Visualising Interpretive Layers in Cultural Heritage: Data narratives with Linked Open Data in mythLOD collection

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This work examines the evolving methods of disseminating Cultural Heritage data, emphasising the transition to Linked Open Data (LOD) and storytelling for enhanced user engagement. The mythLOD project showcases this transition by converting the Mythologiae data collection into LOD, enabling richer data interpretation and visualisation. mythLOD integrates the artwork descriptions and their scholarly interpretations, connecting artworks with literary sources through a layered data model. The resulting Knowledge Base is visualised via an online platform, making the information accessible through an online catalogue and a data storytelling interface. These visualisations reveal latent knowledge and foster deeper exploration of Cultural Heritage data, particularly by revealing the connections between literary sources and artworks and demonstrating LOD's potential to enrich user interaction and knowledge acquisition.

1. Introduction

Cultural heritage (CH) data are constantly growing from digitisation projects by many GLAM institutions. The Digital Humanities (DH) community widely adopted Linked Open Data (LOD) as a standard for knowledge organisation in the CH domain, promoting interoperability and exchange[2]. Several CH platforms disseminate their data through browsable online catalogues with faceted search interfaces, e.g. Europeana[3]. Graphic User Interfaces (GUI) make data accessible also to non-IT experts, such as museum

[1] This contribution is the product of collaboration between the authors on the mythLOD project. For the writing of this article, Francesca Tomasi is credited with writing the *Introduction* and Valentina Pasqual with writing the *Data Modelling* and *Browsing interface and data narratives* sections. The *Conclusions* section is shared.
The mythLOD project was conceived and developed within the context of the Digital Humanities Advanced Research Centre (/DH.arc, <https://centri.unibo.it/dharc/en>) research laboratory, active at the Department of Classical and Italian Philology (FICLIT, <https://ficlit.unibo.it/it>) of the University of Bologna. Special thanks go to the FrameLAB research group, creator and provider of the Mythologiae collection.
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[2] Hyvönen 2012; Alexiev 2018; Po 2020.

[3] https://www.europeana.eu/it.

curators, humanities scholars, students, or the general public, by hiding sometimes complex SPARQL queries. More recently, dissemination practices have relied on narration as a new expedient to interactively involve users more efficiently and effectively[4]. Data storytelling practices can visualise latent relations and new perspectives over data, augmenting users' knowledge. While faceted search allows users to customise data exploration depending on their individual interests, storytelling guides users through a defined narrative path. Visual analytics represents «the science of analytical reasoning facilitated by interactive visual interfaces»[5], employing visualisation and interaction methods to incorporate expert human judgment into the data analysis process. Indeed, visual analytics serves as a methodology that blends human intuition with mathematical deduction to directly perceive patterns and extract insights from complex data structures[6]. Drucker[7] argues for a reevaluation of graphical expressions in digital environments, highlighting the bias introduced by relying solely on conventional statistical data interpretation, criticising the belief that data is inherently quantitative, and emphasising the importance of recognising its qualitative, interpretive nature (referred to as *capta*). In this context, data modelling choices (e.g., ontology selection) highly influence the expressivity of data visualisation and the design of such narrative paths.

mythLOD collection[8] is the revalorisation of Mythologiae data collection[9] by converting its data from tabular data to LOD. The objective of this work is to overtake the modelling, and therefore the visualisation of its data, of mere factual data by bringing out and enhancing the interpretation of the scholars studying the Mythologiae collection and to reveal, through data visualisation expedients, hidden correlations in data. The project workflow followed the life cycle of curation for digital objects, as described by Tomasi[10], addressing the data dissemination task through two visualisations: an online catalogue browsable by facets and a data storytelling experiment applied to the Aeneid by Virgil case study.

2. Data modelling

mythLOD data have been modelled using the Digital Hermeneutics layered approach[11], which implies Nanopublication[12] structure to encode information about cultural objects and contextual information. This approach consists of four layers, and each layer is represented as a named graph in RDF format, organising specific sets of metadata[13].

4 Eide et al. 2019; Windhager et al. 2019.
5 Thomas – Cook 2006.
6 Cui 2019.
7 Drucker 2011.
8 Pasqual – Tomasi 2021.
9 https://mythologiae.unibo.it/.
10 Tomasi 2022.
11 Daquino et al. 2020.
12 Groth et al. 2010.
13 A complete overview of mythLOD data model can be found at: <https://dharc-org.github.io/mythlod/static/datamodel.html>.

- *Layer 0, factual data*. It holds cultural objects' and literary sources' descriptive metadata, forming the foundation of knowledge upon which interpretations (represented in Layer 1, assertion) are built. For instance, it includes details such as authorship, creation dates, types, periods and collocations. The FRBRoo ontology[14] is used to represent cultural objects and literary sources. Additionally, the HuCit ontology[15] is used to model the structure of classical sources, enabling a more granular representation of their content as canonical citations.

- *Layer 1, assertion*. It stores scholars' interpretations regarding cultural objects by representing the relationships between artworks, the conceptual categories they depict, the associated literary sources, and canonical citations[16]. This layer encapsulates the scholarly discourse about the collection's artworks, providing an explicit formalisation of their meaning and interrelations within the broader cultural context.

- *Layer 2, provenance*. It holds contextual information about the interpretations (represented in Layer 1, assertion), detailing their type, who made them, when, and with what criteria, mainly reusing HiCo ontology[17].

- *Layer 3, publication information*. It stores details about the publication of each Nanopublication, including who generated it and when by reusing PROV-o ontology[18].

The semantic model establishes explicit relationships between main entities - cultural objects, literary sources, scholarly interpretations, and contextual metadata - through formal ontological structures that integrate Digital Hermeneutics concepts. These relationships allow for complex queries that can traverse from factual descriptions (Layer 0) through scholarly assertions (Layer 1) to their provenance and publication information (Layers 2-3), creating a comprehensive Knowledge Base (KB) that enhances data quality and supports the identification, citation, and evaluation of scholarly arguments. Data from the Mythologiae collection has been converted into LOD format based on the aforementioned data model. Additionally, controlled forms of agents and literary sources have been used. Canonical citations have been aligned with the Perseus Digital Library's URN CTS[19]. Dates have been converted into a machine-readable format, and geospatial coordinates of the locations have been retrieved from Wikidata to visualise the instances on the map.
mythLOD KB stores 4.260 heterogeneous museum artefacts. These pieces are cat-

[14] IFLA Working Group 2017.
[15] Romanello – Pasin 2013.
[16] In other words, the assertion layer preserves information according to this pattern: "The artwork X represents the mythological scene Y, mentioned in citation Z, extracted from literary source W".
[17] Daquino – Tomasi 2015.
[18] https://www.w3.org/TR/2013/REC-prov-o-20130430/.
[19] https://sites.tufts.edu/perseusupdates/2021/01/05/what-is-a-cts-urn/.

egorised into six types (minor arts, drawings, mosaics, paintings, vase paintings, and sculptures) and span a wide range of historical and artistic contexts, featuring contributions from 1.291 different artists, currently held by 419 cultural institutions, and made across 11 distinct epochs. The artworks in mythLOD depict 132 mythological scenes, which have been organised according to an internal taxonomy. Examples include scenes such as "Enea fugge da Troia in fiamme" ("Aeneas flees from burning Troy"). Each scene is linked to one or more of 84 literary sources categorised as classical sources, medieval or modern sources, modern rewritings and screenplay rewritings, and written by 72 different authors. mythLOD thus serves as a rich repository for exploring the intersection of art, mythology, and literature across various historical periods and artistic media.

3. Browsing interface and data narratives

mythLOD data are accessible via two main visualisations, namely the catalogue and the storytelling sections on the website[20]. While offering a complete overview of the dataset, they have been involved in an actual testing activity for the whole dataset with the domain experts. The visualisations graphically represent the project competency questions, hiding the technical details (e.g., SPARQL queries). The two visualisations have been exposed to domain experts involved in Mythologiae to review both the representativeness of the mythLOD data model and the correctness of data in the KB.

3.1 Browsing interpretations through the catalogue

mythLOD catalogue[21] (Fig. 1), presents a complete overview of the artworks, which can be browsed through facet filters as their metadata, related references and scholars' interpretations. In particular, the facets contain some selected information from the first three layers[22] of the data model: cultural objects are then browsable via a set of factual metadata (e.g. collocation, period, keywords, type and author), scholars' interpretations (assertions) addressing the cultural object's representation (e.g. category) and the literary sources associated with the artworks (e.g. the reference itself, its type and author), and, finally, the interpretations' contextual metadata (e.g. interpretation type, criterion and author). Facets are organised to express the layered approach adopted by the mythLOD data model. This design aims to provide users with a comprehensive browsing interface that highlights scholars' perspectives (referred to as *capta*[23]) on the Mythologiae data, while hiding technicalities and complexities (e.g., the FRBRoo event-centric approach).

[20] https://dharc-org.github.io/mythlod/.
[21] https://dharc-org.github.io/mythlod/catalogue/.
[22] The fourth layer (Publication Information) have not been included in the visualisation since we deemed this information are more related to data exchange and interoperability with respect to users' needs.
[23] Drucker 2011.

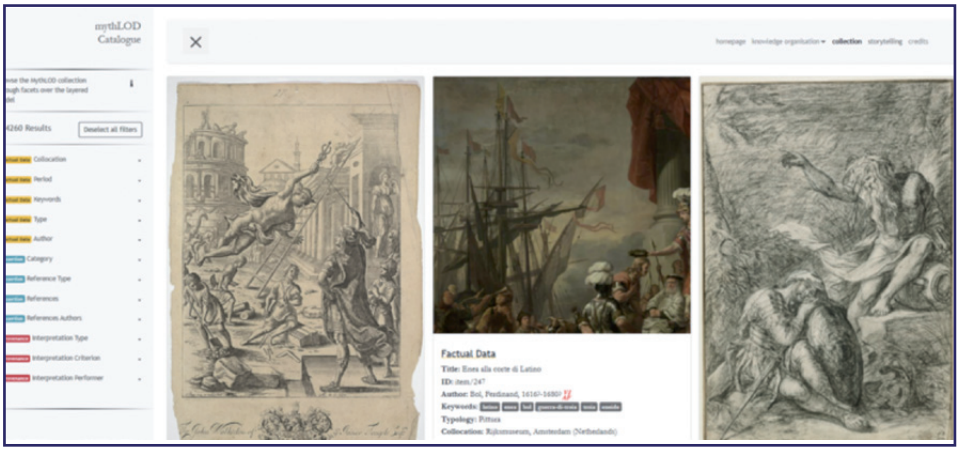

Figure 1. *The mythLOD catalogue and faceted search*

The catalogue's faceted search allows users to customise their search by adding filters from the three data layers. This browsing system allows for complex query searches on mythLOD data, for instance: all modern art (period) paintings (type) that have been interpreted to represent a mythological scene referenced by Virgil (reference author). Each artwork in the catalogue is shown with a set of metadata extracted from the first three layers of the data model. Specifically, at the assertion level (first layer), the catalogue displays a list of literary sources connected to the described artwork, supplemented with a direct link to VIAF[24] and the Perseus Digital Library (only for classical sources). This integration allows users to access the full texts for further exploration. A more accurate granularity is reserved for canonical citations, which are connected to Perseus Digital Library with the use of URN CTS to link to the specific passage describing the mythological scene depicted by the artwork. Overall, the processes of LOD curation (and in particular, data modelling choices, data cleaning, entity reconciliation and metadata enrichment) show its implications at the visualisation level, allowing users to perform more complex queries concerning Mythologiae catalogue[25] and creating interactive relations between mythLOD data and external sources as Perseus Digital Library to deepen the data exploration.

3.2 Telling Aeneis through museal art

While the catalogue section primarily focuses on artworks, *Telling Aeneis through museal art* is the data storytelling section about Aeneid contents in the mythLOD collection. The narrative consists of a restricted set of visualisations investigating the relation between mythLOD artworks and Aeneid literary reference by re-proposing the project competency questions into four categories.

[24] https://sites.tufts.edu/perseusupdates/2021/01/05/what-is-a-cts-urn/.
[25] https://mythologiae.unibo.it/index.php/ricerca/.

- Artworks' temporality (*when*): a timeline illustrates when the museum works concerning the themes of the Aeneid were produced

- Artworks' spatiality (*where*): a map shows where the museum artworks concerning the themes of the Aeneid are located

- Artworks' contents (*what*): a heatmap represents the most frequently cited Aeneid passages in the artworks depicted scenes; a word cloud represents the most frequent terms implied in the description of the artworks related to Aeneid; a network represents the literary references which co-occur with Aeneid in the dataset (Fig. 2).

- Agents involved with artworks (*who*): a network shows the relations between authors who created an artwork whose depicted scene has also been recognised to be present in the Aeneid.

Figure 2. *Snapshots of contents visualisation (what) in mythLOD storytelling*

In addition to the four categories of interest, a textual introduction and tips for each visualisation have been added to guide the user through the four sections. In particular, each tip reports the competency question to which the visualisation is answering and a brief explanation of the results. For instance, the network visualisation in the "WHAT" section addresses the question: "Which literary references co-occur with Aeneid?". The visualisation is also accompanied by a brief explanation noting that four literary sources (namely, Francesco Petrarch's "Trionfi", Giuseppe Ungaretti's "Vita di un Uomo", Dante Alighieri's "Divina Commedia", and Giacomo Leopardi's "Canti") exhibit the highest degree of co-occurrence.

Visualisations strictly depend on the entire data curation process, such as knowledge organisation (e.g., adopted data models and ontologies), data cleaning, and alignment with external resources. For example, the granular representation of canonical citations

is presented in the *heatmap* (Fig. 2), highlighting Aeneid's most cited lines and motives in mythLOD KB. Additionally, machine-readable dates were necessary to create the timeline. At the same time, geospatial coordinates extracted from Wikidata were used to visualise the instances on the map, fostering the valorisation of spatio-temporal data.

4. Conclusions

The implementation of the mythLOD project demonstrates the transformative potential of LOD in CH knowledge representation and production. The analysis presented in this work reveals an epistemological shift facilitated by the transition from traditional tabular data structures (*Mythologiae* data) to a semantically enriched LOD framework (mythLOD KB). This transformation repositions the narrative focus from artifact-centric cataloguing to source-oriented knowledge networks, inverting the traditional museum paradigm.

The visualisation interfaces — both the faceted browsing catalogue and the Aeneid-focused narrative pathway — exemplify how Semantic Web technologies enable the manifestation of latent semantic relationships within cultural datasets. The four-layered Digital Hermeneutics approach, particularly through its integration of factual metadata with scholarly interpretation via the Nanopublication framework, constitutes a methodological advancement beyond simple digitization toward interpretive augmentation of cultural heritage digital resources.

Quantitave analysis of the mythLOD KB — comprehending 4.260 artifacts, 132 mythological scenes, and 84 literary sources — reveals that visualisation methodologies serve not merely as passive interfaces but as active analytical instruments that reify complex relationships between museal artworks and literary references. The Aeneid case study demonstrates how visualisation can function as a hermeneutic tool, allowing for the identification of patterns in artistic interpretation across temporal and spatial dimensions that would remain latent in traditional representations.

Furthermore, this research contributes to ongoing scholarly discourse on what Drucker[26] terms *capta* — the recognition that cultural data embodies interpretive judgments rather than mere objective facts. The mythLOD platform operationalises this theoretical position by explicitly modelling and visualising scholarly interpretations as first-class knowledge entities, thereby acknowledging the subjective dimension of CH information.

These findings suggest that LOD implementations in CH domains should be conceptualised not merely as technical infrastructure but as epistemological frameworks that fundamentally alter how knowledge is organised, accessed, and interpreted. The semantic enrichment facilitated by LOD creates conditions for what might be termed as "emergent knowledge" — insights that exist only as potential within traditional data structures but become accessible through semantically informed visualization interfaces. This work ultimately positions LOD visualisation not as a supplementary feature of digital CH but as a transformative methodology that reconfigures the relationship between artefacts, sources, and interpretation.

[26] Drucker 2011.

Questo lavoro analizza i metodi per la diffusione dei dati del patrimonio culturale, enfatizzando la transizione verso i Linked Open Data (LOD) e lo storytelling per migliorare il coinvolgimento degli utenti. Il progetto mythLOD illustra questa transizione convertendo la collezione di dati Mythologiae in LOD, permettendo un'interpretazione e una visualizzazione dei dati più ricche. mythLOD integra le descrizioni delle opere d'arte con le loro interpretazioni, collegando le opere alle fonti letterarie attraverso un modello dati a livelli. La base di conoscenza risultante è visualizzata tramite una piattaforma online, che rende le informazioni accessibili attraverso un catalogo digitale e un'interfaccia di narrazione dei dati. Queste visualizzazioni rivelano conoscenze latenti e favoriscono un'esplorazione più profonda dei dati del patrimonio culturale, in particolare mettendo in luce le connessioni tra fonti letterarie e opere d'arte, dimostrando il potenziale dei LOD nell'arricchire l'interazione e l'acquisizione di conoscenza da parte degli utenti.

L'ultima consultazione dei siti web è avvenuta nel mese di dicembre 2025.

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