The Shape of a Benedictine Monastery: The SaintGall Ontology

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Abstract. We present an OWL 2 ontology representing the Saint Gall plan, one of the most ancient documents arrived intact to us, which describes the ideal model of a Benedictine monastic complex that inspired the design of many European monasteries.

Keywords. Ontology, OWL 2, Digital Humanities, Benedictine Monasteries.

1. Introduction

Monasteries are conceived by the Benedictine monastic order, founded by Saint Benedict of Nursia, during the last period of the Western Roman Empire. The monastic shape aims preserving the European Christianity inside small self-sustaining communities where to lead a life of mystic and religious contemplation and introspection.[1] The main principle is to protect and shield Christian religion and tradition from barbarian invasions.

Starting from the VII century, Western Europe is characterized by a capillary network of monasteries. Their shape in Occident remained largely unchanged in its characteristics during the whole Middle Age and in all Christian countries.

Monasteries are often also abbeys that are spaces where the *nullius diocesis* is effective. Such norm, in the canon law, represents the independence of a church and of the related monastery from the diocese in which the building is located. Therefore, the abbot substitutes for the bishop inside the Benedictine "village".

Strongly inspired by the rule of Saint Benedict, the plan of St. Gall, illustrated in Figure 1, is a model of monastery better representing the Benedictine architecture.[2] Founded in the context of Pre-Romanesque Carolingian art and architecture, in which a varied partition of the space is preferred, it can be considered a fixed-type for the Middle Age monasteries [9]. Moreover, being one of the most ancient descriptions of primitive Bene-

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[1] «Monasticism has its root in the interpretation of the Christian faith developed in the theology of the VI century firstly in Orient. Analogously to theology and architecture, it is subjected to a deep transformation in Occident. [...] The Benedictine Order remains for a long time the principal one. Hundreds of convents and monasteries are spread across the Christian Europe and represent cells of Christian tradition and faith, of science, and of culture» [10].

[2] http://www.stgallplan.org/
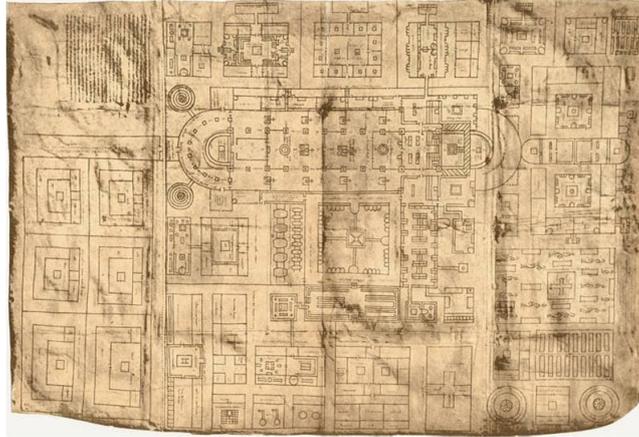
Figure 1. The plan of Saint Gall.

dictine monastery arrived intact today, it turns out to be an important structural, architectonic, and functional landmark for the Benedictine monasteries. In the plan, St. Gall monastery is idealized together with its essential components. In fact, as it often happens in the context of architectural history, buildings realized in a long temporal window are subject to change with respect to the original idea because of historical, economical, practical, and morphological reasons. Many European monasteries are inspired by the St. Gall plan even if for practical and technical reasons they deviate from it. For instance, Catania's Benedictine Monastery [1,8] contains most of the elements of the St. Gall plan with the exception of some locations such as the brewery that, for cultural reasons, is replaced by a distillery. Moreover, Catania's Benedictine Monastery is a urban monastery and therefore the structure of the animal farms is also slightly modified.

In this paper we present an OWL 2 ontology, called SaintGall Ontology, representing the monastery described in the St. Gall plan. SaintGall Ontology has been developed by taking into account structural, architectonic, and functional details of the buildings included in the plan, and information provided by [9,10,11,12]. It consists of more than 400 classes, almost 60 object properties, and more than 1000 logical axioms. It exploits OWL 2 constructs such as existential restriction and qualified cardinality restriction, and has been classified using the Fact++ reasoner.

2. The Ontology of St. Gall plan

The SaintGall Ontology[3] describes buildings and green spaces depicted in the Saint Gall plan considering their cardinal orientation, their position with respect to other entities inside the plan, and their architectonic, structural, and functional features.

The ontology exploits the following main classes. The class Building describes a generic building, Garden specifies a generic green space, Element describes architectural, natural, ornamental, and votive elements, furnitures and tools of common use illustrated in the plan. The ontology also provides classes and properties to describe the car-

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[3]https://goo.gl/XN2hc3
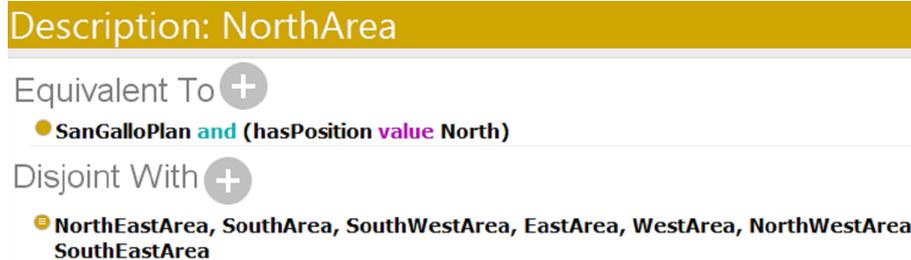
Figure 2. Description of `NorthArea`.

dinal orientation, position, and shape of the structures of the plan, and the role of people living inside the monastery.

At first we model the functional areas of the monastery classifying the buildings represented on the map according to their intended use. Specifically, we introduce as subclasses of `Building` the pairwise disjoint classes `BuildingForEducation`, `BuildingForHospitality`, `BuildingForTheSickAndInfirm`, `FarmBuilding`, `PrincipalMonasticBuilding`.

`BuildingForEducation` includes, in particular, the class `School`, modeling a building intended for the education of scholars, and the class `NoviceCloister`, representing the novice cloister, dwelling of young people oriented to the monastic life. `BuildingForHospitality` contains among others the class `HospitiumDistingueshedGuests`, modeling the hospitium for the reception of eminent strangers, and the class `HospitiumPoorTravelersPilgrims`, representing the dwelling of poor travelers and pilgrims. The class `BuildingForTheSickAndInfirm` contains in particular the subclass `InfirmaryCloister`, representing the cloister where the sick brethren are lodged, and the class `DoctorHouse`, containing among others a private room for the physician and a room for very ill patients. The class `FarmBuilding` models the factory, the working house, and other buildings devoted to domestic cattle, poultry, and their keepers. The class `PrincipalMonasticBuilding` includes in particular the classes `AbbotHouse`, modeling the dwelling of the abbot, `TheCloister`, describing the cloister where monks live, and `TheChurch`, describing the abbey. The hierarchy of `Building` subclasses is shown in [2].

The green spaces inside the monastery are modeled by means of the class `Garden`, having the disjoint subclasses `Cemetery`, `KitchenGarden`, and `PhysicGarden`. Cardinal orientation of buildings and gardens on the map are modeled by the classes `CardinalDirection`, `CentralPosition`, and the object-property `hasPosition`, having as range the union of `CardinalDirection` and `CentralPosition`. `CardinalDirection` is a finite enumeration of the values `East`, `North`, `NorthEast`, `NorthWest`, `South`, `SouthEast`, `SouthWest`, `West`. `CentralPosition` contains only the individual `Centre`. In addition, we introduced the defined classes `CentralArea`, `EastArea`, `NorthArea`, `NorthEastArea`, `NorthWestArea`, `WestArea`, `SouthEastArea`, `SouthWestArea`, `SouthArea`, whose subclasses, representing the buildings and gardens of the monastery, are deduced by inference. Figure 2 and 3 show the description and the inferred hierarchy of `NorthArea`, respectively.
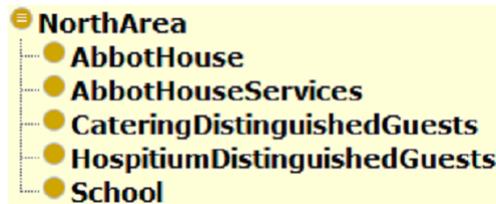
Figure 3. Inferred hierarchy of `NorthArea`.

Figure 4. Subclass hierarchy of `Shape`.

In addition, we define the position of buildings or gardens in the map with respect to other contiguous buildings or gardens, by means of object-properties such as `onEastOf`, `onNorthEastOf`, `onNorthOf`, `onNorthWestOf`, etc., where `onEastOf` is the inverse of `onWestOf`, `onNorthOf` of `onSouthOf`, and so on.

Next we analyze the shape, the size, and the internal structure of buildings and gardens. We define the class `Shape`, modeling the shape of structures and whose subclass hierarchy is shown in Figure 4, and the object-property `hasShape`. The class `Size` and the object-property `hasSize` model the size of buildings.

The class `Element` has as subclasses the class `ArchitecturalElement`, describing general architectural elements inside the map, the class `Forniture`, modeling objects used in everyday life such as `Bedstand` and `Desk`, the class `Tool`, modeling tools of common use such as `Furnace` and `Boiler`, and classes describing rooms, clothes, food, votive and ornamental elements.

In addition, we provide the object-properties `contains`, together with its subproperties `consistOf`, `containsAround`, and so on, and its inverse `isContainedIn`, together with its subproperties `isPartOf`, `isContainedAround`, and so on. The whole hierarchy of subclasses of `Element` and of their related properties is illustrated in [2].

In Figure 5 we show our representation of the abbot house. This building, inhabited by the abbot, is surrounded by a fence. It consists of two stories of which the lower one has an open portico on the east and west sides. The inner space is split into two chambers: the abbot sleeping and sitting rooms. The upper story contains some small chambers and one large chamber. Details concerning the furniture of the abbot sleeping and sitting rooms are modeled by the classes `AbbotSleepingRoom` and `AbbotSittingRoom`, respectively, which are both subclasses of `Chamber`. Our representation of the monk cloister can be found in [2].

We also modeled people living in the monastery. As shown in Figure 6, they are classified according to the place in which they live and spend most of the day.
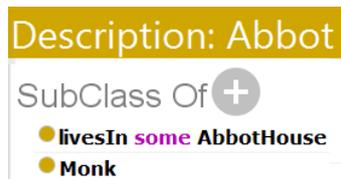
Figure 5. Description of `AbbotHouse`.

Figure 6. Description of `Abbot`.

3. Conclusions

We presented an ontology for the Saint Gall plan, that describes the ideal model of the structure of a monastic Benedictine building. The plan allows one to study the most significant features of European monastic buildings such as the Monastery of San Nicolò l'Arena in Catania, the Abbey of Santa Giustina in Padua, the Cluny Abbey, the Montecassino Abbey [9]. By means of SaintGall Ontology, scholars and researchers in Human Science can effectively compare several distinct monastic architectures and, from their differences and similarities, make inferences not only in architectonic and stylistic ambits, but also in interpretative and theological areas [11].

We are currently considering the integration of the SaintGall Ontology with the ontology for the Benedictine Monastery of Catania presented in [3] and other widespread ontologies for cultural heritage such as as CIDOC-CRM.[4] Some generic classes from the SaintGall Ontology, such as `Church` and `Cloister`, can be reused to design novel ontologies describing buildings outside the Benedectine context. Consider, for instance, the architectonic structure of closed garden (cloister or court), which can be also found in municipal buildings.

The SaintGall Ontology was designed in such a way as to describe the SaintGall map in detail. That makes it more complex than both the ontology of the Monastery of Catania [3] and Ontoceramic [7], an ontology for the classification of pottery. Moreover, the SaintGall Ontology cannot be represented in the set-theoretic fragment considered in [4], used in recent work by some of the authors for ontologies representation and

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

reasoning. Thus, we intend to design a new decidable set-theoretic fragment admitting the composition operator allowing one to represent and reason on the SaintGall Ontology. Results in [5,6] are helpful to construct an appropriate decision procedure for such set-theoretic fragment.

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