

Distant Reading Through Ontologies: The Case Study of Catania's Benedictines Monastery

Claudia Cantale,^(a) Domenico Cantone,^(b) Marianna Nicolosi-
Asmundo,^(b) Daniele Francesco Santamaria^(b)

a) Department of Human Sciences, University of Catania, Italy; b) Department of Mathematics and Computer Science

Contact: Daniele Francesco Santamaria, santamaria@dmi.unict.it.

Received: 15 April 2017; **Accepted:** 22 June 2017; **First Published:** 15 September 2017

ABSTRACT

In this contribution, we developed a Linked Open Dataset, more specifically an OWL ontology, about the history of the renovation of the Catania's Benedictines Monastery by the architect Giancarlo De Carlo. We considered a wide subset of public and private documents collected from 1977 to 2006 during the process of restoration and adaptation of the monastery to a campus for the University of Catania.

The task of modelling and population of the ontology have been carried out from the analysis of documents stored in the "Archivio del Museo della Fabbrica", in the new archive of professor Giuseppe Giarrizzo, in the private collection of Antonino Leonardi, and from the conceptual map of the locations of the monastery.

ACKNOWLEDGMENT

This work has been partially supported by the FIR project COMPACT: Computazione affidabile su testi firmati, no. D84C46

KEYWORDS

Semantic Web; Ontology; Distant Reading; Cultural Heritage; Archives.

CITATION

Cantale, C., D. Cantone, M. Nicolosi-Asmundo and D. F. Santamaria. "Distant Reading Through Ontologies: The Case Study of Catania's Benedictines Monastery". *JLIS.it* 8, 3 (September 2017): 203-219. doi: [10.4403/jlis.it-12342](https://doi.org/10.4403/jlis.it-12342).

Introduction

The renovation of the Catania's Benedictines Monastery of San Nicolò L'Arena and its adaptation as university campus performed by the architect Giancarlo De Carlo is an important project of cultural interest in Sicily. The monastery is, in fact, one of the largest in Europe and has been declared national monument in 1869. The history of its foundation is as much intricate as that one of its recovery and readaptation as a university building. This is why it is worth sketching its outlines, even if on a general scale.

Founded in 1558 on the flat surface of *Cipriana di Collina di Montevergine* around a cloister with a square plan, the Monastery of San Nicolò L'Arena was surrounded by the lava flow coming from Etna on the North and West walls in 1669 and then destroyed by the earthquake in 1693. In 1702, the *fabrica nova* building yard was opened again and went on for the whole 18th century.¹ In 1866 the whole building was confiscated and declared national monument with Royal Decree dating 15th August 1869. Because of *leggi eversive*,² the Monastery became Royal state property. As a result, a substantial part of it was given away to the Municipality of Catania for common benefit purposes, namely defense and education. During that period, the building was modified to receive schools, public gyms, and military barracks: each of these institutions modified the locations according to their needs. From the 1950s on, the Monastery was progressively emptied from civil uses to be almost entirely released in the second half of the 1970s.

At the beginning of the 1970s, when the task of regenerating the old town became urgent and mandatory (see, for instance, *Commissione Franceschini*, Declaration XL, 1967), other possible uses for the Monastery were considered. Meanwhile, the *Facoltà di Lettere e Filosofia* was looking for a new building more suitable to its needs, because of the increased number of enrolled students. Thus, in 1977 the University of Catania became the owner of almost the whole Monastery of Benedictines thanks to a donation in its favour made by the Municipality of Catania.³ By the end of the 1970s, the arrangement of the first rooms was started by *Ufficio Tecnico Universitario* in order to set out the transfer of the first university institutions. Such an initial restoration work brought to light a rich palimpsest of information able to tell the history of the Monastery and of the order which commissioned its construction centuries ago, besides that one of the ancient city.

The drawing up of *Progetto Guida* (De Carlo 1988)⁴ at the heart of the recovery of the Monastery was a long process because of its shape, its new usage, and the deep intertwining of historical stratifications.

¹ In 1695, the building of *Monasteriolo* started on the flat surface *Purità di Montevergine*, abandoning the *Cipriana* for technical reasons: the presence of the lava of 1669 did not allow the sunlight to penetrate into the cloister making it unhealthy. The building will be abandoned in 1702 to allow the viceroy to construct his own castle in that area (S. M. Calogero 2014).

² Legge 15 agosto 1867, n. 3848. art. 20 "I fabbricati dei conventi soppressi da questa e dalle precedenti leggi, quando siano sgombri dai religiosi, saranno conceduti ai comuni ed alle provincie, [...], e sia giustificato il bisogno e l'uso di scuole, di asili infantili, di ricoveri di mendicizia, di ospedali, o di altre opere di beneficenza, e di pubblica utilità nel rapporto dei comuni e delle provincie [...]"

³ However, the taking of possession of the entire building will be postponed until 2001 for several reasons.

⁴ In 1983, Giancarlo De Carlo was in charge of the drawing up of a project, the *Progetto Guida* indeed, for the recovery of the whole monastery. After the approval of such project, the architect was asked to work as consultant and, sometimes, as supervisor.

During his engagement with the University of Catania, Giancarlo De Carlo for the first time intensively tested the *progettazione tentativa*.⁵ Thanks to this particular operational method, the *Progetto Guida* was recognized by Regione Siciliana to be of “important artistic interest”.⁶ Some of the solutions adopted were often slightly and, sometimes, substantially different if compared to the reading of *Progetto Guida*. The reasons that pushed Giancarlo De Carlo and the *Ufficio Tecnico Universitario* to modify the projects in progress are traceable in the numerous archaeological findings, in the permissions by Superintendence, and in the decisions made by the committing university. As a result, the reconstruction of the history of the Benedictines Monastery restoration and of the political, economic, and social implications in the Catania area turns out to be complicated. According to the *Distant Reading* approach,⁷ we use semantic web tools such as Linked Open Data (LOD) and Web Ontology Language (OWL)⁸ in order to reconstruct such history and to provide the researchers with a powerful and efficient tool that can be used to study and integrate the data. Specifically, we define an OWL ontology representing the locations and architectural elements of the Monastery involved in the renovation activities, and a conceptual map of related documents written during the restoration period, stored in private and public archives. A related work is the project *Mapping the Republic of Letters* (Edelstein et al. 2017) using semantic web technology to describe the Grand Tour Travelers and their correspondence from the XVIII to the XX Century. The latter approach, however, differs from ours because it covers an extended period of time and because it is mainly based on well-established databases.

Background tools

Letters, documents, and data

The documents used to construct the ontological dataset, produced from 1977 to 2006, are stored in *Archivio del Museo della Fabbrica dei Benedettini*,⁹ in the new archive of the Department Head Giuseppe Giarrizzo, and in the personal collection of documents of the surveyor Antonino Leonardi.¹⁰ The

⁵ “Tentativa: meaning the attempt to reach the solution by proceeding through tests and checks, but also to tempt the situation one deals with, in order to bring to light its imbalances and to understand how and to what extent it can be changed without being distorted and to reach new balances” (De Carlo 1996).

⁶ DECREE 23rd May 2008, *Gazzetta Ufficiale della Regione Siciliana*, 20th June 2008, Year 62 N. 28: “[...] la ristrutturazione [...] effettuata su progetto redatto nel 1986 dall’architetto Giancarlo De Carlo determina di fatto il riuso del monastero attraverso una serie di interventi che vanno dalla manutenzione ordinaria e straordinaria di alcune delle parti esistenti, all’inserimento di elementi nuovi nel contesto storico, [...] le opere di ristrutturazione del complesso sopraddetto costituiscono pregevole esempio di opera di architettura contemporanea e rivestono importante interesse artistico”.

⁷ Introduced by Franco Moretti (2005), the Distant Reading approach consists in reading literary texts by means of geographical and conceptual maps, graphs, and trees. Such approach differs from the traditional *close reading* because it focuses on relationships among entities by means of processes of abstraction and reduction.

⁸ <http://www.w3.org/2001/sw/wiki/OWL>

⁹ By the end of the 90s, the idea that documents collected for administrative reasons could establish a resource for the creation of a contemporary archive took shape. This archive would be linked to the activities of the new *Museo dell’Edificio dei Benedettini* created thanks to the “*Progetto Coordinato Catania-Lecce*”. Its main goal was the adjustment of university buildings, having substantial lacks in terms of cataloguing and of inventory of library collections and census of scientific, archaeological, and artistic collections. The initiative 6 of the project was referred to the institution of *Museo dell’Edificio dei Benedettini*.

¹⁰ The big intervention of requalification of the Monastery of the Benedictines is to be attributed to the Department Head Giuseppe Giarrizzo (1927-2015). He was the Department Head until 1998 personally following all the stages of the building

juxtaposition of collections of documents of different nature is motivated by the fact that the Monastery of the Benedictines is “an exclusive architectonic event for Sicily” (De Carlo 2003) for both its past and contemporary age. Its restoration, indeed, has been a monumental action lasted more than 25 years (1977-2005), facing different vacillating moments both of speed and optimism and complete arrest and pessimism.

The reconstruction of the relationships among the documents is grounded on the building yard diaries,¹¹ official documents drafted by the architect to inform the Rector of the University of Catania about the progress of works, and addressed in copy to the Department Head Giuseppe Giarrizzo and the surveyor Antonino Leonardi. Each report was accompanied by an introductory letter sent to the three persons mentioned above. However, only letters addressed to Leonardi¹² and to professor Giarrizzo were classified. Each report, when possible, is associated with one or two letters. Letters are meaningful sources of information because they provide indications and ideas by G. De Carlo which are not contained in the reports.

The building yard diaries, the letters addressed to professor Giarrizzo, and the letters addressed to Leonardi are stored in Archivio del Museo della Fabbrica, in the new archive of Department Head, and in the personal archive of the surveyor Leonardi, respectively.

In particular, data drawn from such documents are classified according to the categories belonging to the Archivio Museo della Fabbrica. These are listed in what follows:

- Year: date of contract stipulation or commitment act;
- Category: typology of works to be distinguished between building works and/or alike, restoration works; structure (supplies and/or works), supply and/or decor execution, various (optional performances);
- Place: internal/external location of the Monastery where the work has been carried out.
- Object: activities and/or performances afferent to operational and handcrafted qualifications within each type of category;
- Work Supervision: reporting the indication of the individual responsible for the project and/or works direction of the single intervention.

In addition to letters and reports, we also considered a dataset from the press review stored in the Archivio and concerning the renovation of the Monastery. In fact, this material could help the reader to better understand the mediatic and political mood that characterized such interventions.

yard. The surveyor Antonino Leonardi (1937-2016) was the *Responsabile dell'Ufficio Tecnico Universitario*- Benedictines section from 1980 to 2006.

¹¹ Giancarlo De Carlo's diaries begin in 1989 when the *Progetto Guida* became executive. It was intention of the Department Head Giuseppe Giarrizzo and his collaborators to publish these diaries, which unfortunately never saw the light.

¹²Giancarlo De Carlo's letters mentioned here refer to the correspondence the architect had with the surveyor Leonardi from 1983 on issues concerning the recovery of the monastery. One hundred five of such letters have been selected from the whole corpus and commented by Antonino Leonardi through interviews for the publication of “La rabbia e la gentilezza. 105 lettere di Giancarlo De Carlo sul recupero del Monastero dei Benedettini” (Leonardi et al. 2017).

In the ontology, gathered data have been linked to notions of space and time. As far as space is concerned, the Monastery of the Benedictines is conceptually divided into five levels, as illustrated later.

Semantic web

The *semantic web* (Berners-Lee 2001) is a vision of the World Wide Web in which information can be automatically processed and integrated by machines, and data can be accessed and modified at a global level, thus increasing coherence and dissemination of knowledge. Moreover, thanks to suitable softwares known as *reasoners*, it is possible to extract implicit information present in data, leveraging a deeper knowledge of the domain. The domain is specified by means of expressions describing statements about web shared resources. Such expressions are formulated as triples of the form *subject-predicate-object*. The *subject* denotes the resource to be described, namely the actor of the statement, the *object* denotes the recipient or the result of the action, and the *predicate* denotes traits or aspects of the resource. Specifically, it expresses a relationship of a specific type between the subject and the object that is the action performed by the actor. For instance, if we wanted to express the concept “Michelangelo made the Sistine Chapel ceiling”, we would write <Michelangelo> <makes> <Sistine_Chapel_Ceiling>. Every time we want to add some information about a particular resource, we reuse the resource as subject or object of a new triple, depending on the type of relationship. Sharing data is an important feature of the semantic web. Publishing a set of triples makes it available to other people that can reuse information and add new data. Because of the uniqueness of the URI assigned to the resources and to the document, we can refer to them without ambiguity. Semantic web data are usually published using the Resource Description Framework (RDF)¹³ (or its extension RDF Schema (RDFS)) and the Web Ontology Language (OWL). The capability to extract implicit information from the described data is an important feature of the semantic web that can be implemented by means of the notion of class, a collection of elements of the domain sharing common characteristics and properties, and suitable binary relations on elements of the domain. A knowledge base needs to be defined using a semantic web language that admits non-trivial relations between classes and properties to extract implicit information. The RDFS language admits such task since it allows one to express the sub(super)class and sub(super)property relationships. For instance, the relation “has father” can be modelled as a subproperty of the relation “has ancestor”. Classes and properties of an RDFS knowledge base are organized in hierarchies called *taxonomies*. However, RDFS is far away from allowing complex inferences. This fact justifies the introduction of OWL. Informally, in computer science an *ontology* defines a set of representational primitives, namely classes and properties, allowing to model a domain of knowledge of the discourse (Liu and Tamer, 2009). When an OWL reasoner is executed on OWL data, we can perform the task of mining data from resources. Usually, an RDF document cannot be converted into an OWL ontology and viceversa. RDF and OWL partially share the syntax but not the semantics. OWL is often preferable because it allows one to specify far more about properties and classes than RDFS. More details about OWL reasoning capabilities can be found in (Hitzler et al., 2009).

¹³ <http://www.w3.org/TR/rdf-schema/>

The ontology of the Museo della Fabbrica

The ontology uses the following external ontologies: CIDOC-CRM (Comitato Internazionale per La Documentazione - Conceptual Relational Model),¹⁴ that provides generic definitions for describing concepts and relationships typically used in cultural heritage documentation, LinkedGeoData,¹⁵ the ontology for geographical places, DBpedia and Wikidata, vocabularies for general knowledge. CIDOC-CRM has been developed in order to create a general data model for museums, with a particular focus on information interchange (becoming an ISO standard only recently). The primary role of the CIDOC-CRM is to provide a basis for mediation of cultural heritage information and hence the semantic glue needed to transform today's disparate, localised information sources into a coherent and valuable global resource. LinkedGeoData has been developed by AKSW research group (Agile Knowledge Engineering and Semantic Web) with the aim of adding a spatial dimension to the Semantic Web. Wikidata¹⁶ is a free and open knowledge base that can be read and edited by both humans and machines and acts as central storage for the structured data of its Wikimedia sister projects including Wikipedia, Wikivoyage, Wikisource, and others. DBpedia¹⁷ is a crowd-sourced community effort to extract structured information from Wikipedia and make this information available on the Web.

As illustrated in the ontology import closure described in Figure 1, the main ontology *ArchivioMuseoFabbrica* is the access point to the knowledge base and aggregator of the ontologies presented in this contribution. In fact, as depicted in Figure 1, *ArchivioMuseoFabbrica* links together the ontologies *MonasteroBenedettini* designed to represent the spaces inside the Benedictines Monastery, importing in its turn *EdificiStorici*, a more general ontology describing historical buildings, and *DocumentoAF* that describes documents in the Archivio del Museo della Fabbrica, in the new archive of professor Giarrizzo, and in the private collection of A. Leonardi. The latter ontology imports in its turn the ontologies *Professioni*, representing people and jobs involved in the renovation of the monastery, and *OntoLuoghi*, cataloguing Italian geographical places. Before introducing the entities contained in *ArchivioMuseoFabbrica*, we first present its imported ontologies.

The ontology *MonasteroBenedettini* depicts the monastery by suitably populating classes belonging to the more general ontology *EdificiStorici* with individuals representing areas and elements of the monastery and introducing relations among them, as shown in Figures 2 and 3.

¹⁴ <http://www.cidoc-crm.org>

¹⁵ <http://linkedgeodata.org>

¹⁶ <http://www.wikidata.org>

¹⁷ <http://www.dbpedia.org>

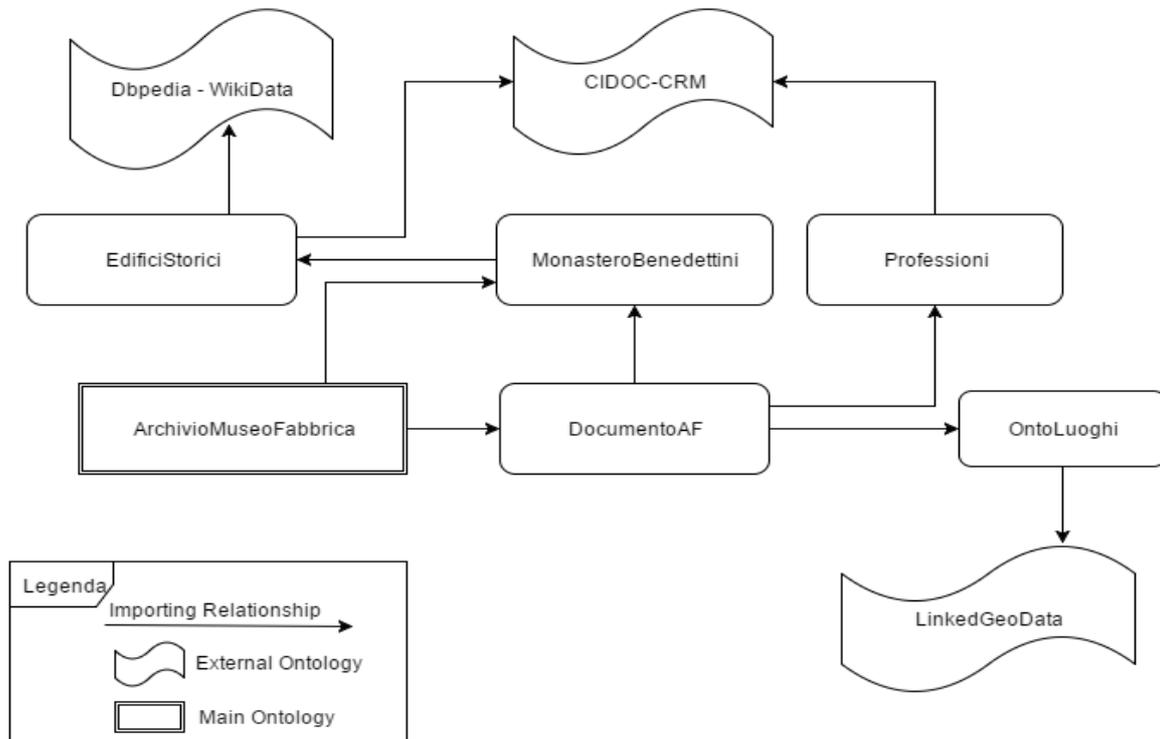


Figure 1. Import closure of the ontology.

The ontology *EdificiStorici* describes the structure of a Benedictines monastery. The ontology contains two main classes: the class “Area” that represents a generic area inside the monastery is a subclass of the CIDOC-CRM class “E53_Place”, and the class “Elementi” that represents decorative, natural, or architectonic structures.

Furthermore, the ontology contains, as a subclass of “Area”, the class “Livello” representing layers of the monastery. The ontology identifies several layers, partitioning the whole space of the building, each corresponding to an instance of “Livello”. Each instance uses the data-property “numeroLivello” having as range the integer corresponding to the level. Each area of the monastery converges to a layer representing its distance from the ground layer, namely layer 0. In the case of Catania's Benedictines Monastery, the ontology identifies five layers, from -1 to 3. Elements described by “EdificiStorici” are shown in Figure 4. Figure 5 and Figure 6 show levels of Catania's Benedictines Monastery and their usage, respectively.

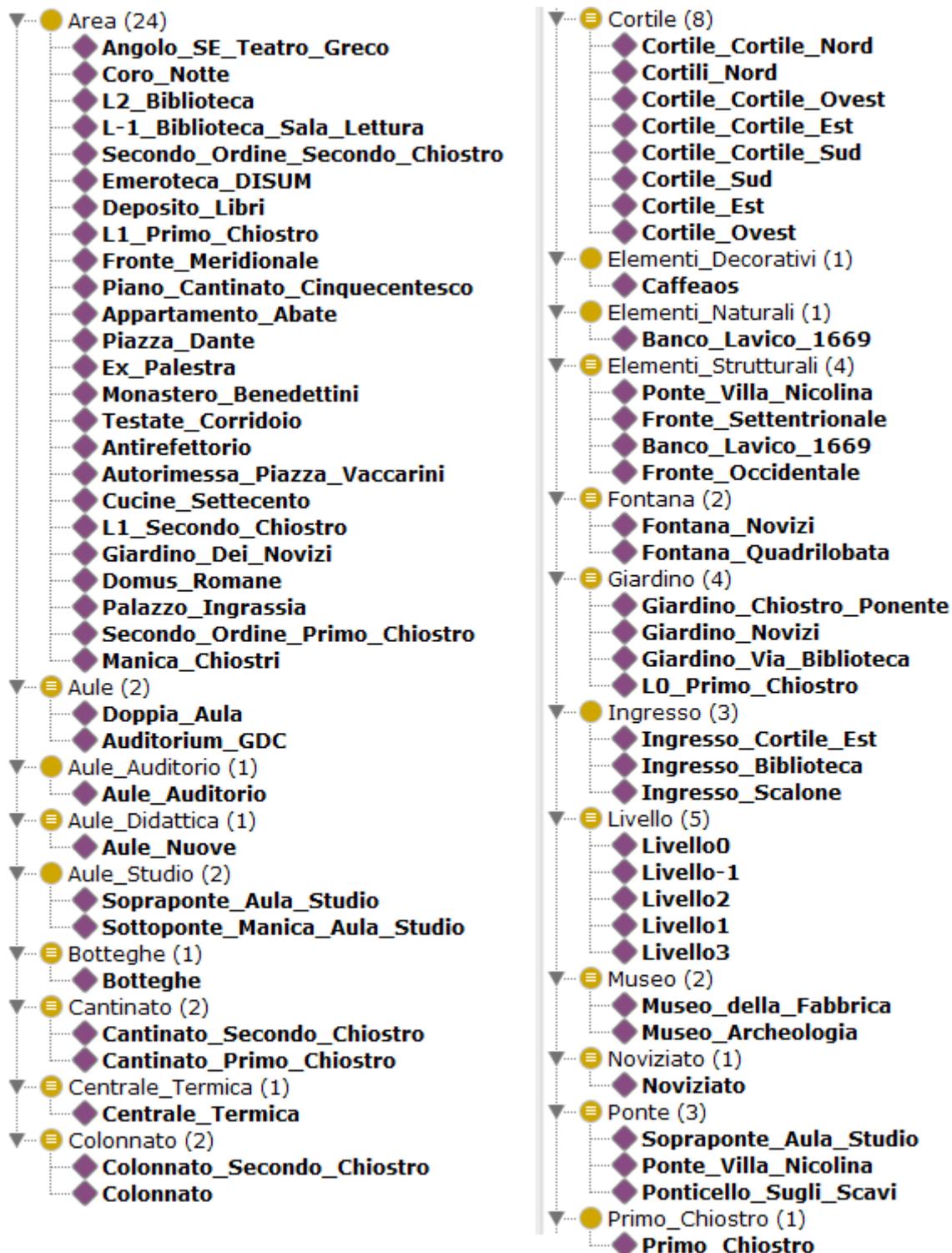


Figure 2. Description of the Catania's Benedictines Monastery.



Figure 3. Description of the Catania's Benedictines Monastery.

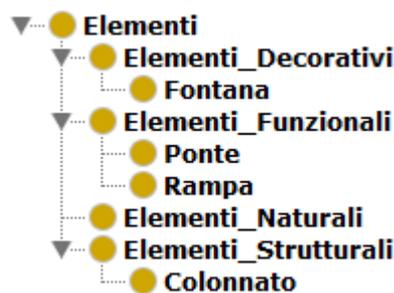


Figure 4. Elements of a Benedictines monastery.

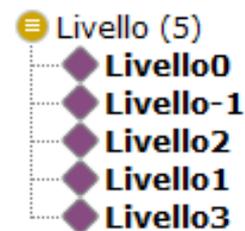


Figure 5. Layers of the Catania's Benedictines Monastery.

Rooms and locations of the monastery are organized in a taxonomy as shown in Figure 7. In addition to the taxonomization of the areas of the monastery, we are also interested in describing relations among areas. Such a conceptualization is defined by means of the object-property “contiene”, representing the general containment relationship among areas and of its inverse relation, “faParteDi”, subproperty of the CIDOC-CRM entity “P89.falls_within”.

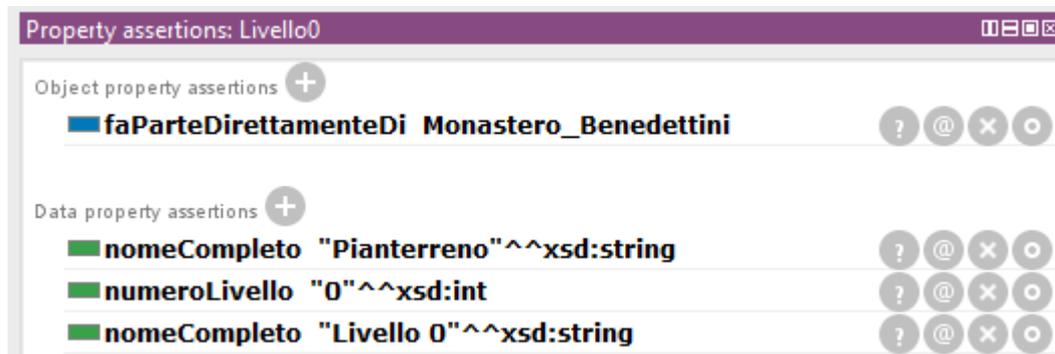


Figure 6. An example of the usage of levels of the Catania's Benedictines Monastery.

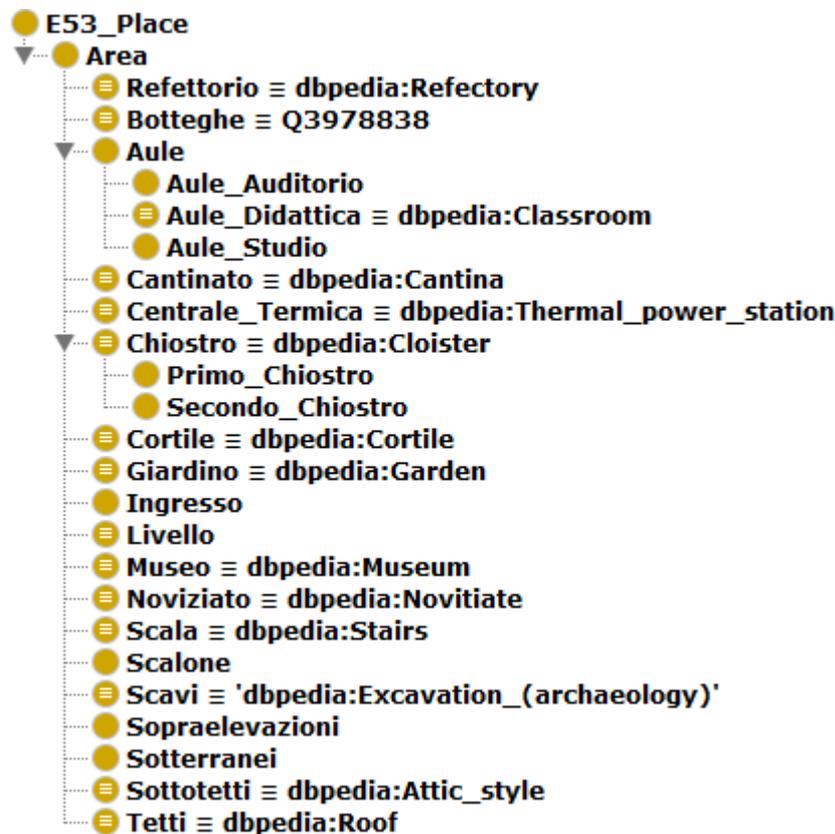


Figure 7. Taxonomy of the Catania's Benedictines Monastery.

The object-properties “contiene” and “faParteDi” are both defined as transitive properties. The ontology also contains the object-property “contieneDirettamente”, subproperty of “contiene”, representing the fact that an area directly contains an element or another area. Indeed, the superproperty “contiene” infers all the indirect inclusions among areas. The inverse of “contieneDirettamente” is the object-property “faParteDirettamenteDi”.

The data-properties “haNomeCompleto” and “haNomeInUso” associate an “xsd:string” representing, respectively, official names and commonly used names to members of the class “Area” and of the class “Elementi”.

The ontology “DocumentoAF” identifies one main class “Documenti”, subclass of the CIDOC-CRM class “E31_Document”, that contains three subclasses “DocumentoPersonale”, “DocumentoIstituzionale”, and “DocumentoMuseoFabbrica”, each describing a document type.

Specifically, the class “DocumentoPersonale” describes generic personal letters, the class “DocumentoIstituzionale” represents documents sent to public institutions such as the University of Catania, and the class “DocumentoMuseoFabbrica” describes the archives of the Museo della Fabbrica. The latter includes two further types of documents: the letters represented by the class “Lettere” and the building yard reports identified by the class “VerbaleDiCantiere”. Each member of the class “Document” is associated to its author by the object-property “haAutore” and to its recipient by the object-property “haDestinatario”. Each member of the class “DocumentoMuseoFabbrica” is related to the area of the monastery cited in the document by the object-property “haRiferimentoCantiere”. The range of the first two object-properties is constituted by the union of the classes “Persona” and “Azienda” belonging to the ontology *Professioni* (see Figure 1) while the range of the latter object-property is the class “Area” of the ontology *EdificiStorici*. Members of the class “Lettere” are related to the provenance place of the letter, represented by instances of the class “Place” of the ontology *Ontoluoghi* (see Figure 1), by means of the object-property “haLuogoAutore”.

In addition, they are associated to the building yard report cited by the letter, represented by members of the class “VerbaleDiCantiere”, by means of the object-property “haRiferimentoDocumentoAllegato”.

The instances of “DocumentoMuseoFabbrica” can specify the date and number of the document by means of the data-properties “haDataDocumento” and “haNumeroDocumento”, respectively. An instance of class “Lettere” can specify the relation number by means of the data-property “haNumeroRelazione” that is subproperty of “haNumeroDocumento” having as range the datatype “xsd:int”. By means of the data-property “haURLDocumentoFisico”, it is possible to refer to the URL of the original document published on the web providing as domain an instance of the class “Documento_Digitale”. An instance of such a class is related to an instance of the class “Document” by means of the object-property “haDocumentoDigitale”. Moreover, dates of inspection cited by a document can be specified by means of the data-property “haDataSopralluogo” using as range the datatype “xsd:date”.

One can also describe newspaper articles somehow related to events concerning the monastery by means of the class “ArticoloGiornale”. The relative newspaper can be specified by means of the object-property “haTestataGiornalistica” having as range an instance of the class “TestataGiornalistica”. The topic of the newspaper is specified by means of the object-property “haRubricaGiornalistica” having as range an instance of the class “RubricaGiornalistica”. Moreover, for a newspaper article one can specify authors, publication date, page number, title, and number of images by means of the object-properties “haAutore”, having as range an instance of the class “Persona”, “dataPubblicazione”, “haPaginaRiferimento”, “haNumeroImmagini”, respectively. Classes and object-properties of the ontology *DocumentiAF* are shown in Figure 8, data-properties in Figure 9.

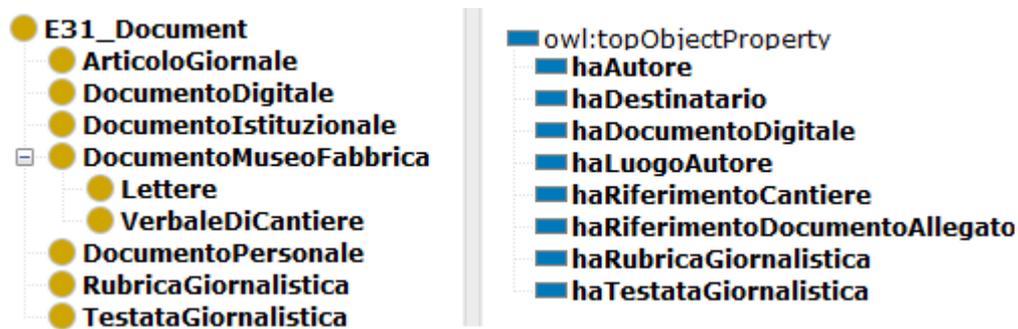


Figure 8. Classes and object-properties of the ontology *DocumentiAF*.

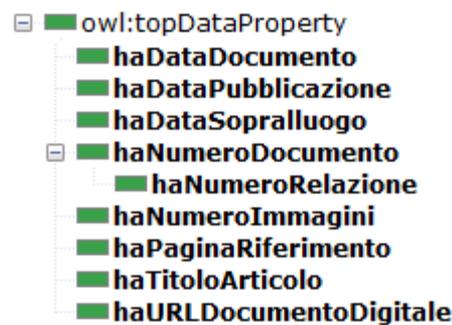


Figure 9. Data-properties of the ontology *DocumentiAF*.

The ontology *OntoLuoghi* has been introduced in Cantone et al. (2015) and (2016), to handle and reason on geographical places, especially in the Italian country. In the context of the Museo della Fabbrica, we are interested in referencing the provenance place of the letters. The ontology extends *LinkedGeoData* providing a taxonomy of geographical Italian places together with object-properties that associate a place with its own administrative locations.

The ontology *Professioni* describes people and companies cited in the documents of Museo della Fabbrica. The ontology represents persons and companies by means of the classes “Persona” and “Azienda”, respectively. The former is equivalent to the CIDOC-CRM class “E21_Person” while the latter is a subclass of the CIDOC-CRM class “E74_Group”. An instance of “Persona” can be a member of the class “Professionista” that describes the profession of the person. The ontology also provides a taxonomy for the jobs a person can carry out. The superclass of the taxonomy is “Mansioni”.

One can specify first name and last name of each element of the class “Persona” by means of the data-properties “haNome” and “haCognome”, respectively.

The class “Incarico” describes a task performed by a professional. We distinguish two kinds of tasks, “IncaricoAffidato” that refers to tasks effectively assigned, and “IncaricoIndicato” that refers to tasks suggested for a professional. The person (company) designated to perform the task is an element of the class “Persona” (“Azienda”) and the job specified in the task is an instance of the class “Mansione”.

“Persona” and “Azienda” are related to the classes “IncaricoAffidato” and “IncaricoIndicato” by means of the object-properties “haIncaricoAffidato” and “haIncaricoIndicato” respectively, both subproperties

of the object-property “haIncarico”. People and job assigned are related by the object-property “haQualificaIncarico” having as domain subclasses of the class “Incarico” and as range the class “Mansione”. These object-properties are subproperties of the CIDOC-CRM relation “P14i_performed”.

The classes “Mansione” and “Incarico” are subclasses of the CIDOC-CRM class “E7_Activity”. The start and the end dates of the commission are introduced by the data-properties “haDataInizioIncarico” and “haDataFineIncarico”, respectively, having as range the data-type “xsd:date”, and as domain an instance of the class “Durata_Incarico”. Such instance is associated with an instance of “Incarico” by means of the object-property “haDurataIncarico”.

The classes of the ontology *Professioni* are shown in Figure 10.



Figure 10. Classes of the ontology *Professioni*.

As outlined in the first part of this section, *ArchivioMuseoFabbrica* is the aggregator of the ontology presented in this contribution. The usage schema of the ontology *ArchivioMuseoFabbrica* is shown in Figure 11.

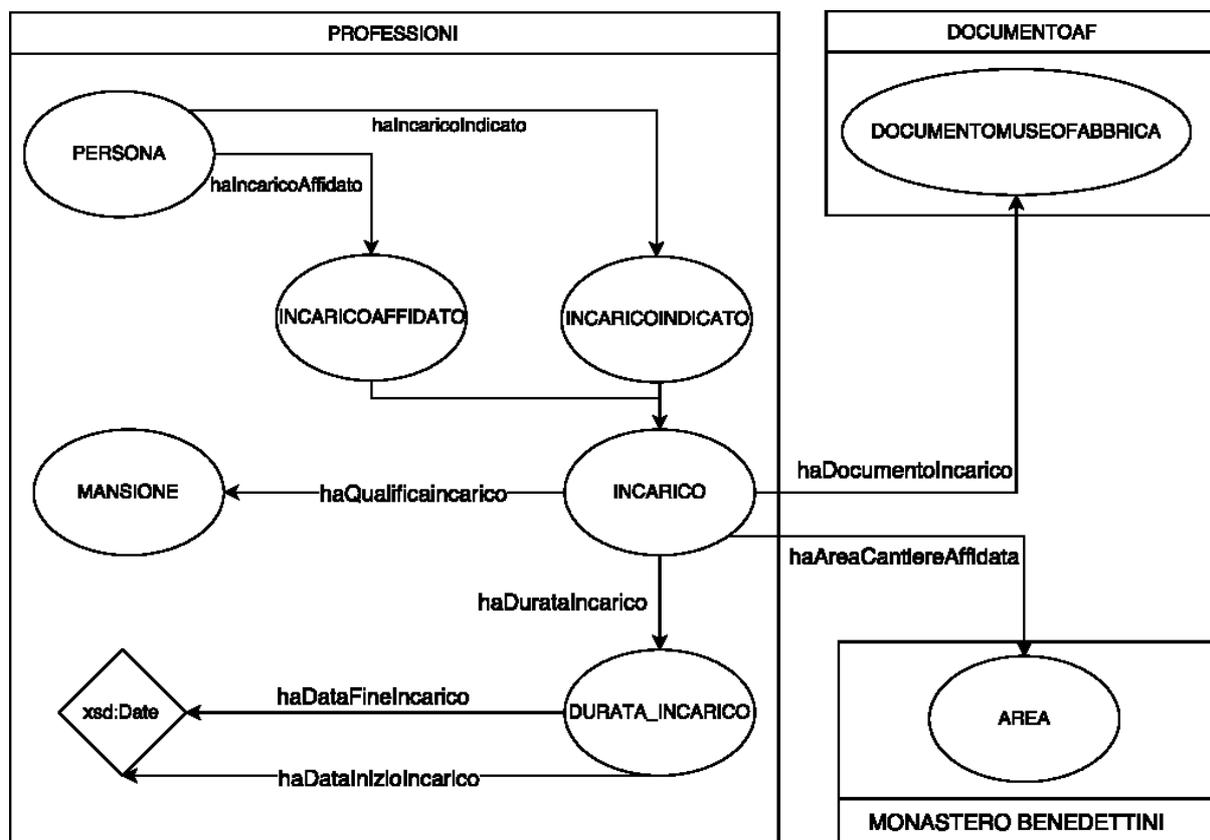


Figure 11. Schema of the ontology *ArchivioMuseoFabbrica*.

Specifically, it contains the object-property “haAreaCantiereAffidata” having as domain the class “Incarico” and as range the class “Area”. It provides the link between tasks from the ontology *Professioni* to the areas of the monastery (ontology *EdificiStorici*) involved in the task. The second object-property is “haDocumentoIncarico” having as domain the class “Incarico” and as range the class “Documenti”, associating a task performed by a professional with the archive of the Museo della Fabbrica (ontology *DocumentiAF*) that documented the task. The latter object-property is a subclass of the CIDOC -CRM relation “P70_documents”.

The task of populating the ontologies has been accomplished by means of several scripts ad-hoc written in Java to read the source data, mainly provided as Excel sheets, and to return the ontological dataset. The main library used is the OWL-API, a Java utility for manipulating ontologies. Some examples of source data and ontological mapping are shown below. Figure 12a shows the input data, while Figures 12b and 13 show the ontological data displayed by the editor Protégé.

	A	B	C	D	E
1	data Luogo	n. relazione	data sopralluogo	Mittente	Destinatario
2	Milano 27 marzo 1991		13 20, 21, 22, 23 marzo 1991	Giancarlo De Carlo	Giuseppe Giarrizzo
3	Milano 26 luglio 1991		15 19/20 luglio 1991	Giancarlo De Carlo	Giuseppe Giarrizzo
4	Assente		59 29/30/31 gennaio 1999	Giancarlo De Carlo	Giuseppe Giarrizzo
5	Milano 10 settembre 1991		16 5/6/7 settembre 1991	Giancarlo De Carlo	Giuseppe Giarrizzo
6	Milano 4 ottobre 1991		17 1/2/3 ottobre 1991	Giancarlo De Carlo	Giuseppe Giarrizzo
7	Milano 7 novembre 1991		18 3/4 novembre 1991	Giancarlo De Carlo	Giuseppe Giarrizzo
8	Milano 21 novembre 1991		19 19/20 novembre 1991	Giancarlo De Carlo	Giuseppe Giarrizzo
9	Milano 20 dicembre 1991		20 14/ 15/ 16/ 17 dicembre 1991	Giancarlo De Carlo	Giuseppe Giarrizzo
10	Milano, 28 gennaio 1992		21 19/20/21 gennaio 1992	Giancarlo De Carlo	Giuseppe Giarrizzo

Figure 12a. Dataset example of professor Giarrizzo's letters.

The screenshot shows an ontology editor interface. The top bar indicates the description 'Milano27marzo1991' and property assertions for the same. On the left, under 'Types', 'Lettere' is selected. Below it are options for 'Same Individual As' and 'Different Individuals'. The main area is divided into 'Object property assertions' and 'Data property assertions'. Object assertions include: **haLuogoAutore dbpedia:Milan**, **haDestinatario giuseppegiarrizzo**, and **haAutore giancarlodecarlo**. Data assertions include: **haNumeroRelazione "13"^^xsd:int**, **haDataSopralluogo "1991-03-22T00:00:00"^^xsd:dateTime**, **haDataSopralluogo "1991-03-23T00:00:00"^^xsd:dateTime**, **haDataSopralluogo "1991-03-20T00:00:00"^^xsd:dateTime**, **haDataSopralluogo "1991-03-21T00:00:00"^^xsd:dateTime**, and **haDataPubblicazione "1991-03-27T00:00:00"^^xsd:dateTime**.

Figure 12b. Example of the ontological mapping of professor Giarrizzo's letters.

The screenshot shows an ontology editor interface. The top bar indicates the description 'LASICILIA2002-01-20_10' and property assertions for the same. On the left, under 'Types', 'ArticoloGiornale' is selected. Below it are options for 'Same Individual As' and 'Different Individuals'. The main area is divided into 'Object property assertions' and 'Data property assertions'. Object assertions include: **haTestataGiornalistica LASICILIA**. Data assertions include: **haPaginaRiferimento "19"^^xsd:int**, **haDenominazione "LASICILIA2002-01-20_10"^^xsd:string**, **haTitoloArticolo "Dipartimento di scienze umane"^^xsd:string**, **haNumeroImmagine "0"^^xsd:int**, and **haDataPubblicazione "2002-01-20T00:00:00"^^xsd:dateTime**.

Figure 13. An example of the ontological mapping of press review.

Conclusions

In this contribution, we introduced an ontology describing the spatial organization of Catania's Benedictines Monastery, and a conceptual map of reports and letters sent by Giancarlo De Carlo to professor Giuseppe Giarrizzo and to Antonino Leonardi about the renovation of the monastery and collected in the "Archivio del Museo della Fabbrica", in the new archive of professor Giuseppe Giarrizzo, and in the private collection of Antonino Leonardi.

Our aim was to provide an information system based on semantic web tools that could serve also as digital support for illustrating the relationships among building yards and professionals that worked

on the renovation of the monastery in a temporal window of more than twenty-five years. Specifically, our contribution sheds light on the assignment of human, economic, and intellectual resources in terms of time and building yards. The work promotes the dissemination of such data making them available to researchers in the field of digital humanities and architecture, publishing in *Open Access* and *Open Data format* the building yard reports with reference to the archive collection sources stored in the *Archivio del Museo della Fabbrica*.

At present, the formalization of the inventory of the Archivio del Museo della Fabbrica is not complete. Our next goal is to extend the dataset with such information as soon as it is made available. In addition, we plan to analyze the historical context and its influence on the progress of the works by modelling the internal events and relating them to relevant coeval historical events. The latter task will be carried out by resorting to well-known ontologies such as the LOD ontology.¹⁸

Subsequently, we intend to implement queries over the dataset and provide an online system together with a graphical interface to query and explore data. In addition, we plan to extend our ontology so as describe generic monastery buildings and to integrate data currently populating it with datasets belonging to other monasteries. We intend to start such future work analyzing St. Gallen plan (De Vecchi et al. 1995).¹⁹ In this way, the Benedictines Monastery, which can already be regarded as a model of architectural reuse because of the quality of methodologies, ideas, and processes of participation, would also become a model of ontological abstraction for the study and the analysis of urban sociology and history.

References

- Berners-Lee Tim. 2001. *L'architettura del nuovo web*, Feltrinelli: Milano.
- Calogero Salvatore M. 2015. *Il Monastero catanese di San Nicolò l'Arena. Dalla posa della prima pietra alla confisca post-unitaria*, Editoriale Agorà: Catania.
- Cantone Domenico, Andrea Fornai, Marianna Nicolosi-Asmundo, Daniele Francesco Santamaria, and Emiliano Tramontana, "An OWL framework for rule-based recognition of places in Italian nonstructured text", in *Proceedings of KDWEB 2016*, Cagliari, 8-10 September 2016, CEUR Workshop Proceedings, Vol. 1748.
- Cantone Domenico, Marianna Nicolosi-Asmundo, Daniele Francesco Santamaria, and Francesca Trapani, "OntoCeramic: an OWL ontology for ceramics classification", in *Proceedings of the 30th Italian Conference on Computational Logic, CILC 2015*, Genova, Italy, July 1-3, 2015, CEUR Workshop Proceedings, Vol. 1459, pp. 122-127.
- De Carlo Giancarlo. 1988. *Un progetto per Catania. Il recupero del Monastero di San Nicolò l'Arena per l'Università*, (a cura di Daniele Brancolino), Sagep: Genova.
- . 1996. "Lettura e progetto del territorio", Atti del Convegno di studi in occasione del 20° anniversario di fondazione dell'ILAUD, Ferrara aprile 1995, Maggioli Editore: Rimini.

¹⁸ LOD: An ontology for Linking Open Descriptions of Events, <http://linkedevents.org/ontology/>

¹⁹ The Parchment of the plan of St. Gallen Monastery is held by the Stiftsbibliothek Sankt Gallen (Manuscript Ms 1092).

———. 2003. Nel presente il passato, Inaugurazione Anno Accademico 2002 - 2003, Siracusa 11 febbraio 2003, Università degli Studi di Catania: Catania.

De Vecchi Pierluigi and Elda Cerchiari. 1995. *Arte nel tempo*, Bompiani, Volume 1, tomo II, p. 331 – 332.

Edelstein Dan, Paula Findlen, Giovanna Ceserani, Caroline Winterer, and Nicole Coleman. 2017. *Historical Research in a Digital Age: Reflections from the Mapping the Republic of Letters Project*, in “American Historical Review”, Volume 122 Issue 2, pp 400-424.

Hitzler Pascal, Markus Krotzsch, and Sebastian Rudolph. 2009. *Foundations of Semantic Web Technologies*, Chapman & Hall/CRC.

Leonardi Antonino e Claudia Cantale (a cura di). 2017. *La gentilezza e la rabbia. 105 lettere di Giancarlo De Carlo sul recupero del Monastero di San Nicolò a Catania*, Editoriale Agorà: Catania.

Ling Liu and Özsu, M. Tamer. 2009. *Encyclopedia of database systems*. Springer Publishing.

Moretti Franco. 2005. *La letteratura vista da lontano*, Torino: Einaudi.