Accessing the Spanish Digital Network of Museum Collections through an Interactive Web-based Map

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Abstract. Within the scope of the SeMap project, we have developed a web-based tool that aims to offer innovative dissemination of movable assets held in museums, linking them semantically and through interactive maps. SeMap is focused on depicting the objects that are catalogued in CER.ES, the Spanish Digital Network of Museum Collections, which offers a catalogue of 300,000+ objects. To properly represent such objects in the SeMap tool, which considers their semantic relations, we needed to preprocess the data embedded in catalogues, and to design a knowledge graph based on CIDOC-CRM. To that end, the collaboration among academia, heritage curators and public authorities was of high relevance. This paper describes the steps taken to represent the CER.ES objects in the SeMap tool, focusing on the interdisciplinary collaboration. We also bring the results of a usability test, that proves the developed map is usable.

Keywords: Interactive Map, Cultural Heritage, Interdisciplinarity.

1 Introduction

Cultural objects have a history, but also a geography. For most art history researchers, geography poses great challenges [1]. They are not trained to use spatial analysis, not even on a basic level. They usually focus on extraordinary pieces and creators, the leading examples, leaving the rest to a discreet second (or third, fourth…) place. Their discourse often revolves solely around historical centers, omitting the peripheries in as much as they remain unrelated to those centers established by previous historiography. Nonetheless, the largest part of cultural objects are not those leading examples, but the huge amount of secondary or even trivial productions, including crafts and popular arts. Peripheries did have a life of their own, and many did not consider themselves to be peripheries at all.

Visualizing the geographical aspect of museum collections can, therefore, bring a new approach to art historical knowledge. The combination of Geographical

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DOI: 10.1007/978-3-031-08760-8_34

Information Systems and collections' databases should provide innovative and powerful ways to visualize the spatial connections between their objects. Trade routes, production workshops, artists' travels, centers of distribution and consumption, formal or iconographic influence, patterns of modern collecting… many kinds of historical art or anthropological analysis can benefit greatly from digital systems that allow us to see heritage through geographical tools.

In this paper we present the results of SeMap [2], a research project that aims to offer innovative dissemination of movable cultural assets, linking them semantically to spatiotemporal maps. It is built on the objects that are catalogued in a network of Spanish museums set up by the Ministry of Culture and Education, which are currently accessible through a web portal [3]. SeMap brings a new way of accessing such information: on the one hand, because it provides a spatiotemporal map that expands the possibility of exploring data; on the other hand, because the data is embedded in a knowledge graph, allowing to retrieve knowledge from it, e.g., looking for similar objects. Additionally, SeMap combines different visualization and filtering strategies to offer an intuitive and innovative way to navigate through the map, combining GIS tools, graphical representations and knowledge-assisted visualization.

The paper is structured as follows. Section 2 introduces the SeMap project and the CER.ES collection, and explains how they have been integrated. Section 3 brings a usability evaluation of the tool. Finally, Section 4 offers some conclusions and outlines future work on this area.

2 Accessing Cultural Heritage through an Interactive Map

2.1 The SeMap Project

SeMap is a research project that aims to offer an innovative dissemination of movable cultural assets kept in medium-size and small museums, linking them semantically and through a web-based interactive map [4], so users can access such data more intuitively. There are other works focused on visualizing cultural heritage assets on maps. To represent spatial features, most solutions use interactive icons and clustering, and also message boxes depicting text and images [5, 6]. Choropleth maps are also quite common, especially to show historical moments [7, 8]. Some of the maps show links to other pages or sidebar windows with detailed information of objects [9, 10]. SeMap use some of these strategies, such as representing the objects with interactive icons and clustering, providing a filtering menu, and allowing to inspect individual objects. Additionally, the data embedded in SeMap are semantically related. Few works can be cited in this regard in the field of mapping cultural heritage [11]. SeMap is focused on depicting the objects that are catalogued in CER.ES, the Spanish Digital Network of Museum Collections, which offers a catalogue of 300,000+ objects. Currently, CER.ES allows searching objects of its catalogue by typing a text or applying filters, and results are provided in the form of traditional lists or image thumbnails. The interactive map developed in SeMap offers an extended approach, where users can see georeferenced results of their queries and filter them further.

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DOI: 10.1007/978-3-031-08760-8_34

2.2 The CER.ES Collection

In Spain, the DOMUS [12] system was created in 1993 when the Documentary Standardization Commission was set up with the aim of establishing standardized and common management protocols for National Spanish museums, as well as developing an integrated automated system for museum documentation and management. The DOMUS system provides terminological control tools [13] that would serve for the correct identification, classification and description of the Cultural Heritage housed in Spanish museums [14], the first one being the Dictionary of Drawing and Printmaking, published by the National Chalcography in 1996. These controlled vocabularies can be classified into two groups [15]: specialized dictionaries, which bring together terminology specific to their corresponding subject area (ceramics, numismatics and furniture) and generic thesauri, which are applicable to the cataloguing of all types of movable and immovable cultural assets.

This system served as the basis for the creation of the cultural heritage thesauri and CER.ES, which includes 118 Spanish museum collections. It brings together information and images from the museums that make up the Digital Network of Spanish Museum Collections (Red Digital de Colecciones de Museos de España), its contents are also available on the HISPANIA network and EUROPEANA [16]. CER.ES can be consulted at [3] and belongs to the Ministry of Culture and Sport. It is a clear commitment to facilitate universal access to culture and to provide citizens with a legal offer of cultural content on the Internet. It is therefore a unified access to the cultural assets of Spanish museums, regardless of their administrative dependence or specialty. Through its website users can perform general and advanced searches in all the museums or make an advanced search, consult online catalogues, or specify objects by museum types, geographical location, or ownership. Currently, CER.ES offers more than 329,000 cultural assets and 580,000 images.

2.3 Integrating the CER.ES collection in SeMap

The integration of the CER.ES collection in the interactive map developed under the SeMap project, has been possible thanks to the close collaboration between researchers at the Universitat de València and museum technicians from the Collections Area, Sub-Directorate General of State Museums (Subdirección General de Museos Estatales, SGME), from the Spanish Ministry of Culture and Sport.

Information Preprocessing. The total amount of data provided by the SGME team was 239,836 objects of various typologies and 78,074 elements of the document typology, which includes documents, photographs, films, etc.

Relationship to CER.ES dictionaries. The intended purpose of the data is that they can be consulted in a usable form, through the interface of a web application. However, this is very complex to reconcile with the number of terms in the different thesauri. For example, the Diccionario de Denominaciones de Bienes Culturales [13], used to determine the typology of an object, has 8,727 different terms. As the aim of the project is

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DOI: 10.1007/978-3-031-08760-8_34

to disseminate cultural heritage to arrive to as many people as possible, a much smaller classification has been made. The thesauri used and the simplification applied are:

- Typology of the object, references to the “Bienes Materiales” CER.ES thesaurus. 8,276 terms were reduced to classification with 16 items.
- Material of the object, references to the “Materias” CER.ES thesaurus. 1,841 terms were simplified to a set of 21 elements.
- Techniques employed, references to the “Técnicas” CER.ES thesaurus. 1,355 terms were reduced to 20 items.

Georeferentiation. In SeMap, the provenance of the object and its current location, which is a museum, have been processed. Therefore, obtaining the current location has not been a problem. The problem was with its provenance, since each object has a place of provenance (country, toponym, etc.) and a name of the specific place or site from which it comes (monastery, site, etc.). The geolocation of provenance is a complex issue for several reasons. On the one hand, there were data without provenance information, on the other hand, there were data with low granularity (only country, or large administrative regions) and others with generic place names, with several possible references. To obtain the geographic location, an application was developed that introduced the information about the origin of the objects to the Geonames and Google Maps APIs.

Heterogeneity. In the information there are several data that have a high level of heterogeneity, because they have been introduced by humans with different criteria and format. The most affected fields have been the dimension and the dating of the object. With different units of measurement, separators, etc. This heterogeneity is easy to detect and to correct automatically.

Knowledge Graph Design. Since the supported information is related to cultural heritage, it was decided to use the model proposed by CIDOC-CRM as a starting point. This model is the most used to represent this type of data through a knowledge graph. As the model proposed by CIDOC-CRM is theoretical, SeMap decided to use an OWL (Web Ontology Language) implementation of this model [17]. The ontology schema used in the knowledge graph of SeMap can be found in [18].

2.4 Example of Use

In this section, we show an example of how the map can be used to access a specific object, after applying a filter and navigating through the visual results. This is exemplified in Fig. 1. Fig. 1a shows a map view centred on Europe. We can see all the objects that are preserved in the database whose origin correspond to Europe and that meet the condition of "funerary". The colour of the circular markers (orange, yellow and green) indicates the number of objects that are grouped within a marker. Fig. 1b depicts those objects that were already filtered. Green markers correspond to clusters with less than ten objects, yellow to more than ten and orange to more than one hundred objects. Fig. 1c shows an additional zoom, representing a smaller area where there is an object.

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DOI: 10.1007/978-3-031-08760-8_34

Additionally, the panel to the right shows the detailed information of such an object, after the user has clicked on its marker. Lastly, in Fig. 1d, the same object is depicted in the CER.ES website, which is automatically opened as a new window in the browser after a user clicks on “see in CER.ES” button (in Fig. 1c).

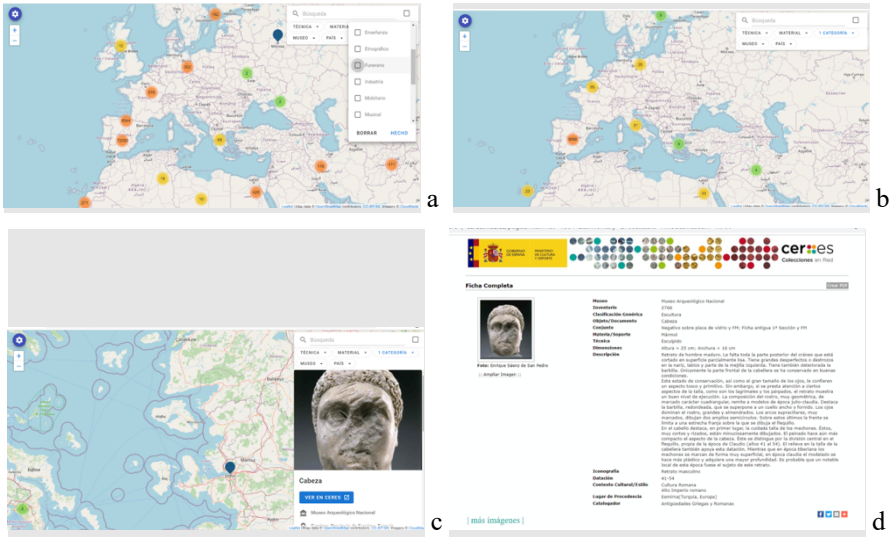

Fig. 1. An example of how to interact with the tool developed in SeMap, where: a) a view of a large area centred on Europe after filtering by category/funerary; b) depicts objects that were already filtered; c) a larger zoom representing a specific object; d) the same object of "c", as shown in CER.ES.

3 Usability Evaluation

In order to test the usability of our tool, we have performed an evaluation activity, based on the System Usability Scale (SUS) test [19]. People were recruited in written form, and an open call was provided at the project webpage and social networks. The evaluation was opened for three weeks. A total of 45 people participated in the evaluation.

We asked the participants to access the SeMap tool [4] and to do some specific tasks in order to test its functionalities (e.g., zooming, filtering, accessing specific objects, etc.). After that, they had to fulfill a questionnaire, which was anonymous. The questionnaire consisted of the SUS test [19], composed of ten questions (Q1 to Q10). For each question, participants must rate them with a score in the range 1–5, which means: 1: strongly disagree, 5: strongly agree. Odd questions (Q1, Q3, …, Q9) are positive, so the best possible answer would be 5 points; on the other hand, even questions (Q2, Q4, …, Q10) are formulated in a negative way, so the best possible answer would be 1 point. For this reason, the given scores by users are summarized in different graphs: in Fig. 2, the positive questions; in Fig. 3, the negative questions. In both cases, the best possible answers (5 and 1, respectively) are depicted in dark blue colour, so it is easier to analyse the results. As it can be seen, for the positive questions, the one receiving the

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maximum score (5 points) more times is Q3 (n=11), that refers to the easiness of using the tool. Q7 and Q9 have similar satisfactory results, while Q5 brings the poorest result. For the five questions, at least 77.8% of the people (n=35) rates them with a score of 3 (neutral value) or better (4 or 5 points). For the negative questions, the best rated is Q10, which refers to the easiness of learning how to use the tool. Q4 and Q8 also give very positive results, depicting that most users think that they would not need the support of a technical person to use the tool and that it is not cumbersome to use. For the five questions, at least 88.9% of the people (n=40) rates them with a score of 3 (neutral value) or better (1 or 2 points). Comparing both graphs, it can be seen that overall, negative questions are better rated –in terms of the highest scores (in dark blue colour)– than positive questions. From the given scores (in the range 1–5), the SUS score is computed. This score ranges from 0 to 100, meaning 100 the best imaginable result. In our case, the SUS score reaches 70.7 points, which can be considered acceptable.

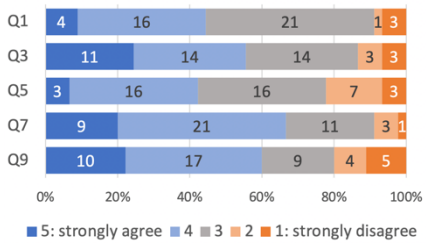

Fig. 2. Number of scores (from 1 to 5) for each positive SUS question.

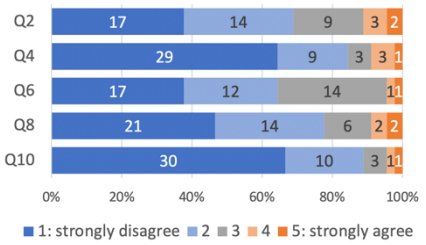

Fig. 3. Number of scores (from 1 to 5) for each negative SUS question.

4 Conclusions and Further Work

The work presented in this paper reports the collaborative work between disciplines and institutions that has led to the results of the SeMap project, an interactive web-based map that makes it possible to access the objects embedded in CER.ES (300,000+), the Spanish digital network of museum collections. We have described the steps taken in order to visualize in a map the objects from CER.ES, namely, the information processing (relating dictionaries, georeferencing and heterogeneity) and the design of a knowledge graph. We have also shown the results of a usability test with 45 participants. The obtained satisfactory results prove the added value of stablishing such collaborations, among academia, heritage curators and public authorities.

Acknowledgements

The research leading to these results is in the frame of the project “SeMap: Acceso avanzado a los bienes culturales a través de la web Semántica y Mapas espacio-temporales”, which has received funding from Fundación BBVA. Cristina Portalés is supported by the Spanish government postdoctoral grant Ramón y Cajal, under grant No. RYC2018-025009-I.

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To cite this paper please use the final published version:
DOI: 10.1007/978-3-031-08760-8_34

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DOI: 10.1007/978-3-031-08760-8_34