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Short paper Submission

Connecting and visualizing data: a Knowledge Base of Germanic Cultural Heritage items in Venice

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The OntoVE project, *Ontologies for the valorization of Germanic Cultural Heritage in Veneto within the perspective of the European Open Science Cloud (EOSC)*, aims to develop ontological modules for the description of Germanic Cultural Heritage (CH) items related to the Veneto region and provide different visualization outputs designed for both an academic and a non-academic audience. This contribution aims to present the dataset and the different visualization outputs to query and explore it.

The project aims to connect heterogeneous data by providing uniform descriptions of them by reusing established ontologies and making them accessible through the same platform. Therefore, the project adheres to the Findable, Accessible, Interoperable, Reusable (FAIR) principles (Kush et al. 2020) and strives for a more democratic fruition of CH, in light of the Faro Convention (<https://www.coe.int/en/web/culture-and-heritage/faro-convention>), by providing different visualization outputs targeted at different audiences. The project is being carried out at Ca' Foscari university of Venice, in close collaboration with a partner IT company, Net7 (<https://www.netseven.it/>). It is funded by the Italian *National Operational Plan* (PON, <http://www.ponricerca.gov.it/pon-ricerca/programme/>) on Research and Innovation 2014-2020 and the *European Social Fund* (ESF, <https://ec.europa.eu/esf/home.jsp?langId=en>) within the *Recovery assistance for cohesion and the territories of Europe* (REACT-EU, <https://www.europarl.europa.eu/factsheets/en/sheet/215/recovery-assistance-for-cohesion-and-the-territories-of-europe-react-eu->).

The dataset included in the Knowledge Base is a very specific one, since it comprises CH items of Germanic origin produced or left in the Veneto region. These range from the first attestations of the Gothic and Lombard periods (from the 5th century AD onwards, Villa 2006) with the ultimate goal of including moreover items up to the Early Modern period, e.g. related to the *Fondaco dei Tedeschi* (cf. Braunstein 1987, Häberlein 2010). At the same time, the dataset is heterogeneous; in fact, it comprises both archaeological and documentary findings that witness the different exchanges between the Veneto region and the different Germanic populations that transited through it.

Not only are the items of heterogeneous nature, but also their metadata are. In fact, we decided to include only items that are already digitised and described in some online repository; the availability of the resources in some online platforms enhances the retrieval and reuse of data, but requires metadata to be carefully scrutinized in order to develop a common model. The individuals to be included in the dataset were identified by querying different online repositories, a prominent resource being e.g. the General Catalogue of Italian Cultural Heritage (<https://catalogo.beniculturali.it/>). By describing these items through established ontologies, the

project aims to add value to the resources themselves, by making the connections between them visible through their aggregation within the same platform, highlighting the history of Venice, its neighbouring territories and the relationship to the Germanic populations that transited through it.

The archaeological and documentary CH items are described through two ontological modules, *OntoVE_Archeo* and *OntoVE_WrittenRecords* respectively, that reuse established abstract ontological models such as CIDOC-CRM, v. 7.1.2 (Bekiari et al. 2022) and LRMoo, v. 0.9.6 (Bekiari et al. 2023) and align them with finer grained ontologies, such as ArCo (Carriero et al. 2019) and Bibframe (<https://www.loc.gov/bibframe/implementation/index.html>). This way, the model guarantees interoperability, and provides for an adequate description of the CH items in the Knowledge Base. Whereas in fact CIDOC-CRM (and LRMoo) provide abstract classes and properties that allow to describe CH and bibliographic items, these are not easily implementable, due to the lack of a standardized vocabulary and of finer-grained classes (Barzaghi, Palmirani and Peroni 2022). Within the OntoVE Knowledge Base, we therefore compare and align semantic equivalent classes through an assertion of equivalence and assign finer grained classes as subclasses of the more general and abstract ones (cf. De Bastiani 2023 for an example applied to the *OntoVE_WrittenRecords* module). The definition of the ontological modules and the description of the single individuals are carried out with the editor Protégé Desktop, version 5.5.0 (<http://protege.stanford.edu>, Musen 2015).¹ The ontology documentation, created with Widoco (Garijo 2017) can be consulted at <https://chideba.github.io/ontove/ontove.html>, and is currently stored within the following repository: <https://github.com/ChiDeBa/ontove/tree/main>.

The dataset will be available through a SPARQL Endpoint built on Apache-Jena-Fuseki-4.7.0 (<https://jena.apache.org/documentation/fuseki2/>), thereby allowing the users with the relevant expertise to investigate the dataset. However, the project aims at providing new kinds of access to data, that could open the dataset to the non-academic user interested e.g. in the local history. Whereas SPARQL is the most powerful language to explore Linked Open Data and RDF Databases, it implies, however, specific knowledge, which makes the querying and exploring of such datasets a possibility reserved to people with the relevant expertise. Therefore, we decided to reuse the Sampo UI model for semantic portals (Ikkala et al. 2022, GitHub repository <https://github.com/SemanticComputing/sampo-ui>) to make the dataset accessible to a wider pool of users.

The Sampo UI model allows one to visualize the items belonging to the database according to pre-set search perspectives; at the basis of the search perspectives lies a SPARQL query, which is formulated at the backend level and interrogates directly the SPARQL Endpoint mentioned above. The user only sees the results of the query, but can further filter the data according to different search criteria (cf. Figures 1 and 2). The UI therefore offers different aggregations of the dataset for users who are not expert in SPARQL. Furthermore, thanks to the joint efforts between OntoVE and another PON project conducted at Ca' Foscari, namely CHIt, a third visualization output for the OntoVE dataset is being implemented. The partial results of this collaboration were presented in De Bastiani/Fabbris (2023), and the model is being developed further. The collaboration consists in making the OntoVE dataset available through the aggregator developed within the CHIt project

¹ We decided to align the ontologies manually, as (semi-)automatic alignment methods are often error-prone and require nevertheless human intervention (Carriero et al. 2020, Osman et al. 2021).

(Fabbris 2023 and Aiola/Fabbris 2023). The CHIt aggregator collects data stored in different repositories and makes them available through the same platform, providing uniform metadata for them. The user has moreover the possibility to annotate the data through the open source tool Pundit (<https://www.netseven.it/pundit/>). The collaboration between OntoVE and CHIt therefore resulted in a third visualization output for OntoVE (cf. Figures 3-4), through the CHIt frontend powered by Muruca (<https://www.muruca.org/>), that gives the user the possibility of interacting with the data by making their annotation possible. Moreover, the collaboration resulted in a model that can be applied to other Knowledge Bases by the CHIt aggregator, thereby resulting in a protocol for the retrieval of data stored in SPARQL Endpoints.

Concluding, this project adheres to the FAIR principles since one of its key aspects is to provide uniform ontological descriptions for CH items present in different repositories online by reusing established ontological models and aligning them with finer-grained ontologies. The dataset will be available through a SPARQL Endpoint and a portal based on the Sampo UI model. Finally, thanks to the collaboration with another PON project, a third visualization output is being developed, which will connect the OntoVE dataset to the other datasets retrieved through the CHIt aggregator, thus connecting data and providing new visualizations for them.



Figure 1 Search perspectives, User Interface created according to the Sampo UI model (Ikkala et al. 2022, <https://github.com/SemanticComputing/sampo-ui>)

The screenshot shows the 'Locations' search perspective in OntoVE. The interface includes a search bar at the top, navigation tabs (WORKS, EVENTS, PLACES, LOCATIONS, ENTITIES, RELATEDRESOURCES), and a sidebar with filters. The main area displays a table of results with columns for 'Archaeological Property', 'Current Location', and 'Web'. The table lists various archaeological sites and their associated locations and web resources.

Archaeological Property	Current Location	Web
Basile	Palazzo Fieschi (SOPRINTENDENZA ARCHEOLOGIA, BELLE ARTI E PAESAGGIO PER L'AREA METROPOLITANA DI VENEZIA E LE PROVINCE DI BELLUNGO, PADOVA E TREVISO) ...	http://www.soprintendenzasvve.beniculturali.it/soprintendenza/ve-sedi/la-ruota-fieschi-la-ca-del-fino/
Convento lateranense lombardo - Tomba 32	Depositi Soprintendenza Archeologia del Veneto, nucleo operativo di Verona	http://www.sban-ve.beniculturali.it/
Basile	Palazzo Fieschi (SOPRINTENDENZA ARCHEOLOGIA, BELLE ARTI E PAESAGGIO PER L'AREA METROPOLITANA DI VENEZIA E LE PROVINCE DI BELLUNGO, PADOVA E TREVISO) ...	http://www.soprintendenzasvve.beniculturali.it/soprintendenza/ve-sedi/la-ruota-fieschi-la-ca-del-fino/
Alemanno Tomba 2	Civico Museo Archeologico Milano	http://www.pedemonte.org/1113640/museo-archeologico.html
Lanfridei Fortificazione	Museo Archeologico Nazionale di Venezia	http://www.pedemonte.org/11194992/museo-archeologico-nazionale.html
Basilica di San Michele all'Adriatico	Tomba di Castelvinci fort	-
Convento lateranense lombardo 1 - Tomba 81	Depositi Soprintendenza Archeologia del Veneto, nucleo operativo di Verona	http://www.sban-ve.beniculturali.it/
Basile	Palazzo Fieschi (SOPRINTENDENZA ARCHEOLOGIA, BELLE ARTI E PAESAGGIO PER L'AREA METROPOLITANA DI VENEZIA E LE PROVINCE DI BELLUNGO, PADOVA E TREVISO) ...	http://www.soprintendenzasvve.beniculturali.it/soprintendenza/ve-sedi/la-ruota-fieschi-la-ca-del-fino/
Alemanno Tomba 1	Civico Museo Archeologico Milano	http://www.pedemonte.org/1113640/museo-archeologico.html

Figure 2 The 'Locations' search perspective and filtering function

The screenshot shows the CHIT frontend displaying records retrieved from a SPARQL query. The interface includes a 'Filter results' section on the left with search and subject filters. The main area shows a list of records with details for each, including titles, provenance, and subjects. The records are: 'Casteldardo struttura di fortificazione', 'Lastra sepolcrale di Lanfrido', 'Fibula a disco', and 'Rocca di Castelvinci'. A 'Show n results' button is visible at the bottom right.

Figure 3 Resources retrieved from the SPARQL query and visualized in the CHIT frontend

Metadata	Query	Archprop	http://www.semanticweb.org/utente/ontologies/2023/0/OntoVE_Archeo#Castelvint_fort
		Label	Rocca di Castelvint
		LabelLoc	Mel
		ExternalLink	https://www.geonames.org/3173644/mel.html
		Bibliographies	http://www.semanticweb.org/utente/ontologies/2023/0/OntoVE_Archeo#Castelvint_fort_Catalogue_of_Cultural_Heritage_pof_entry , http://www.semanticweb.org/utente/ontologies/2023/0/OntoVE_Archeo#Necropoli_dell_Eta_longobarda_nel_Veneto , http://www.semanticweb.org/utente/ontologies/2023/0/OntoVE_Archeo#Necropoli_longobarde_in_Italia_indirizzi_della_ricerca_e_nuovi_dati_atti_del_Convegno_Internazionale_26-28_settembre_2011_Castello_del_Buonconsiglio_Trento , http://www.semanticweb.org/utente/ontologies/2023/0/OntoVE_Archeo#Luoghi_e_segni_della_morte_in_eta_in_eta_longobarda_tradizione_e_transizione_nelle_pratiche_dell_aristocrazia
		References	https://catalogo.beniculturali.it/dettaglio/ArchaeologicalProperty/0500591271 , Elisa Possenti. 2001. «Necropoli di Età longobarda nel Veneto» <i>Quaderni Friulani di Archeologia</i> XI (00): 133-52. NECROPOLI LONGOBARDE IN ITALIA indirizzi della ricerca e nuovi dati (PRIMA PARTE) Atti del Convegno internazionale 26 - 28 settembre 2011 Castello del Buonconsiglio, Trento a cura di Elisa Possenti PROVINCIA AUTONOMA DI TRENTO CASTELLO DEL BUONCONSIGLIO MONUMENTI E COLLEZIONI PROVINCIALI 2014, Caterina Giostra Luoghi e segni della morte in età in età longobarda: tradizione e transizione nelle pratiche dell'aristocrazia [A stampa in <i>Archeologia e Società tra Tardo Antico e Alto Medioevo</i> , a cura di G. P. Brogolo, A. Chavarria, Mantova 2007, pp. 311-344 © dell'autrice - Distribuito in formato digitale da "Reti Medievali", www.retimedievali.it].
		id	http://www.semanticweb.org/utente/ontologies/2023/0/OntoVE_Archeo#0500591271
		RepoLink	https://catalogo.beniculturali.it/dettaglio/ArchaeologicalProperty/0500591271

Figure 4 Visualization of a single resource retrieved from OntoVE and visualized in the CHIt frontend

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