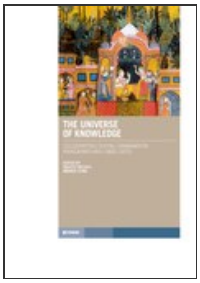
FORUM EDITRICE UNIVERSITARIA UDINESE



Martina Dello Buono e Chiara Livio

Designing the Complexity of Scholarly Digital Editions. The Śivadharma Project Case Study

Abstract: This article explores the design of a conceptual model for publishing digital editions of texts and inscriptions in Sanskrit and other South Asian languages. Using a section from the Śivadharmottara, the rules of conduct for the communities of devotees of the god Śiva, as a case study, this research focuses on identifying the appropriate data structure for representing complex textual phenomena that are challenging to manage formally, such as non-linear overlapping hierarchies. First, we analyse the structural complexity of Sanskrit editions with examples from the Scholarly Edition of the first chapter of the Śivadharmottara edited by Florinda De Simini. Second, we describe the advantages of a graph representation over a tree representation of a text. Third, we discuss the choice of the graph database Neo4j to store the textual annotations in a stand-off graph structure to formalise the data and their relationships produced in the Śivadharma Database environment. The outcome of this research is a CRUD web application consisting of user-friendly tools to create, publish, catalogue, visualise, and browse the Śivadharma Scholarly Digital Editions online. Moreover, this web application aims to be adaptable to the needs of Scholarly Digital Editors outside the South Asian realm. The web application described in this article is based on a version from 2023.
Keywords: Scholarly Digital Editions, Sanskrit, Śivadharma Project, Data modelling, Graph database

Contenuto in: The Universe of Knowledge. Celebrating Shiyali Ramamrita Ranganathan (1892-1972)
Curatori: Fausto Freschi e Andrea Cuna
Editore: Forum
Luogo di pubblicazione: Udine
Anno di pubblicazione: 2024
Collana: Tracce. Itinerari di ricerca/Area umanistica e della formazione
ISBN: 978-88-3283-428-4
ISBN: 978-88-3283-486-4 (versione digitale/pdf)
Pagine: 193-204
DOI: 10.4424/978-88-3283-486-4-07

Per citare: Martina Dello Buono e Chiara Livio, «Designing the Complexity of Scholarly Digital Editions. The Śivadharma Project Case Study», in Fausto Freschi e Andrea Cuna (a cura di), *The Universe of Knowledge. Celebrating Shiyali Ramamrita Ranganathan (1892-1972)*, Udine, Forum, 2024, pp. 193-204
Url: https://forumeditrice.it/percorsi/lingua-e-letteratura/tracce/the-universe-of-knowledge/designing-the-complexity-of-scholarly-digital

FARE srl con socio unico Università di Udine
Forum Editrice Universitaria Udinese
via Larga, 38 - 33100 Udine
Tel. 0432 26001 / Fax 0432 296756 / forumeditrice.it

Designing the Complexity of Scholarly Digital Editions. The Śivadharma Project Case Study

Martina Dello Buono and Chiara Livio*

Abstract

This article explores the design of a conceptual model for publishing digital editions of texts and inscriptions in Sanskrit and other South Asian languages. Using a section from the *Śivadharmottara*, the rules of conduct for the communities of devotees of the god Śiva, as a case study, this research focuses on identifying the appropriate data structure for representing complex textual phenomena that are challenging to manage formally, such as non-linear overlapping hierarchies. First, we analyse the structural complexity of Sanskrit editions with examples from the Scholarly Edition of the first chapter of the *Śivadharmottara* edited by Florinda De Simini. Second, we describe the advantages of a graph representation over a tree representation of a text. Third, we discuss the choice of the graph database Neo4j to store the textual annotations in a stand-off graph structure to formalise the data and their relationships produced in the Śivadharma Database environment. The outcome of this research is a CRUD web application consisting of user-friendly tools to create, publish, catalogue, visualise, and browse the Śivadharma Scholarly Digital Editions online. Moreover, this web application aims to be adaptable to the needs of Scholarly Digital Editors outside the South Asian realm. The web application described in this article is based on a version from 2023.

1. Introduction

Scholarly Digital Editions are conceptually and structurally complex entities (Bonsi & al. 2015) as they are "the critical representation of historic documents" (Sahle 2016). As Sahle states, the text reconstructed in an edition is a "representation" aimed at reliably reproducing a document transmitted over time, i.e.,

* This paper has been written within the ERC Horizon 2020 research project "Translocal Identities. The Śivadharma and the Making of Regional Religious Traditions in Premodern South Asia" (Grant agreement ID: 803624). Authors' responsibility: Martina Dello Buono is responsible for writing sections 2, 2.2, 3; Chiara Livio is responsible for writing section 2.1; all authors are responsible for writing section 1 and 4.

"historic", and constituting a new reading of the text (Sahle 2016). Editors are therefore tasked with the dual synchronous objectives of re-establishing the original form of a text while providing their interpretation and perspective (Sahle 2016). This complexity implies that the process of editing a text is intrinsically sophisticated from the start. It includes a reflection on its transmission, and the identification and coherent analysis of its structure and entities of interest. The result is that the text is both "constrained by its sequential presentation" and characterised by a "multidimensional complexity" (Neil & Kuczera 2019), significantly impacting the technology that lies behind their digital structure. To formally model such complexity, it is necessary to start with the reading and the analysis of the text, its relevant layers, and inter-textual and intertextual relations.

This complexity is even greater in the case of South Asian texts. Ranging from oral traditions to meticulously maintained written records, South Asia has a rich literary history. However, as noted by Bausi (2008: 22), a distinct contribution to the historical analysis of the editorial techniques applied to these texts remains almost absent[1]. While philological methodologies and approaches initially conceived for Classical Studies, including New Testament and Romance Studies, have evolved over time to accommodate some of the characteristics of South Asian texts, many of these characteristics remain unique to South Asian texts. This is reflected in the difficulty of finding an established methodology in South Asian textual criticism, which, in turn, hinders the development of digital standards for Scholarly Digital Editions.

This article aims at supporting the workflow of creating and publishing Scholarly Digital Editions in the South Asian domain. More specifically, we will use as a case study one of the texts of the Śivadharma *corpus*, a collection of eight anonymous texts whose manuscripts are currently edited by Florinda De Simini and her team within the framework of the ongoing ERC Project *Translocal Identities: The* Śivadharma *and the Making of Regional Religious Traditions in Premodern South Asia*[2].

[1] An attempt at an overview and standardisation of philological principles and terminology applied to South Asian texts, in Sanskrit in particular, has been performed by Formigatti 2015.

[2] This article is written in the framework of the ongoing ERC Project *Translocal Identities: The* Śivadharma *and the Making of Regional Religious Traditions in Premodern South Asia*, also known as the Śivadharma *Project*, based at L'Orientale University of Naples and at two partner institutions, the École Française d'Extrême-Orient and the Alma Mater Studiorum University of Bologna with the /DH.arc Research Centre (https://shivadharmaproject.com/). The principal investigator, Florinda De Simini, and her team examine the impact of the Śaiva religion on the formation of regional religious identities in South Asia through a great wealth of resources, such as manuscripts in Sanskrit and Dravidian languages, inscriptions, and icons. These resources form what is known as the Śivadharma *corpus* (De Simini 2016b).

In Section 2, we describe the *conceptual model* that will serve as a basis for the development of the Śivadharma Database, a Content Management System (CMS) that has been exclusively designed to streamline the process of preparing, publishing, and updating the Digital Scholarly Editions of the Śivadharma *corpus*. The fundamental idea behind this database is to cater to the growing needs of researchers who require a user-friendly interface that does not demand any technical coding expertise. As a result, this web application empowers philologists to effortlessly prepare their texts and their supplementary components, such as critical apparatus, notes, parallels, and translations, and its use can be extended to other South Asian textual traditions as well. In Subsection 2.1, we focus on the technical issue of *overlapping annotations* taking as a case study one of the texts of the Śivadharma *corpus*, the *Śivadharmottara*, a dialogue in Sanskrit that expounds upon the obligations a śaiva devotee must observe and currently edited by De Simini (2016a; 2016b; 2017). Consequently, Subsection 2.2 elaborates on how overlapping annotations are better managed in a graph database and why this is the preferred choice to store textual annotations within a stand-off graph structure. In Section 3 we show the editing (Subsection 3.1) and reading mode (Subsection 3.2) of the interface of the Śivadharma *Scholarly Digital Editions*, along with the set of *user-friendly* tools for preparing and updating editions over time on the user-side. Finally, in Section 4, we draw some preliminary conclusions to the present study.

2. Textual Modelling: Annotations and Data Structures

To make the relevant textual features and relationships computer-readable and processable, a philologist should necessarily adopt a *formal annotation system* that can aptly represent them.

Annotations allow establishing specific relations between data in a given context (Oren & al. 2006). Each relation embodies a particular perspective on the text according to the editor's interpretation (Barzaghi 2021). Annotations are conveyed via precise markup languages, facilitating the formal representation of identified textual phenomena. Two primary markup languages are utilised for text annotation: (1) the eXtensible Markup Language (XML) and (2) LaTeX.

In the context of South Asian texts, specific guidelines have been formulated, drawing upon the TEI vocabulary. In particular, the DHARMA project released a set of XML tags for annotating diplomatic (Balogh & Griffiths 2020) and critical editions (Griffiths & Janiak 2023)[3].

[3] It should be kept in mind that "digital editions, unlike printed ones, are not limited by the spatial features of a page-based layout and do not need to use anything like "layers of appa-

In most cases, the entity-relation structure in a given text is complex and non-linear, reflecting its multidimensional nature and interpretation. Annotations, as discussed by Neill and Schmidt (2021), often *overlap* with one another, meaning a given section of text can be the subject or object of multiple annotations and may appear in a non-sequential order, as defined by Peroni and Vitali (2009). This complexity challenges traditional text encoding methods, like XML-based syntax (e.g., standard XML/TEI), which rely on linear and hierarchical structures.

To address this inadequacy, scholars have explored ways to represent text semantics more effectively. Many have pointed out the limitations of tree-based text representation using XML-based syntax (Peroni & Vitali 2009; Renear & al. 2002; Schmidt 2010) and proposed solutions to overcome these limitations.

Some research suggests extending tree hierarchies to handle issues like overlapping while still maintaining the tree as the primary data structure. Techniques such as TEI *milestones* and *fragmentation* have been introduced for this purpose (Di Iorio & al. 2011).

A more practical approach that has gained traction is using a graph data structure to convey texts' structural and semantic complexity, where a document is formalised as a network of entities connected through typed links (Daquino & al. 2019). Documents are no longer seen as standalone entities but as subjects or objects that can be associated with other entities, subjects, or objects, including people, places, or events. This intricate network of relationships forms the graph.

Graph text modelling enables a comprehensive approach, where text is seen as a multidimensional entity characterised by various dimensions and relationships (Bonsi & al. 2015). The primary language used for technical and formal graph creation is the Resource Description Framework (RDF), which organises data as nodes connected by typed links[4]. This approach simplifies handling issues like overlapping hierarchies since any annotation can be assigned to the same text range (Peroni & Vitali 2009).

While these techniques effectively address the problems of XML-based tree structures, they come with some trade-offs. Semantic technologies are flexible to support overlapping but can be more challenging to learn. Additionally, visualisation is not directly supported by RDF (Daquino & al. 2019).

ratus" to represent the relationship between the text as constituted by the editor and his observations on particular segments of that text" (Griffiths & Janiak 2023: 67).

[4] Some projects demonstrate that the graph is sufficiently flexible to represent the discontinuity of the interpretation of a text. In *Edizione Nazionale delle Opere di Aldo Moro* (Moro 2021), the RDF serialisation Resource Description Framework in Attributes (RDFa, https://www.w3.org/TR/rdfa-primer/) is used to provide the HTML documents with structured data as mentioned people, places, etc. In the semantic digital edition of *Paolo Bufalini, Appunti (1981-1991)* (Daquino & al. 2020), RDF triples extracted from the XML/TEI document of the edition constitute the graph.

Some other research proposes *stand-off properties* to represent annotations, completely overcoming the tree structure of XML-based markup[5]. According to this technique, the annotations are stored separately from the text, and may freely overlap (Neill & Schmidt 2021).

2.1. A Case Study: Overlapping in Śivadharmottara *1*

Within the scope of this article, the first chapter of the *Śivadharmottara*, herein referred to as "Śivadharmottara 1", will serve as a case study to provide an overview of a specific technical issue related to annotations, i.e., the overlapping[6]. As discussed above (Section 2), any given range of text may simultaneously be the subject or object of more than one annotation causing these annotations to inherently *overlap*. An example of this can be found in Śivadharmottara 1.7 (Table 1)[7]:

Table 1. *Śivadharmottara* 1.7 edited by Florinda De Simini. Focus on the critical apparatus and the stanza for the combined complex phenomena of *inversion* and *overlapping*.

Śivadharmottara 1.7	
pāda a	*pāda* b
vidyādānaṃ ca ***dānānāṃ***	***sarveṣām*** *uttamaṃ kila*
pāda c	*pāda* d
tac ca śrutau dvijendrāṇāṃ	*nānyeṣāṃ samudāhṛtam*
Critical apparatus	
7ab ***dānānāṃ sarveṣām***] Σ* *sarveṣām dānānāṃ* $P_{75}{}^{T}$	

* The symbol Σ is conventionally used to declare: "All the manuscripts except one".

As can be observed in the Critical apparatus of Śivadharmottara 1.7 (Table 1), we are presented with a textual phenomenon called "transposition", which occurs

[5] For instance, in the *Codex* project, the annotations correspond to entities, i.e. people, dates, etc., represented as nodes and connected through typed links, and stored in a Neo4j graph database (Neill & Kuczera 2019).

[6] Some of these features pertain specifically to Sanskrit, while others are language-independent. This observation suggests that the greater the level of abstraction inherent in these identified features, the more flexible the formalisation will be.

[7] In terms of features related to textual structure, Śivadharmottara 1 comprises 102 *stanza*s. Each stanza is further subdivided into four quarters (Skt. *pāda*, lit. "foot"), commonly referred to by the scholars as *pāda* a, *pāda* b, *pāda* c, and *pāda* d. In printed editions of these texts, the presentation of these *pāda*s is typically configured in either two or four lines, contingent upon the length of the metre employed within the stanza. To enhanced readability, printed editions add a short vertical line, referred to as *daṇḍa* (lit. "stick"), at the end of each line, and a double short vertical line, usually referred to as double *daṇḍa*, at the end of each stanza.

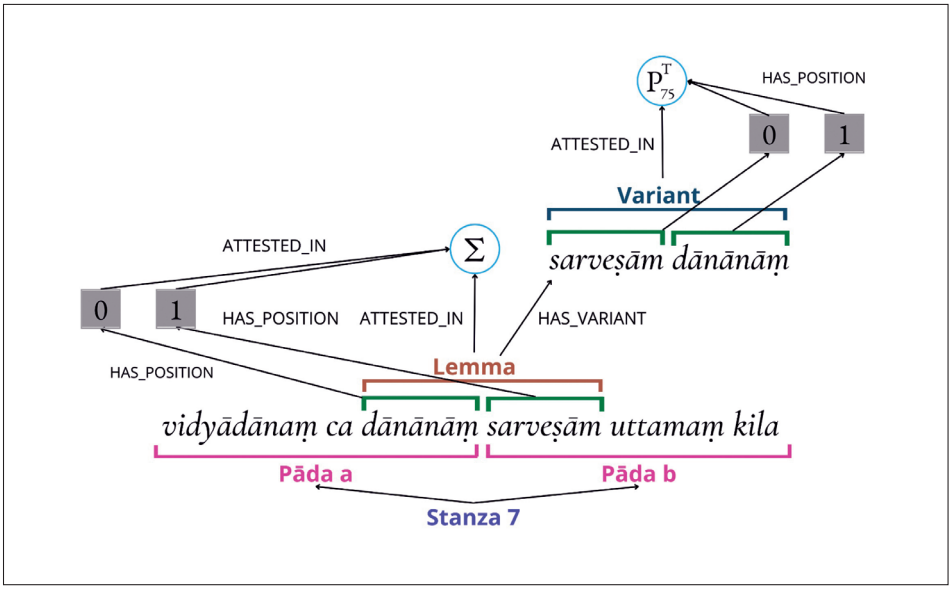


Figure 1. Conceptualization of the entities and relations of the first line of *Śivadharmottara* 1.7.

when a section of the text has been moved in the text with respect to the other manuscripts. In this example, the two words composing the lemma, i.e., ***dānānāṃ sarveṣām***, have a different order in manuscript $P_{75}{}^{T}$, showing the subcategory of the "inversion", which occurs when the transposition involves two contiguous words (Roelli 2020).

Annotating this transposition wouldn't be problematic if it were not for the fact that the string *dānānāṃ* is positioned in *pāda* a, while the string *sarveṣām* is positioned in *pāda* b, causing the lemma to span across two *pāda*s (Table 1). This results in *overlapping annotations* for the *lemma*, as the annotation extends beyond the single *pāda*'s block-level container.

2.2. Graph Data Modelling for the Śivadharma Database *Project*

To illustrate how data modelling can be applied to overlapping annotation, a conceptualization of the entities of Śivadharmottara 1.7ab and their relations is shown below (fig. 1). A *tree* data structure hardly fits such a complex entity-relations setting. To solve such a problem, a *graph* data model is applied to structure the identified textual features as connected nodes in a graph[8].

[8] *Codex* is taken as reference (Neill & Kuczera 2019).

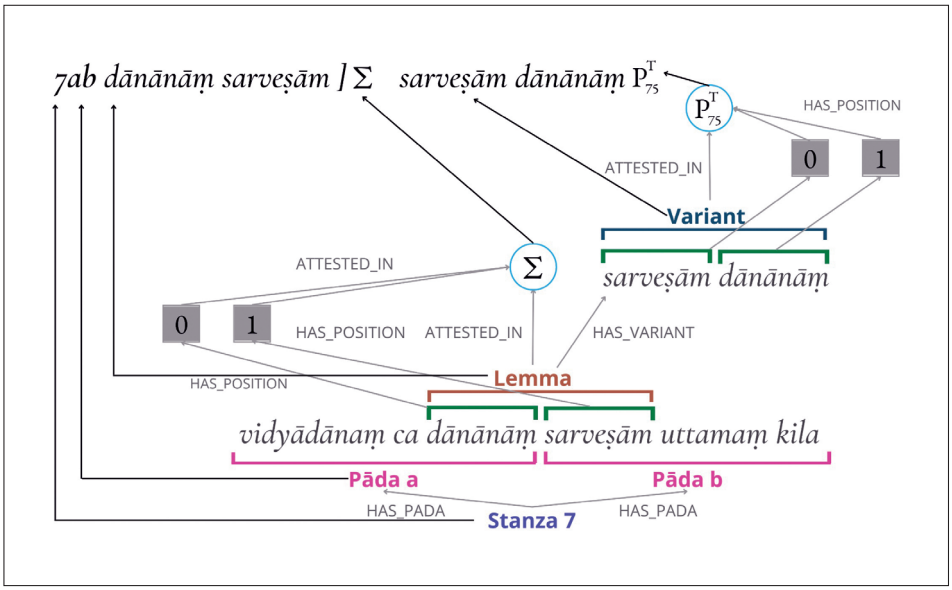


Figure 2. Apparatus entry generated by extracting data from the database.

According to this model, each textual string subject or object of annotation is the atomic unit of the graph and is identified by its starting and ending position. Then, it is formalised as a node connected to its related entities according to specific ontological models[9], and stored in a graph database, i.e., Neo4j (https://neo4j.com/).

According to this model, the annotations are *stand-off*, i.e., stored separately from the text. This way, the readability of the text is improved, and the problem of *overlapping hierarchies* is solved, as each node may have any number of relations with any number of nodes. In addition, complex components of editions, i.e. *apparatus*, *notes*, *parallels*, *citations*, and *translation*, can be automatically generated by extracting specific data directly from the database through a *query*.

As shown in figure 2, an apparatus entry is generated by extracting the entities: (1) number of the stanza; (2) specific *pāda*s in which the lemma and its variant are positioned; (3) lemma; (4) variant; (5) related manuscripts and their relations.

[9] The plugin *Neosemantics* (n10s) allows the integration of RDF and its associated vocabularies in Neo4j (https://neo4j.com/labs/neosemantics/).

3. *Śivadharma Scholarly Digital Editions*: Interface

The final output of the project is a Digital Library that will contain *Śivadharma Scholarly Digital Editions*, provided with a set of *user-friendly* tools for preparing and updating editions over time on the user-side. The interface to perform such operations is shown in figure 3.

In the *editing mode*, it is provided with a series of tools to (1) insert the metadata related to the edition; (2) upload or manually insert the *textus* of the edition; (3) add annotations by using a specific set of buttons to identify textual strings and assign them properties and values; (4) store the *stand-off* annotations in the underlying Neo4j database; (5) recombining the text with the annotation to generate the main components of the edition, i.e. *textus*, *apparatus*, *notes*, *parallels*, *citations*, and *translation*; (6) publish the edition.

In the *reading mode*, instead, it is possible to visualise and browse the published editions.

The resulting web application is under development[10]. From a technical point of view, it corresponds to a CRUD (Create, Read, Update, Delete) application, i.e., it allows the operations of creation, reading, updating, and deleting data, developed in Node.js (https://nodejs.org/en), Express (https://expressjs.com/), Vanilla JS (http://vanilla-js.com/), EJS (https://ejs.co/), SCSS (https://sass-lang.com/), and Neo4j.

It is intended to implement an export function of the editions in XML/TEI to guarantee their interoperability.

3.1. Interface: Editing Mode

The necessary steps for scholars to prepare a digital edition in Śivadharma Database are the following. First, the *textus constitutus* must be provided by uploading a file or typing it in the main text area. The system automatically converts it into an HTML file and stores it in a specific folder. Next, the editor can select any fragment in the text and annotate it via buttons of different colours that indicate available types of annotations, such as yellow for *apparatus* entries. Upon selection of a fragment, a line in the corresponding colour highlights the chosen section in the text. The selected fragment in HTML corresponds to a string surrounded by uniquely identified empty spans that act as milestones for handling overlapping issues. Simultaneously, a module opens up on the right side of the *textus*, containing *forms* to declare specific information about the selected fragment. For instance, to create an apparatus entry, the location of the selected

[10] The GitHub repository of Śivadharma Database is available at https://github.com/martinadellobuono/shivadharma-database

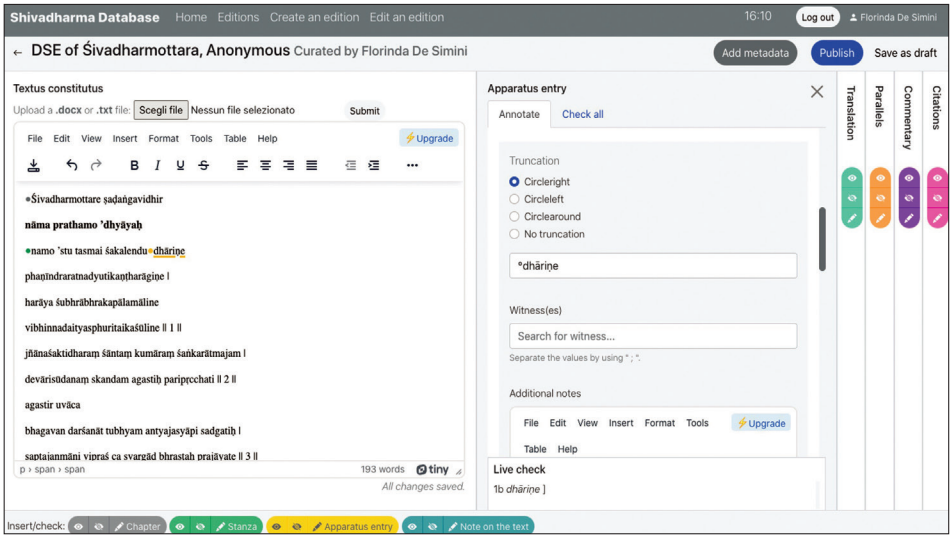


Figure 3. Editor of *Śivadharma Database*. Under development.

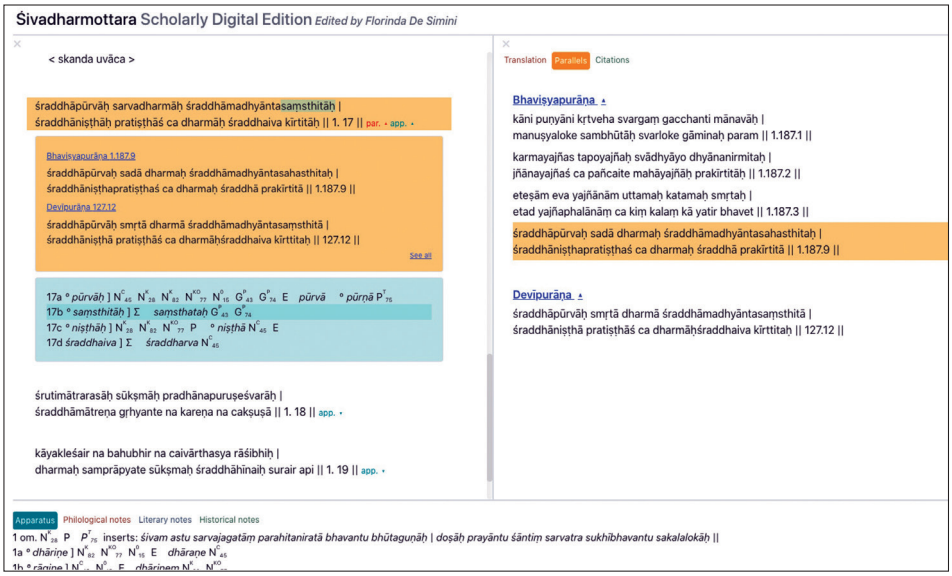


Figure 4. Visualisation of an edition in *Śivadharma Database*.

fragment, lemma, variant readings, witnesses, additional notes, and omissions can be declared. Finally, upon clicking the Save operation, the data is submitted to the database, corresponding to specific nodes and relations automatically lin-

ked to their reference fragment, identified as a node in the database (figure 2). The same system applies to updating any data.

3.2. Interface: Reading Mode

When using the Śivadharma Database in reading mode, users are able to access previously published editions on the same platform. From a technical standpoint, the *textus* is represented by an HTML file and can be visualised without the need for any data processing. However, other components, such as the apparatus, require an intermediate step. Specifically, these components must be extracted from the database using tailored queries in the backend, sorted based on preset criteria, and then displayed.

The interface of the edition in figure 4 is divided into two sections. The right section displays the *textus* alongside the user-generated components. Under each stanza, users can access the corresponding apparatus and its parallels. On the left section, a comprehensive list of parallels, translation of the *textus*, and quotations annotated by the editor are displayed. At the bottom of the page, readers have access to the complete *apparatus*.

The interface is interactive, allowing for navigation between various components of the edition and the *textus*.

4. Conclusions

Scholarly Digital Editions are conceptually and structurally complex. As shown in Śivadharmottara 1, phenomena as *overlapping hierarchies* are recurring and difficult to represent formally. Since the traditional *tree* structure of XML-based encoding is insufficient to handle such a complexity, a better solution is identified in *stand-off* annotations structured as a *graph* and stored in a graph database, i.e., Neo4j. A technique of this kind is adopted in the Śivadharma *Database* project, and it allows managing the multidimensional and *overlapped* readings of texts. In addition, the main components of editions, e.g., the *apparatus*, can be easily generated by extracting data from the graph. In conclusion, a suite of *user-friendly* annotation tools allows the creation of editions by populating and extracting data from the *graph*.

While the traditional XML-based tree structure is insufficient in handling the non-linearity of these textual features, a graph structure offers a more effective solution for representing the manifold textual layers and the intra-textual and intertextual relationships. Thus, we propose the utilisation of the Neo4j graph database to formalise the data and the relationships generated within the Śivadharma Database environment.

References

Balogh, D. & Griffiths, A. (2020). *DHARMA Encoding Guide for Diplomatic Editions*, [Technical Report], https://shs.hal.science/halshs-02888186.

Barzaghi, S. (2021). *La modellazione dei dati nell'Edizione Nazionale delle Opere di Aldo Moro*, in Zenodo, https://doi.org/10.5281/zenodo.5144961.

Bausi, A. (2008). *«Philology» as Textual Criticism. «Normalization» of Ethiopian Studies*, "Ethiopian Philology", 1, 13-46.

Bonsi, C. & al. (2015). *Manzoni's electronic interpretations*, "Semicerchio", LIII, 2, 91-99.

Daquino, M. & al. (2019). *Linked Data per le edizioni scientifiche digitali. Il workflow di pubblicazione dell'edizione semantica del quaderno di appunti di Paolo Bufalini*, "Umanistica Digitale", 7, https://doi.org/10.6092/issn.2532-8816/9091.

Daquino, M. & al. (2020). *Paolo Bufalini, Appunti (1981-1991)*. [Edizione scientifica digitale semantica]. Bologna, Digital Humanities Advanced Research Centre (/DH.arc), https://doi.org/10.6092/unibo/amsacta/6415.

De Simini, F. (2016a). *Of Gods and Books: Ritual and Knowledge Transmission in the Manuscript Cultures of Premodern India*, Berlin & Boston, De Gruyter, https://doi.org/10.1515/9783110478815.

De Simini, F. (2016b). Śivadharma *Manuscripts from Nepal and the Making of a* Śaiva *Corpus*, in *One-Volume Libraries: Composite and Multiple-Text Manuscripts*, ed. by M. Friedrich & C. Schwarke, Berlin & Boston, De Gruyter, 233-286, https://doi.org/10.1515/9783110496956-009.

De Simini, F. (2017). *When Lachmann's Method Meets the Dharma of Śiva. Common Errors, Scribal Interventions, and the Transmission of the* Śivadharma *Corpus*, in *Indic Manuscript Cultures through the Ages: Material, Textual, and Historical Investigations*, ed. by V. Vergiani & al., Berlin & Boston, De Gruyter, 505-548, https://doi.org/10.1515/9783110543100-017.

Di Iorio, A. & al. (2011). *A Semantic Web approach to everyday overlapping markup*, "Journal of the American Society for Information Science and Technology", 62, 9, 1696-1716, https://doi.org/10.1002/asi.21591.

Formigatti, C.A. (2015). *Sanskrit Annotated Manuscripts from Northern India and Nepal*, Ph.D. Thesis, Hamburg, Universität Hamburg.

Griffiths, A. & Janiak, A. (2023). *DHARMA Encoding Guide for Critical Editions*, [Technical Report], https://hal.science/hal-04085137.

Moro, A. (2021). *Edizione Nazionale delle Opere di Aldo Moro*, Bologna, Università di Bologna, https://doi.org/10.6092/unibo/aldomoro.

Neill, I. & Kuczera, A. (2019). *The Codex – an Atlas of Relations*, in *Die Modellierung des Zweifels – Schlüsselideen und -konzepte zur graphbasierten Modellierung von Unsicherheiten*, ed. by A. Kuczera & al., Wolfenbüttel 2019 (=Zeitschrift für digitale Geisteswissenschaften, Sbd. 4), https://doi.org/10.17175/sb004_008.

Neill, I. & Schmidt, D. (2021). *SPEEDy. A Practical Editor for Texts Annotated with Standoff Properties*, in *Graph Data-Models and Semantic Web Technologies in Scholarly Digital Editing,* ed. by E. Spadini & al., Norderstedt, BoD, 45-54, http://kups.ub.uni-koeln.de/id/eprint/55224.

Oren, E. & al. (2006). *What are Semantic Annotations?*, [Technical Report], Galway (IRE), DERI, http://www.siegfriedhandschuh.net/pub/2006/whatissemannot2006.pdf.

Peroni, S. & Vitali, F. (2009). *Annotations with EARMARK for Arbitrary, Overlapping and out-of Order Markup,* in *DocEng '09: Proceedings of the 9th ACM Symposium on Document Engineering*, New York, ACM, 171-180, https://doi.org/10.1145/1600193.1600232.

Renear, A. & al. (2002). *Towards a Semantics for XML Markup*, in *DocEng '02: Proceedings of the 2002 ACM Symposium on Document Engineering*, New York, ACM, 119-126, https://doi.org/10.1145/585058.585081.

Roelli, P. (2020). *Introduction*, in *Handbook of Stemmatology: History, Methodology, Digital Approaches*, ed. by P. Roelli, Berlin & Boston, De Gruyter, 1-8, https://doi.org/10.1515/9783110684384.

Sahle, P. (2016). *What Is a Scholarly Digital Edition?*, in *Digital Scholarly Editing: Theories and Practices*, ed. by M.J. Driscoll & E. Pierazzo, Cambridge, Open Book Publishers, 19-39, https://doi.org/10.11647/OBP.0095.

Schmidt, D. (2010). *The Inadequacy of Embedded Markup for Cultural Heritage Texts*, "Literary and Linguistic Computing", 25, 3, 337-356, https://doi.org/10.1093/llc/fqq007.