OntoBellini: towards an RDA based ontology for Vincenzo Bellini's cultural heritage

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Abstract. The rich cultural heritage preserved in the Belliniano Civic Museum of Catania has been studied and promoted in the last years mainly thanks to the BellinInRete project. It includes collections of objects (or *resources*) of a very different nature: paintings, photos, pianos, autograph scores, manuscript leaves, books preserved in the Museum's library, etc. In order to make the Belliniano Museum's heritage interoperable and reusable by scholars and cultural operators, we propose to semantically organize it in a unique homogeneous container, the OntoBellini ontology, designed and developed according to the Linked Open Data and Semantic Web paradigms. The wide variety of the involved museum resources, not even fully digitalised and catalogued, led us to the idea of experimenting with the RDA (*Resource Description and Access*) standard for creating library and cultural heritage resource metadata.

In this paper we describe the ongoing work towards the realization of the OntoBellini ontology.

Keywords. Vincenzo Bellini, Museum, Cultural heritage, Ontology, RDA

1. Introduction

The cultural heritage preserved in the Belliniano Civic Museum of Catania includes collections of objects (or *resources*) of a very different nature; in fact, the currently identified resources consist of about:

– 250 objects among paintings, photos, pianos, brooches, watches, furnishings, posters, medals, textiles, etc.;
– 4,500 manuscript leaves of documents and letters;
– 9,300 sheets of manuscript scores;
– 1,900 printed scores;
– 50 printed music booklets;
– 280 books of the museum library;
– 60 vinyl records of various musical compositions.

In the last years, this rich cultural heritage has been promoted particularly by BellinIn-Rete project [1]. The BellinInRete project stems from the collaboration between the Municipality of Catania, the CNR Institute of Cognitive Sciences and Technologies of Catania and the University of Catania's Department of Humanities. The project aims at renewing and creating a lasting change in the exploitation and enhancement of the Belliniano Civic Museum of Catania.

In order to make the Belliniano Museum's heritage interoperable and reusable by scholars and cultural operators, we propose to semantically organize it in a unique homogeneous container, the OntoBellini ontology, designed and developed according to the Linked Open Data and Semantic Web paradigms. The wide variety of the involved museum resources, not even fully digitalised and catalogued, led us to the idea of experimenting with the RDA (*Resource Description and Access*)[1] standard for creating library and cultural heritage resource metadata [2].

In this paper we describe the ongoing work towards the realization of the OntoBellini ontology.

The paper is organized as follows. In Section 2 we briefly review some related works. Then, in Section 3 we describe the work carried out and in progress concerning the analysis and the representation of the Belliniano Museum's resources, motivating the exploration and exploitation of RDA to build up the OntoBellini ontology. Finally, in Section 4 we draw our conclusions and discuss some hints for future works.

2. Related works

Various proposals concerning the semantic organization of museums cultural heritage have been presented over the years. A lot of them relies on the CIDOC Conceptual Reference Model (CRM)[2], which is the international standard for the controlled exchange of cultural heritage information since 2006. CRM provides a general core ontology which can be adopted in cultural heritage contexts to develop semantic web-based information systems, and to improve information sharing. Based upon CRM, semantic web models have been devised aiming at enhancing semantic expressivity in the cultural heritage domain and to address specific issues not completely covered by other existing models. This is the case, for instance, of the *OA entry* and the *F entry* ontologies presented in [3] which enrich CRM descriptive capabilities by defining several possible relations between works of art (OA entry) and photography (F entry), following the ICCD Italian content standards *Scheda OA* and *Scheda F*, respectively. In [4] it is possible to find an extensive listing of other projects and proposals underlined by CRM in the domain of cultural heritage.

Recently, the RDA standard has emerged in the context of cultural heritage promotion. The main objectives of RDA are to *identify* and to *relate* entities at an abstract level. Originally, RDA implements the *Functional Requirements for Bibliographic Records* (FRBR) data model, classifying information resources in terms of a four-level entity hierarchy called WEMI (*Work*, *Expression*, *Manifestation* and *Item*)[3]. In fact, in its Novem-

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[1] http://www.rda-rsc.org/

[2] http://www.cidoc-crm.org/

[3] https://www.ifla.org/best-practice-for-national-bibliographic-agencies-in-a-digital-age/node/8915

ber 2016 meeting, the RDA Steering Committee subsequently agreed in adopting the *IFLA Library Reference Model* (LRM)[4] as a conceptual model for the development of RDA[5], superseding FRBR.

RDA aspires to provide a *universal standard for data recording*, a unique code for representing *heterogeneous resources* that can be found in:

(A) libraries (manuscripts, books, music and movies);
(B) archives (institutional documents, personal and family papers and business documentation);
(C) museums (works of art, costumes, artifacts and natural objects and photos).

To be highlighted that within the Italian context, the resources related to the union Libraries, Archives and Museums are managed, through the use of sound and acknowledged standards, by the respective institutions ICCU, ICAR and ICCD, coordinated by MAB (*Musei, Archivi, Biblioteche*) Italian Association[6].

3. Museum data re(organization)

Within the BellinInRete project, the Belliniano Civic Museum's heritage has been partially studied and analysed by musicologists, and by other museum personnel with archival and library skills, aiming at retrieving information about the museum resources. The museum resources have then been formally represented as data records comprising different fields of information (see below). The collection of these records forms the basis which our proposed semantic organization of the Belliniano's heritage relies upon[7].

Records for the museum resources have been created following the ICCD and ICCU Italian standards for cataloguing and documentation (*Scheda OA*, *Scheda F* and *SBN cards*)[8]. The number of fields in each record, and their meaning, depends on the type of resource represented by the record itself. There have been identified 14 different *basic types* of museum resources, namely[9]:

- *Manoscritti* (Manuscripts)
- *Testi a stampa* (Printed texts)
- *Musica manoscritta* (Manuscript music)
- *Musica a stampa* (Printed music)
- *Materiale grafico* (Graphic material)
- *Arredi* (Furniture)
- *Dipinti* (Paintings)
- *Documenti* (Documents)
- *Foto* (Photo)
- *Medaglie* (Medals)

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[4] https://www.ifla.org/publications/node/11412
[5] http://www.rda-rsc.org/ImplementationLRMinRDA
[6] http://www.mab-italia.org/
[7] Notice that, actually, the number of the created records correspond to about 70% of the total number of estimated museum resources. The involvement of the remaining resources is planned for the early future.
[8] http://www.iccd.beniculturali.it/, https://www.iccu.sbn.it/it/
[9] Notice that the italian language has been used to record resource information.

- **Statue** (Statues)
- **Strumenti musicali** (Musical instruments)
- **Tessuti** (Textiles)
- **Oggetti generici** (Generic objects)

(Notice that, for completeness, in the list above we have reported the English translations (enclosed in parentheses) of the Italian terms (written in boldface) originally adopted to name basic types.) Within each basic type, the resources are subdivided, in turn, into more restricted, *specialized subtypes*. For instance, **Manoscritti** includes: *letters*, *draft letters*, *copies of letters*, *baptismal certificates*, *death certificates*, *marriage certificates*, *expense reports*, *medical bulletins*, etc. The **Materiale grafico** includes the *posters*, while the *scores* fall within the **Musica manoscritta**. **Oggetti generici** involve items owned by Vincenzo Bellini, such as *watches* and *brooches*, and other every-day life objects like *spoons*, *knives*, *cups*, etc. Figure 1 reports a selection of record fields in tabular form. Note that the information block stored within some record fields, presents a high

Manoscritti						
autore	editore	soggetto	descrizione	data	formato	lingua
Dall'Ongaro, Francesco <1808-1873>	Trieste : autografo	Perucchini, Giovanni Battista - Lettere e carteggi	Contiene copia autografa di Dall'Ongaro di quattro lettere, l'ultima delle quali, sebbene anch'essa autografa di Francesco Dall'Ongaro, riproduce lo scritto di una donna non identificata e risulta incompleta	1842-04-21	1 lettera, cc. 4rv ; mm 270 x 210	ITA
Materiale grafico						
autore	editore	soggetto	descrizione	data	formato	lingua
	Milano : Tipografia Pirola			1834-05-03	1 manifesto ; 41 x 30 cm	ITA
Musica a stampa						
autore	editore	soggetto	descrizione	data	formato	lingua
Bellini, Vincenzo <1801-1835>	Milano : Gio. Ricordi ; Firenze : Gio. Ricord e C.°, [1829]		Spartito del duetto lo troverò nell'Asia nell'atto II dell'opera Zaira. Nel margine superiore sinistro: «Al museo Belliniano -	12/7.1934.XII - Bazan Ascanio»	1829	1 spartito (15 p.) ; 24 x 33 cm	ITA
Musica manoscritta						
autore	editore	soggetto	descrizione	data	formato	lingua
Bellini, Vincenzo <1801-1835>	[S.l.] : copia, [1819-1826]		Spartito dell'aria "Quando incise sul quel marmo". Sul frontespizio nell'angolo superiore destro: «Al museo Belliniano	M° Bazan Ascanio»	1819	1 spartito manoscritto (8 c.) ; 220 x 270 mm	ITA

tipologia	descrizione	dimensioni	stato di conservazione	indicazioni specifiche	provenienza	cronologia
Arredi						
MOBILE	LIBRERIA CON CASSETTINI E	CM. 100 X 163	DISCRETO	RIPORTA INTARSI FLOREALI SUL FRONTALE	DONO SALVATORE POLLINA	XIX SECOLO
TAVOLO	IN LEGNO OVALE	CM. 71 X 47	DISCRETO	STILE IMPERO SOSTENUTO DA UNA CHIMERA	DONO	XIX SECOLO
Dipinti						
QUADRO	RITRATTO GIOVANILE DI BELLINI	CM. 63 X 74	OTTIMO	DIPINTO AD OLIO SU TELA	DONO	XIX SECOLO
Medaglie						
MEDAGLIA	REAL ORDINE DI FRANCESCO I DI BORBONE	CM. 4 CIRCONFERENZA	BUONO	EFFIGE DEL RE – IN ARGENTO IN CUSTODIA ROSSA	-	28 SETTEMBRE 1829
Statue						
STATUA	BELLINI ALL'ETA' DI 5 ANNI	H. CM. 183	DISCRETO	IN GESSO SU PIEDISTALLO IN LEGNO	DONO DEI PARENTI DELLO SCULTORE	XIX SECOLO
Strumenti musicali						
PIANOFORTE	PIANOFORTE VERTICALE INGLESE	CM. 104 X 240	DISCRETO	NON FUNZIONANTE	DONO CATERINA NICOLOSI CIRELLO	XIX SECOLO
Tessuti						
BACHECA MURALE	TRE ANGOLI DI TAPPETO CON TRE OPERE BELLINIANE	CM. 51 X 143	DISCRETO	RAPPRESENTANO "STRANIERA, PIRATA, SONNAMBULA" – RIPORTA N° 62	DONO DEL NIPOTE ASCANIO BAZAN	1831
Oggetti generici						
OROLOGIO	A CILINDRO IN ORO		PESSIMO	CASSA ARABESCA	PROPRIETA' DI BELLINI	XIX SECOLO

Figure 1. Some records corresponding to the Belliniano Museum's resources: green rows contain record field names; blue rows denote resource basic types. Notice that the top most table involves only paper printed resources.

level of granularity (*coarse-granularity*) which could be further refined by splitting the block across additional (*atomic*) data fields. This is the case, for instance, of the **formato**

field (see Figure 1: the second to last column of the top most table) which is used to composedly describe certain physical characteristics of a manuscript such as dimensions, number of pages, foliation, writing direction, etc. It is worth mentioning that certain record fields are specific to the particular type of museum resource described by these fields. For instance, the **lingua** field (cfr. Figure 1) has been specifically designed to represent the language(s) of written resources. Similarly, it makes no sense to talk about the foliation of a table or a chair (cfr. the field **formato**). We mention further that the Belliniano Museum's heritage even involves certain compound physical objects (such as medal containers and photo frameworks) which require a hierarchical record structure to be reasonably described[10]. Additionally, the Belliniano preserves also some music booklets which have not been catalogued yet. Also, we underline that several archival documents (like the various certificates), have received a rough analysis: it is planned to create detailed metadata for them by following the standards adopted by the National Archiving System of Italy (*Sistema Archivistico Nazionale*)[11].

As it emerges from the considerations above, the created representations of the Belliniano Museum's resources present a coarse, heterogenous character which makes it difficult to effectively translate them into an homogenous *knowledge base*. (Note that this partly derives from the particular representation criteria adopted for creating the data records corresponding to the museum resources.)

In order to improve such representations it would be useful to first clean, refine and then possibly merge the recorded data, so as to obtain a more uniform record collection. Then, RDA guidelines could be fruitfully exploited to get a more effective data (re)organization. In fact, RDA, through the WEMI classification mechanism (which inherits from FRBR), lends itself better than (e.g.) CRM to the description of both museum collections (composed of unique objects, and for which CRM has been primarily designed) and bibliographic resources held by libraries, as well as archival documents[12].

In very general terms, the main activities involved in the (future) development of the OntoBellini ontology, can thus be schematized as follows. After a first phase of data restructuring, aiming at creating more homogeneous, finer-grained record collections (as described above), it is planned to identify the main concepts and properties underlying the OntoBellini ontology in compliance with RDA's entity-relationship framework.

4. Conclusions and future work

In this paper we have proposed to semantically organize the rich cultural heritage preserved in the Belliniano Civic Museum of Catania into a shared ontology–the OntoBellini

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[10]Actually, such compound objects have not yet been disassembled for conservation reasons, and therefore, at the present, it was possible to retrieve only poor descriptive information for them. The created records for these resources are in fact poorly informative.

[11]http://san.beniculturali.it/SAN

[12]We mention that, basing on the IFLA FR models, an extension of CRM has been developed, namely FRBRoo (http://www.cidoc-crm.org/frbroo/home-0), which intends to represent the semantics of bibliographic information and to facilitate the integration and interchange of bibliographic and museum resources. However IFLA LRM, as an underlying conceptual model of RDA, allows for a greater level of generality than FRBRoo, as it includes less details compared to this latter.

ontology–, relying upon the large amount of currently recorded data for the museum resources. The heterogeneous character of the recorded museum data, requires however a preliminary reorganization of the data itself in order to make it more homogeneous and easily encoded into the ontology. To this end we plan to exploit the RDA guidelines for creating library and cultural heritage resource metadata.

Acknowledgements

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