Conceptual Models for Intangible Art

A formal modeling proposal

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Formal Models for Cultural Heritage

Cultural heritage has a long tradition in conceptual modeling, rooted in the cataloguing activities brought about by cultural institutions and national entities since the XIX century (Chan 2007). The development of archival science has promoted the establishment of comprehensive schemata for describing heritage entities, with standards emerging at the international level for bridging the differences among the national systems. Cataloguing activities, especially when carried out with a scientific approach, imply underlying conceptual models, than can be expressed in an explicit way using formal representation tools (Doerr 2003). With the advent of the digital era, then, the need for explicit representation has moved from description of artworks to the definition of processes and actors that characterize cultural heritage[1] in search for a shared, comprehensive view of the domain.

Issued by the International Council of Museums (Icom), the CIDOC Conceptual Reference Model (CIDOC-CRM) is intended as a "common language for domain experts and implementers"[2], specifically aimed at the design of information systems (Doerr 2003). Developed along more than two decades by the CIDOC Documentation Standards Working Group (DSWG), CIDOC-CRM[3] is currently released in a semantic format that supersedes the previous conceptual model encoded in the relational data model. In this paper, we discuss the use of this model for representing the "intangible" artworks taken as case studies in the Invisibilia project, and describe its adaptation to the case studies through some examples, using formal ontologies as the representation tool. We then illustrate and exemplify possible extensions to the model aimed at representing the traits of the case studies that do not fall within the boundaries of the model. Here, the label "intangible art" refers to the contemporary artworks that are mainly characterized by performativity and interactivity, such as installations and public performances, rather than a set of cultu-

[1] Processes concerning cultural heritage entities can be seen also in a narrative perspective (Damiano & Lieto 2013).

[2] <http://www.cidoc-crm.org/index.html>.

[3] CIDOC-CRM is also the ISO standard 21127:2006.

ral practices as defined by Kirshenblatt-Gimblett in her discussion of "intangible heritage" (2004). Also called "variable media art", these artworks are characterized by traits such as interactivity, co-creation, impermanence and intangibility among others (Triphonova et al. 2008). Given the orientation to the regional heritage of the project, the case studies also include more traditional artworks, issued from public art initiative, characterized by a tight integration with the urban context.

Since Berners Lee's manifesto of Semantic Web appeared in 2001 (Berners-Lee et al. 2001), semantic technologies have proven their suitability for the dissemination of cultural heritage (Doerr 2009). The ontology languages designed as part of the Semantic Web project allow conceptual models to be described in an unambiguous way, open to understanding and manipulation by human users and software programs. Several research projects have explored the application of semantic technologies to cultural heritage, among which one of the most representative is the Finnish Culture Sampo project (Hyvönen etal. 2009). Conceived as a large-scale demonstrator, Culture Sampo is a cultural heritage portal entirely relying on a "mash up" of domain ontologies that encode all the relevant features of artworks, from geographical data to craftsmanship.

Formal ontologies consist of logic-based descriptions of the concepts of a domain and of their relations. *Classes* represent entity types (e.g., the notion of artwork may be represented by the *Artwork* class) and are arranged in a hierarchy from the most general to the more specific (e.g., *Painting or Sculpture*). Classes, at any level of the hierarchy, contain sets of exemplars, or individuals (e.g., Picasso's painting entitled *Guernica* may be represented by an individual belonging to the *Artwork* class). Relations, or properties, are defined over pairs of classes, and are instantiated on the individuals that populate the ontology. For example, the individual named *Guernica* may be connected to the individual named *Picasso* (instance of the *Artist* class) by the *painted by* relation. A class may also have properties that attach data to the individuals belonging to it, such as a *creation date* or a *country of origin* for an artwork. Finally, classes can have necessary and sufficient conditions that are the object of automatic reasoning processes. For example, a *Painter* may be defined as an *Artist* having created at least one artwork of type *Painting*. Although formal ontologies can be exploited to develop large knowledge bases by leveraging the expressive power of their logical foundations, here we are concerned only with their use for conceptual modeling, and we will not discuss the use of formal ontologies to create information systems for cultural heritage.[4]

[4] However, it is worth remembering that the interoperability of knowledge representation systems is a main concern of semantic technology designers, beside the interoperability of conceptual models, and that semantic knowledge bases can be easily published on the web following the paradigm of Linked Data (Bizer et al. 2009).

Suitability of the existing models for Invisibilia

The top level of CIDOC-CRM includes five classes: *TimeSpan*, *Place*, *Dimension*, *PersistentItem* and *TemporalEntity*. *ManMadeThing* (subclass of *PersistentItem*) encompasses the classes for representing *PhysicalObjects* and *ConceptualObjects*, further subdivided into the *PropositionalObject* and *SymbolicObject* classes. The *TemporalEntity* class includes the *Event* class, a subclass of which is the *Activity* class. The *Actor* class, encompassing participants to *Events*, is a subclass of the *PersistentItem* class.

The documentation of CIDOC illustrates the functioning of the model through an example: the bronze statue "Monument to Balzac" by Auguste Rodin. The monument itself is represented an *Information Carrier* (i.e., it is an instance of the *Information Carrier* class, subclass of the above mentioned *ManMadeThing*) and it *depicts* a *Person*, Honoré de Balzac. The statue *has type* is "bronze" and it *was produced by* a *Production* process (the bronze casting, a type of *Activity*) *carried out* by a *Legal Body* (the firm that made the bronze casting, "Rudier et Fils"). The bronze casting *continued* a previous *Production* (the plaster modeling) *carried out* by a *Person*, Auguste Rodin. As this example illustrates, CIDOC-CRM is not limited to the representation of the internal structure of the artwork, but it opens to the reference to real world entities that are not intrinsically related to the art domain, such as physical persons, historical events, etc. It also represents in a fine-grained way the production processes that have originated the artwork and the roles played in them by various actors, including individuals and groups.

Although CIDOC-CRM is mainly devoted to the representation of physical artworks and of the processes involved in their preservation and dissemination, the notion of "event" encoded CIDOC-CRM can be easily adapted to the domain of intangible art. In particular the *Event* class enables the representation of the *creation activities*, which extend from the traditional ones (like the bronze casting in the example above) to the production processes of "intangible" art, such as installations and performances. These art forms typically include new media production such as video making, pre-visualization and interaction design, conducted by different agents with roles such as director, illustrator, multimedia designer; sometimes, in the Invisibilia case studies, the production is formalized in collective creative sessions, or workshops. The *Event* class, intended as process, is also employed to represent the *performative aspects* of the artworks, such as the artists' performances and the interaction of audience with the artwork. As it will be discussed below, the complexity of the production process in contemporary art advocates a more sophisticate model that accounts for serialization and reproduction.

The adaptation of CIDOC-CRM to INVISIBILIA has pointed out two other possible uses of this class, possibly not envisaged at the design time of the model. The first concerns the representation of the relations between a work (or performance, or manifestation) and its documentation, which is the result of the process of *docu-*

menting the art, a practice that is strongly encouraged by today's availability of digital media. In Invisibilia, they prevalently consist of pictures taken during the design activity and videos shot during a performance. The second use of this class is the process of providing explicit instructions for the maintenance of the artwork, a step that is often necessary due to the more transitory nature of many contemporary artworks, which involve disposable components such as light bulbs or neon tubes. Documentation and maintenance are highly relevant issues for the impermanent components that characterize contemporary art.

Finally, the case studies of Invisibilia are often characterized by reproducibility, since the artwork design can be reproduced several times in different contexts by changing actors, with variations brought in by the different context and participants. A performance, for example, can be carried out more than once by adhering to the same score. In interactive installations, the interaction with users is distributed over several sessions, normally characterized by a predefined flow. Aspects such as reproducibility and serial production are dealt with by the model known as "Functional Requirements for Bibliographical Records" (FRBR), described by O'Neill (O'Neill 2002). Designed for capturing "the underlying semantics of bibliographic information"[5], FRBR encompasses four main entities, mainly *Work*, or abstract ideation, *Expression*, its encoding in a specific language such as text or music, *Manifestation*, its embodiment in a concrete representation, and *Item*, a single manifestation in an editorial process. Doty (2013) suggests that FRBR is suitable to account for the problem of variation in performance: "The problem of variation is the problem of how, if a Work is defined by all the examples of it, we can determine that two examples that are not identical are nonetheless part of the same Work. This problem is especially pronounced in live performance, which, by its very nature, has the potential for each of its examples to be unique" (Doty 2013). In Invisibilia, we include the FRBR model in the ontology, relying on the mapping of the FRBR model onto the CIDOC-CRM proposed by the FRBRoo working group (Doerr & LeBoeuf 2007). According to this proposal, the notion of *Work* corresponds to the *ConceptualObject* class in CIDOC-CRM, and different versions of the same work are represented as instances of the *Manifestations* class, which corresponds to the *SymbolicObject* class in CIDOC-CRM.

Extending CIDOC to represent intangible art: a proposal

The ontology developed for the Invisibilia project extends the CIDOC-CRM ontology (Doer 2003) to the world of the intangible component of contemporary art. Contemporary art, as surveyed by Invisibilia, is characterized by the commixture of

[5] <http://www.cidoc-crm.org/frbr_inro.html>.

installations (often impermanent), performances and interactive elements. Specific inadequacies of CIDOC-CRM emerged regarding the modeling needs of interactive installations and live performances. Our proposal relies on the introduction of new properties to describe the "invisible" components of contemporary artworks and to put them in relation. In particular, in our case studies, we have provided an extension regarding both the process-based components of the intangible art production (e.g. by modelling the creative processes involved in the realization of intangible art) and the aesthetic design elements that are at the core of specific expressions of contemporary art (e.g. in the case of live performances).

Previous extensions of the CIDOC-CRM models can be found in the literature. For example, Theodoridou et al. (2010) proposed an extension aimed at modeling the notion of reliability and provenance in the transfers of possession of cultural heritage items. In this case, the extension regards mainly the modelling of roles involved in such processes of over time. A relevant extension of CIDOC-CRM, for the Invisibilia project, is given by Ng etal.(2008) where the notion of performance (not present in the original model of CIDOC-CRM) is proposed for the integration into the ontology. A limitation of this contribution, however, is given by the fact that the integration into the existing ontology of the concepts required to describe performances is provided by the authors. In particular, this extension is limited to the exclusive introduction of the class "Performance" in the ontology, without any specification about the relation that such type of class (and therefore the members of such class) entertain with the other ontological components (actors, roles, processes etc.). In our case, we have treated the modeling of the Manifestation (intended as in FRBR terminology) of live performances as particular events enjoying a subset of the whole attributes associated to the artistic manifestations. In particular, the performances may still be described in terms of constitutive elements characterizing their status (e.g. they may take place in particular places, may be directed by some persons, etc.) but they cannot be directly qualified in terms of physical components (e.g. a performance is not "composed by" stones) as the standard manifestations. This modelling style, along with other examples, is described in the next section.

Examples

In this section, we briefly report three different modelling examples regarding the representation of an installation, a live performance and, finally, a physical modern artwork in the extended version of CIDOC-CRM that we designed for the Invisibilia project.

Let us consider the representation of the installation, "Nomadi" displayed at the PAV museum in Turin, on two different occasions, in December 2013 and February 2014. In our approach, the idea underlying the installation (*Installation1*, instance of C*onceptualObject/Work class*) is connected with two different realizations

(*Version1* and *Version2* respectively, instances of the *Manifestation/SymbolicObject class*, see the yellow arrow in figure) by the *hasManifestation* property. Each version takes part into two different events (*Workshop* and *Revision*, yellow arrows in the figure) that took place in different locations, while the idea takes part to both events. The whole picture of such situation is reported in the Figure 1.

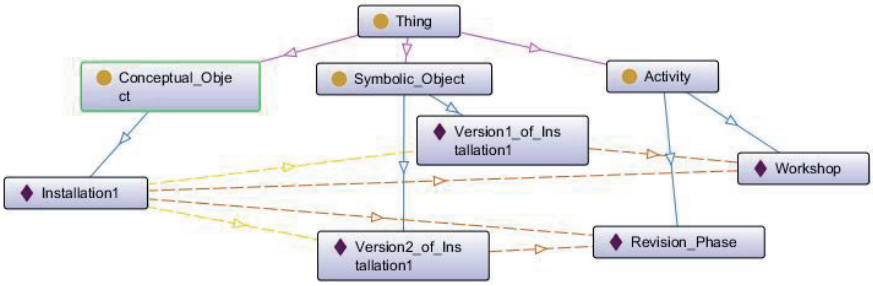

Figure 1. Work – The ontological description of Manifestation and Processes in Nomadi. Boxes represent individuals, dashed lines represente their relations, or properties.

The model of the installation Nomadi was, then, enriched with information (not shown in the figure) about:
the *Creation activities* that generated the events, such as the Workshop (which contained video editing, graphic animation and interaction design as its sub-activities);
the *Physical components* encompassed by the idea and its manifestations, such as scenery, hardware and multimedia devices;
the *Agents* who participated in the various activities, with roles such as designer, actor, etc.;
the *Location* of the events (e.g., PAV - for the main event) and the Time of the events (e.g., November 5th 2012 for the main event);
the reference to the *Documentation* (e.g. pictures documenting the design activity) and the link to the maintenance manual (where present) for the manifestations.
The same approach, which allows us to differentiate between the physical and the process-based aspects involved in the realization and the fruition of the artistic artifacts – along all the phases individuated by FRBR, Work, Expression and Manifestation – has been used to model a more complex artistic event, namely "Costruire Comunità" by Marinella Senatore. Such event took place at the Castello di Rivoli on 24th of November 2014, and consisted of a live artistic parade executed by an organized multitude of citizens and groups along the streets of the city of Rivoli. In Invisibilia, this event has been modelled as a complex work, since

different creative and design processes have been individuated as being part of the whole idea of "Parata". For example: in the case of "Costruire Comunità", the *Work* (*Idea_Parata*) also includes a more simple work based on the fact that a constitutive design element of the event (used for the artistic fruition *in absentia* of the event itself) is given by the necessity that it is filmed. Therefore, the general idea of the Parata is splitted in two subworks. *Idea_Video_Parata* (Work 1) is the starting point for the design of the creative processes regarding the video of the parade, while *Idea_Performance* (Work 2) is the work for the live event itself that must be then described, according to FRBR, in terms of *Expression* and *Manifestation* (see Figure 2).

For what concerns the modelling of the expression level of a live manifestation it was necessary to introduce in CIDOC-CRM the concept of *Score* as a particular

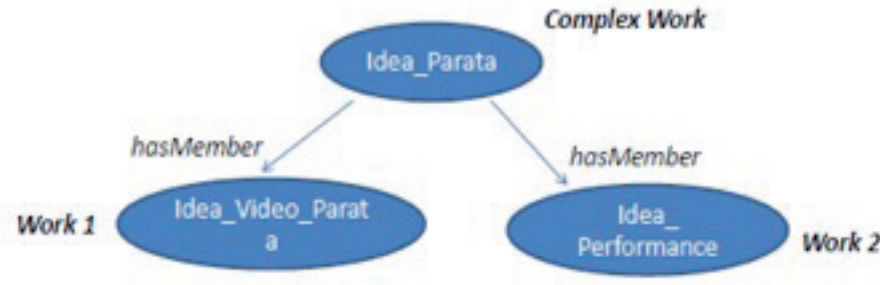

Figure 2. Complex Works for artistic performances in Costruire Comunita

subclass of the *Design* and *Procedure* classes needed for the realization of artistic live performances. This introduction allowed us also to deal with the above mentioned problem of variations (Doty 2013).

A third modelling example, different from the two already seen, was the modelling of a physically realized contemporary public art. Let consider the idea of the artwork "Fontana" (Fountain) by the artist Mario Merz. The Fountain of Mario Merz is a public artwork in Turin, released in 2002, that has the shape of igloo with the surface consisting of a puzzle of plates of slate, emerging from a rectangular water tab, with water jets, located in a road widening; four red neon lights, that light up at evening, mark the cardinal points.[6] The artwork is an instance of *PropositionalObject/Work* class, and is described by a *ProceduralPrescription* (executive specifications) to which it is connected via the property *isRealizedIn*. The manifestation of the idea (instance of the *SymbolicObject/Manifestation* class)

[6] «The igloo structure has been frequently revisited by Merz, since 1968, with essential forms, providing an idea of living a place, a balanced architecture, with an internal/external space, that enlarges according to life necessities». (from the records of the Municipality of Turin)

is given by an installation made of plates of slate and neon tubes, whose size, layout, etc., also described in the ontology. The physical artwork, then, is related to its maintenance activity (instance of *MantainanceActivity*), documented by some specific document (instance of the *MaintenanceDocumentation* class), and distinct (for time, location, actors) from the *CreationActivity* that originated the monument, which has a different Time and Location. Again, we have used the class *Score* with the goal of representing scripted, complex artistic performances. In the case of Merz's Fountain, this class is simply employed to describe the enlightening of neon lights in the evening. With respect to the invisible artistic productions the information encoded in this case also represents in detail the physical components of the artistic artwork. On the other hand, an element that, from a modelling perspective, is in common between the intangible artistic productions and the physical ones (represented, in our case, by the monument described above) regards the representation of the design processes (transversal to all the phases of *Work*, *Expression* and *Manifestation*) through which the realization of the artistic creation is obtained. In particular, the description of the *design cycle* (and of its possible multiple loops) involving, at the different stages, the conceptualization of the artistic idea (*Work*), its relation with the design elements through which the idea is implemented (*Expression*) and, finally, the realization of the artistic production according to the defined design (*Manifestation*) can be a symptom that the real *invisible* red thread connecting intangible and tangible arts is represented by the possibility of modelling, in a diachronic perspective, all the processes, the actions, the actors, the roles, the documents (digital or not) and the physical components involved in the artistic creation of contemporary art.

Conclusion

In this paper, we proposed to adopt and extend the CIDOC-CRM conceptual model to describe some of the traits of the contemporary artworks included in the Invisibilia project. Well aware of the caveat expressed by Schwartz & Cook (2002) that "Archives are social constructs. Their origins lie in the information needs and social values of the rulers, governments, businesses, associations, and individuals who establish and maintain them." we adhered to the vision, started by the Semantic Web Project, that ontology languages can foster the emergence of shared, unambiguously described conceptual models and that this paradigm applies also to cultural heritage. The pivot of our modeling proposal is the notion of *process*, that we employed to describe both the articulation of the artistic creation processes in Invisibilia, often of performative nature, and the interaction with the audience, with some extensions aimed at grasping the use of new media technologies. Inspired by the analysis of the case studies of the project, the data driven methodology by

which the model was designed and validated, is the primary evidence in favor of its future applicability to exemplars that share the main traits scrutinized by Invisibilia.

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