

# On Linking Cultural Spaces and e-Tourism: An Ontology-Based Approach

Elena García-Barriocanal and Miguel-Angel Sicilia

Information Engineering Research Unit  
Computer Science Dept., University of Alcalá  
Ctra. Barcelona km. 33.6 – 28871 Alcalá de Henares (Madrid), Spain  
{elena.garciab,msicilia}@uah.es

**Abstract.** Cultural tourism is linked to the art, social practices or particularities of concrete geographical areas. Cultural tourism offerings require thus considering both the cultural aspects but also a variety of operational constraints mainly related to the availability of services for the tourist. The design of this kind of offerings or the provision to users with tools to personalize them can be supported by computer tools equipped with the required knowledge representation. Ontologies representing cultural spaces can be used for that purpose. This paper describes a partial ontological model for cultural spaces and the approach to link that model to services useful for devising touristic offerings. It also reports on a prototype for recommending short itineraries in the centre of the city of Alcalá de Henares.

**Keywords:** Cultural tourism, ontologies, Semantic Web, tourism, art and architecture, service ontology.

## 1 Introduction

Cultural tourism is a kind of tourism concerned with a country or region's culture. It usually focuses on concrete geographical areas of special interest or on communities who have diverse customs, unique forms of art and distinct social practices, which distinguish them from other types/forms of culture. Cultural tourism includes tourism in urban areas, but also tourism in rural areas showcasing the traditions of indigenous cultural communities and their differentiating values and lifestyle. The localization of this kind of tourism lead to a concept of “cultural space” that puts boundaries to the area and/or cultural aspects addressed. The value of cultural tourism offerings is associated with the degree in which the offering fits the preferences of the visitors, and creativity is considered as a key element in the design of cultural tourism experiences (Richards and Wilson, 2006). In competing for cultural tourists, it is important for destinations to understand the cultural motivations of visitors and non-visitors (or potential visitors). Preference for cultural tourism is defined as a selection of an activity that takes place on the mosaic of places, traditions, art forms, and experiences deserving separate study (Tran and Ralston, 2006). The inherent complexity of considering the mosaic of cultural aspects in a concrete area combines with the

operational view on constraints, accessibility and availability of services of a various kind, including means of transport, hotels and restaurants, but also information services. Measures for the visitor-friendliness have been proposed that account for these kinds of aspects (Russo and van der Borg, 2002). Computer tools can be use for supporting preference gathering in cultural tourism. Gathering cultural preferences is challenging since it entails considering a wide number of aspects. A pragmatic approach can be that of recording a number of cultural aspects in some kind of knowledge representation and then provide tools to users that exploit them, eventually using the preferences recorded to recommend activities. Ontologies can be used as the knowledge representation formalism and they have already been applied to applications of e-tourism (Kanellopoulos and Panagopoulos, 2008). However, an ontological schema flexible enough for different aspects of cultural spaces integrated with a service view is still not available.

This paper describes a partial ontological model for cultural spaces and the approach to link that model to services. The model can be re-used and extended for any other cultural space. It also reports on a prototype for recommending short itineraries in the centre of the city of Alcalá de Henares (Spain). The rest of this paper is structured as follows. Section 2 describes the approach for the modeling of the main aspects of the ontology. The links of that ontology to services is provided in section 3. Then, section 4 reports on a prototype related to cultural objects in a concrete cultural space. Finally, conclusions and outlook are provided in Section 5.

## 2 Representing Cultural Spaces

Cultural spaces are determined by *tangible, material objects*. These objects are the base material for the design of the cultural tourism experiences. The representation of these material objects require representing geographical things, but also geopolitical entities or regions that are not determined solely by geography. Figure 1 depicts an excerpt of the a cultural space ontology and some instances particular to the municipality of Tineo in Asturias, Spain. In the left upper side, geographical things of some particular kinds are depicted. A significant amount of reuse in terminological structures and tools can be achieved by building KM systems on top of existing large terminological bases like OpenCyc. OpenCyc is the open source version of the Cyc Knowledge Base (Lenat, 1995). Cyc attempts to provide a comprehensive upper ontology of “commonsense” knowledge. Ontology elements prefixed by “oc\_” are borrowed from OpenCyc. As an example, *Palace* is a concrete kind of building.

Schemas as the CIDOC CRM<sup>1</sup> can be used also for the description of these kinds of tangible objects. Geographical things can be either regions or concrete material elements, and in both cases there are of course part-of relationships describing the structure. Every geographical thing can be geocoded, e.g. by codes or geographic coordinates expressed as latitude-longitude. This can be combined with knowledge on traveling distance as that available in GPS car navigators to compute distances and times to destinations with reasonable degrees of reliability.

---

<sup>1</sup> <http://cidoc.ics.forth.gr/>

Aspects related to culture are depicted in the right upper part of Figure 1. In the example, art styles and historic figures are used as examples of the many facets that can be represented. Regarding historic figures, the Events in their lives are explicitly modeled, including the geographical places in which they took place. The relations from individuals to places as depicted in Figure 1 can then be inferred as it will be explained later.

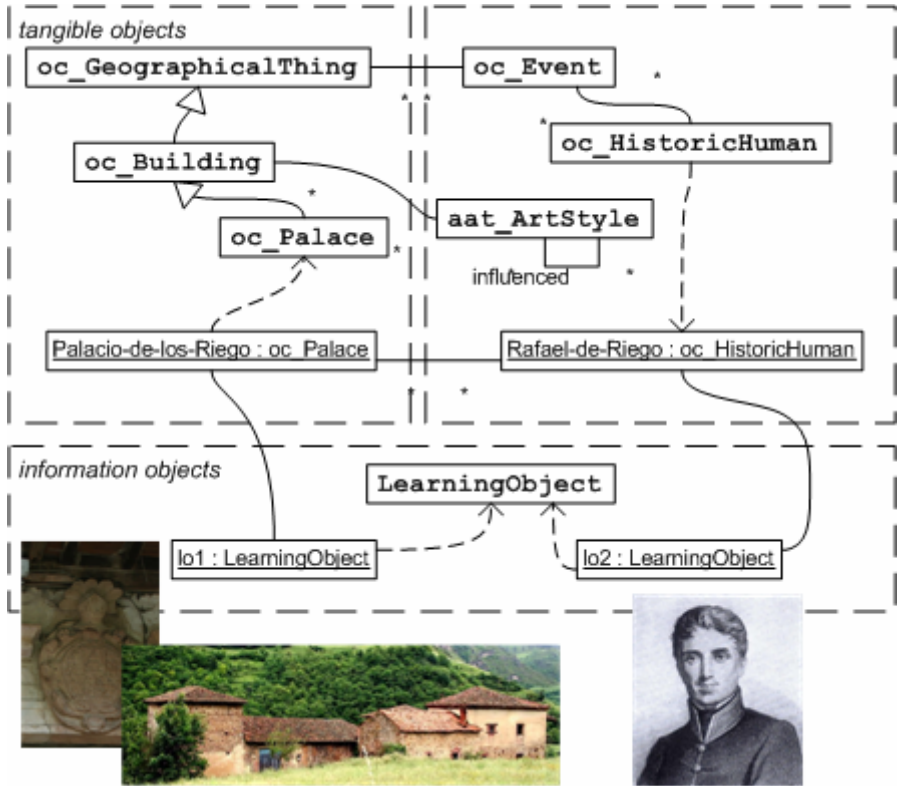


Fig. 1. Fragment of a basic ontology for cultural spaces

Regarding art styles, the basic conceptualization is borrowed from the *Art & Architecture Thesaurus*® (AAT), an structured, controlled vocabulary that can be used to improve access to information about art, architecture, and material culture. It represents a knowledge base that includes semantic networks that show links and paths between concepts; these relationships can make retrieval more successful by themselves. It contains *terms* but no instances, and it is updated annually with the additions coming from diverse institutions. The translation of the AAT schema is straightforward, e.g. `aat_ArtStyle` represents the styles recorded in the AAT, which are related to the category of geographical things made by humans by a `hasStyle` predicate. Relations as `influenced` can be used to represent their relations. This

enables a first form of preference refinement, since the relationships between styles can be used for a first selection of places to visit.

The bottom part of Figure 1 depicts the third concern of the ontology, the existence of learning or information objects that somewhat describe the elements in the other two aspects. These can be annotated following metadata standards as IEEE LOM, for which ontological versions yet exist (Sánchez-Alonso, Sicilia and Pareja, 2007). The three aspects sketched so far provide the basic model for describing a cultural space with the degree of detail or focus required, including information resources that can be used as on-line surrogates of the actual tangible objects. This enables a form of preparation and configuration of the touristic path on-line, as a pre-design for the experience.

### 3 Linking Cultural Spaces to e-Tourism Services

Richards and Raymond (2000) considered creative tourism as “tourism which offers visitors the opportunity to develop their creative potential through active participation in courses and learning experiences which are characteristic of the holiday destination where they are undertaken”. This definition is similar to previous definitions of educational tourism, so the link to information or learning objects enables the connection of the educational and the purely touristic. Anyway, there is a need to connect the preferences expressed in the cultural space to concrete service needs. Not every cultural tourism path that comes from combining cultural preferences is feasible in practice for some users. Services are key elements in making a path possible for some users. Here we sketch the main modeling elements for such complex task. There exist various tourism ontologies and research efforts related to semantic metadata models applied to the tourism industry, collectively managed by the research community (OTA<sup>2</sup>, IFITT<sup>3</sup>, WTO<sup>4</sup> and other bodies and institutions). The e-tourism ontology<sup>5</sup> also provides a basic schema for accommodations, activities, events or locations, and there are other ontologies reported elsewhere (Cardoso, 2006). However, *services* are not integrated with cultural spaces in existing schemas. The EU Project OBELIX described a RDF service ontology in its deliverable D6.1. "*Service ontology specification*". That model divided the ontology in three viewpoints: service value (the customer perspective), service offering (the supplier perspective) and service process (how the service is actually performed), which has been adopted here.

The concept of *ServiceEvent* in OpenCyc represents the actual service interactions, and *ServiceProduct* the subset of those events that are done for payment. Also, *ServiceEstablishment* represents restaurants and other typical facilities in tourism. However we are interested in a detailed representation of *ServiceOfferings*, i.e. single or compound services offered that fulfill some types of needs. This way, the services can be classified by the tourist needs they address. For example, a *TransportNeed* from and to some concrete locations may be fulfilled

<sup>2</sup> OTA (open travel alliance) <http://www.opentravel.org/>

<sup>3</sup> IFIT (International Federation for IT and Travel & Tourism) <http://www.ifitt.org>

<sup>4</sup> The World Tourism Organization, <http://www.world-tourism.org/>

<sup>5</sup> <http://e-tourism.deri.at/ont/>

by a variety of offerings differing in price, quality and many other attributes. Two important aspects of this formulation are the following:

- Some of the attributes of service offerings, as price and duration can then be used to adjust global constraints, e.g. the total price for fulfilling a set of needs should not exceed some given amount.
- Many service offerings are also geographically constrained, since they are provided in physical establishments, so the search for service offerings is driven by the geographical path to be followed.

A consequence of the above is that many different algorithms can be devised for automating the task of suggesting itineraries. For a given cultural space represented in ontological form, there is an associated collection of services, concretely those offered to tourists in that particular area. Then, an algorithm that attempts to devise a path for some preferences should take into account also the services available.

## 4 Case Study

The architecture of a cultural tourism itinerary generator for a geographically bounded location has been prototyped for the city of Alcalá de Henares. The center of the city is one of UNESCO's World Heritage Sites, and contains several historic buildings and places in which many events of the life of historical figures have taken place.



Fig. 2. Main user interface allowing the selection of cultural preferences

Figure 2 shows the main interface, in which the user is able to select either persons and/or architectural styles related to the city, along with a departure point for the visit under design. The architecture of the application uses the semantic learning object

repository developed in the EU project LUISA<sup>6</sup>, which uses the WSML<sup>7</sup> ontology language for describing the cultural space. The application provides two kinds of services: providing touristic itineraries and providing learning objects to learn more about the user's interests (in order to obtain information or prepare for a future visit, for example). In both cases users have to select the historical figures who are related to Alcalá de Henares or/and the architectural styles they would like to include in their visit or take information. In the case of taking a visit suggestion the user obtains a tourist route in which different buildings/places are involved, taken as departure point the place he or she selects. In the case that the user selects personalities exclusively, the route includes those places in which events related to selected personalities took place (rule 2 below). If the user only selects architectural styles, the route includes buildings/places of these styles or styles related to those selected, i.e. *influenced by* the selected styles or a *kind of* the selected styles (rule 1 below). If both personalities and styles are selected, then a visit which includes places related with personalities according to the selected styles is shown. WSML rules involved in this case are the following:

?styleA[relatedTo ?styleB] impliedBy ?styleA[aboutStyle ?styleB] or  
 ?styleA[typeOf ?styleB] or ?styleA[influencedBy ?styleB] (1)

?person[relatedTo ?monument] impliedBy  
 ?event[doneBy ?person] and ?event[locatedAt ?monument] (2)

In all cases, results are ordered by closeness to the initial place of the route and if two places are very close (distance between them is less or equal to 0.1 km.) and events related with the same personality took place in them then they are chronologically sorted. See figure 3 to take an example of the result in the case different literary Spanish personalities are selected (Cervantes, Lope de Vega, Calderon de la Barca, etc). As Cervantes birthplace and Antezana Hospital are very near, they are show in chronological order, for example.

The process can be viewed as a heuristic process of filtering and sorting that considers several aspects. The “*Learn more*” option provides the user with learning objects about the places in which events related to select personalities took place, places according to the selected styles (or related to the selected style) or places of the selected styles (or related to the selected styles) in which events related to select personalities took place. If some styles are selected, results are sorted as following (the higher the first):

- 1<sup>st</sup>) Learning objects about monuments that belong exactly to some of the selected styles.
- 2<sup>nd</sup>) Learning objects about monuments that belong to styles related with some of the selected styles.
- 3<sup>rd</sup>) Learning objects about monuments influenced by several selected styles.
- 4<sup>th</sup>) Learning objects about monuments influenced by some of selected styles.

<sup>6</sup> <http://luisa.atosorigin.es/www/>

<sup>7</sup> <http://www.wsmo.org/wsml/>

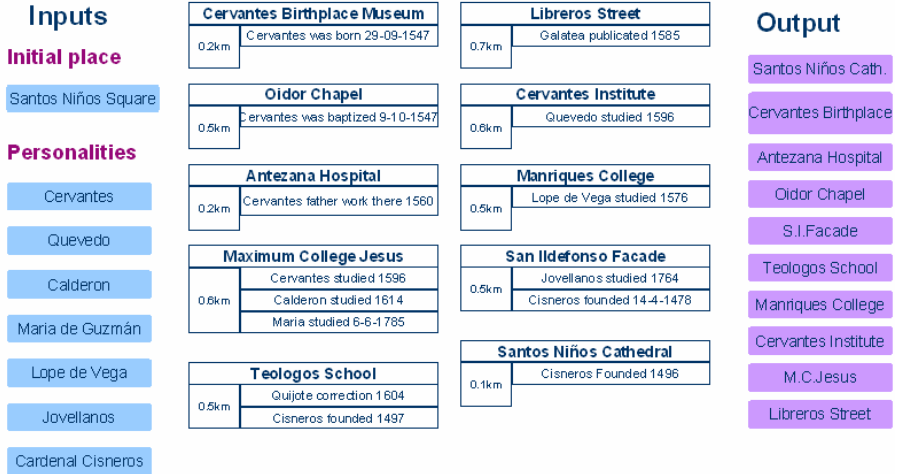


Fig. 3. Outputs for "take visit suggestions" option

strolling through **Alcalá**

**Results:**

Directly related to selected styles:

- [Oidor Chapel]**

**Description:** At the southern end of the Cervantes square there was placed the parish church of Santa Maria la Mayor. Set on fire during the Civil War, today it is only standing the bell tower, part of the apse and some attached chapels, one of them being The Oidor. It is decorated with Mudejar style plasterwork, and it keeps the font where in October 9th 1547 Miguel de Cervantes was baptized. Nowadays it is used as exhibition room.

**Style:** Mudejar

**Events:** At this church Cervantes received baptism (9-10-1547)
- [Santos Niños Cathedral]**

**Description:** The church was build on the site where it is thought the children Justo and Pastor from Alcalá were martyred. The building was formerly an old Collegiate church rebuilt by Cardinal Cisneros. There are three naves and an ambulatory.

**Style:** Isabelline Gothic is a type of Gothic. Isabelline Gothic is influenced by Mudejar

**Events:** Cardenal Cisneros founded this cathedral (1496)
- [Antezana Hospital]**

**Description:** Aristocratic house from fifteenth century that became Charity Hospital in 1483. Great set of isabelline gothic architecture. Castilian porch with Mudejar elements. It is considered to be the oldest private sanitary institution that has been working non stop since then in Europe.

**Style:** Isabelline Gothic is a type of Gothic.

Fig. 4. Results for "Learn more" search

See figure 4 to see an example of results of learning objects about Mudejar or Gothic styles and related to Miguel de Cervantes or Cardenal Cisneros.

The algorithms described are only some straightforward options, but many other approaches can be devised, including more complex relationships or additional cultural aspects that indicate preference. Also, collaborative filtering approaches could be combined with algorithms as the above.

## 5 Conclusions and Outlook

The design of cultural tourism requires personalization to complex and varied preferences. Ontologies can be used for the purpose to represent geographically-bounded cultural spaces, and they can be used for the development of applications as itinerary generators or recommenders. Then, such ontologies can be combined with a model of service offerings so that the paths found to be closer to the user's preferences are constrained by the availability of the required and desired service offerings available.

The cultural aspects that may be considered in these kinds of support systems can be widely diverse and complex. Also, many different strategies and algorithms can be used to shape the recommended strategies and to compose the right mix of services for the given preferences. Both areas require extensive work and contrast before useful cultural tourism recommenders can be widespread.

## Acknowledgements

This work has been supported by project LUISA (Learning Content Management System Using Innovative Semantic Web Services Architecture), code FP6-2004-IST-4 027149.

## References

- Cardoso, J.: Developing an OWL Ontology for E-Tourism. In: *Semantic Web Services, Processes and Applications*. Springer, Heidelberg (2006) ISBN:0-38730239-5
- Lenat, D.: Cyc: A Large-Scale Investment in Knowledge Infrastructure. *Communications of the ACM* 38(11), 33–38 (1995)
- Kanellopoulos, D., Panagopoulos, A.: Exploiting tourism destinations' knowledge in an RDF-based P2P network. *Journal of Network and Computer Applications* 31(2), 179–200 (2008)
- Richards, G., Raymond, C.: Creative tourism. *ATLAS news* 2000(23), 16–20 (2000)
- Richards, G., Wilson, J.: Developing creativity in tourist experiences: A solution to the serial reproduction of culture? *Tourism Management* 27(6), 1209–1223 (2006)
- Russo, A., van der Borg, J.: Planning considerations for cultural tourism: a case study of four European cities. *Tourism Management* 23(6), 631–637 (2002)
- Sánchez-Alonso, S., Sicilia, M.A., Pareja, M.: Mapping IEEE LOM to WSML: an ontology of learning objects. In: *Proceedings of the ITA 2007 - 2nd International on Internet Technologies and Applications*, pp. 92–101 (2007)
- Tran, X., Ralston, L.: Tourist preferences influence of unconscious needs. *Annals of Tourism Research* 33(2), 424–441 (2006)