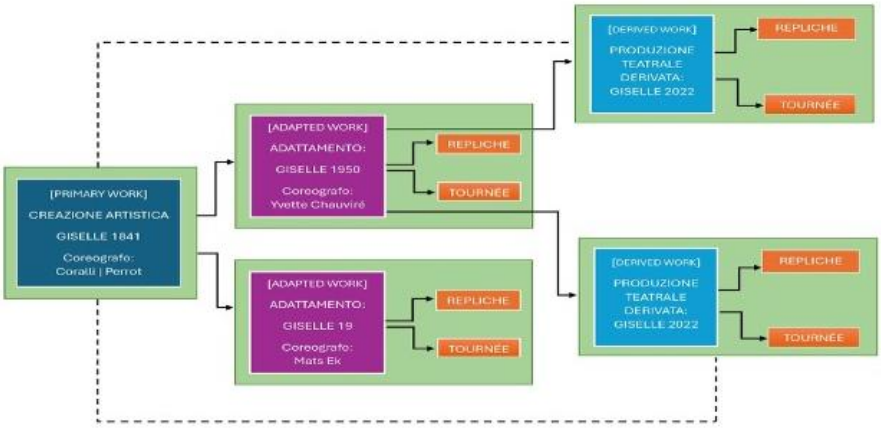


Figure 10: The Hyperstage hierarchical model of theatrical works, designed by Valeria Paraninfi, project research fellow. First level. 'Primary work ; Artistic Creation' (in dark blue). Second level 'Adapted Work ; Adaptation' (in purple). Third level 'Derived Work ; Derivation' (in light blue). It presents further transformations and reworkings compared to the 'Adapted Work' from which it originates. Reruns and tournès (in orange).



This is essential to maintain a clear distinction between different theatrical works and avoid erroneous fusions between entities. In fact, by defining hierarchical levels, clear and unambiguous relationships can be established, facilitating the analysis of the origin and evolution of the different components of a theatrical production. Figure 1 presents the conceptual scheme described briefly below.

It should be noted that in Hyperstage, reruns are regarded as theatrical productions in their own right. This is because, compared to the premiere, a rerun may feature variations in the cast, stage setup, and so on, which are documented.

Another strength of the Hyperstage project lies in the research activities conducted in libraries and historical theatre archives, in order to compile a bibliography for

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each event. Even if materials have been digitized, they are often buried in theatre administration databases. Sifting through these materials in the theatres historical archives we found many unknown documents.

The next step is to create a user-friendly interface that is easy to use for everyone. The front end (search and presentation) will be handled by a user-friendly Web application built with widely used open-source software. Upon release, the Hyperstage platform will provide users with access to a comprehensive knowledge base of theatrical events, as well as a registry of digital theatre and performing arts archives in Italy. The platform will be interconnected with the forthcoming Italian Archive and Theatre Database, which was designed by Elisa Passone.

Hyperstage aims to offer researchers, scholars and a broad audience a valuable tool for exploring and understanding the history of Italian theatre by creating a collaborative knowledge-sharing environment.

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