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CARARE: connecting archaeology and architecture in Europeana



Figure 1:
CARARE
project logo
© CARARE 2010

1. Introduction

CARARE set out to put in place an infrastructure that will continue to increase the archaeological and architectural content available to Europeana by involving and supporting Europe's heritage national agencies and archaeological research institutions, museums and specialist digital archives. The project aimed to demonstrate the contribution to be made to Europeana by content from these institutions. At the same time, the project sought to establish a network of institutions and people with the skills, expertise and motivation required to support researchers, archaeological field units, site museums and local institutions throughout Europe to make their content available.

Over its three year duration, from 1st February 2010, this Best Practice Network has acted to improve the interoperability of the digital content held by archaeological and architectural institutions and make it accessible through the CARARE aggregation service to Europeana and in principle to other services, helping establish a network of interoperable OAI-PMH compliant repositories and content management systems.

CARARE has worked with Europeana to make 3D content accessible to Europeana's users and to demonstrate the potential for map-based search services for tourism and mobile applications. It has sought to work with Europeana to establish efficient and sustainable processes through which institutions can easily make their content available during and after the project, by defining the CARARE metadata schema as an EDM compliant application profile for the domain, promoting the use of the MINT tool and OAI-PMH repositories for metadata harvesting, establishing the MORE repository and a workflow from content provider to Europeana, and by promoting the Europeana Data Exchange agreement and the acceptance of the CC0 licencing form metadata and in this way the move forward to semantically-enriched linked open data.

2. Project achievements

CARARE achieved a considerable success in having over 2 million items ingested by Europeana by the end of the project in spring 2013. This figure represents a significant percentage of all the content now accessible through Europeana with CARARE becoming the 3rd largest content provider. CARARE's contribution also provides a critical mass of content relating to archaeological monuments and historical buildings in Europe and a significant amount of 3D content.

At the start of the project, partners completed a content survey in which they identified 80 separate collections. These varied considerably in size and in terms of their "readiness" to be made available to Europeana and its users. Only 44 of the collections were available online; more than 55 different metadata schemas were in use; and metadata could be exported or remotely accessed from only 35 of the collections. By the end of the project, CARARE partners had

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successfully published content metadata for 75 separate collections in Europeana and their digital content was available online for end-users to enjoy.

CARARE established an aggregation service and, importantly, a workflow for metadata harvesting from the content providers' repositories to Europeana. It defined the CARARE metadata schema (CARARE, 2010) as a harvesting protocol for the archaeological and architectural heritage domain. The schema is fully interoperable with the Europeana Data Model (EDM) and is now being used in the 3D-ICONS project. CARARE has been one of the first projects to implement EDM and is currently the largest provider of EDM metadata to Europeana.

Another achievement has been establishing 3D in www.europeana.eu. Understandably one of Europeana's goals is to promote the use of standard content formats to minimise the need for users to install plugins before viewing content. CARARE recommended 3D-PDF as a format suitable for publishing 3D models with contextual information for Europeana and its users. By working to promote the adoption of 3D-PDF by content institutions and other projects CARARE has had impact beyond the project consortium.

Notably CARARE has established a pilot map-based search interface. This demonstrates the potential for developing route planning and mobile applications for Europeana. The application also realises a long-held ambition amongst researchers and conservation managers of bringing together archaeological sites and monuments from across Europe in a common point of access and of enabling research across borders.

3. Archaeology and Architecture in Europeana

A major objective of CARARE has been to increase the quantity and quality of content for the archaeological and architectural heritage available to users of Europeana. Such content has great potential to support services for cultural tourism and for users with interests in local history, family history and other research.



Figure 2:
Visitors at
Nimtofte Djursland
Genindvielse,
2007
Foto
Lars Bjarke
Christensen,
Kulturarvstyrelsen





The main target user groups for CARARE content are:

- Heritage agencies, archaeological museums, digital archives and aggregators of cultural content from archaeological or architectural research across Europe who wish to establish interoperable services, and need sustainable methods by which to make their content available to Europeana and obtain wider exposure to users;
- European and national policy makers who wish to see Europeana incorporate and provide successful services based on a critical mass of content;
- National policy makers who wish to promote the archaeological and architectural heritage of their region and its conservation to audiences for tourism, education and research of all kinds;
- End users including researchers, students and teachers, tourists and visitors who seek easy and reliable access to content in their field of interest, especially those with an interest in the archaeological and architectural heritage, and the historic localities of Europe.

The content made available by the CARARE network to Europeana is:

- greatly expanding and enriching the range of freely available and accessible content for archaeological sites, monuments and historically important buildings to be found by users through the Europeana portal, including items of World, European and National Heritage importance ('treasures');
- providing a significant mass of geographically referenced content sourced from heritage agencies and in this way increasing the potential for Europeana to develop map-based services and mobile applications for tourism, education and other uses;
- establishing 3D as a content type in Europeana and 3D-PDF as a user friendly, accessible format suitable for adoption by content providing institutions;
- including material relevant to the unique archaeological and architectural heritage from Member States previously under-represented in Europeana's coverage.

Figure 3:
Červený Kameň
Castle,
Slovak Republic



3.1 Geographic Information

Geographic location is one of the most important attributes of archaeological monuments, historic buildings and archaeological landscapes. Place is one of the most frequent starting points for enquiries about the archaeology and architectural heritage of an area, whether for local history research or for planning and development control, and most records about monuments and historic buildings include such information. Heritage agencies and archaeological researchers were early adopters of Geographic Information Systems (GIS), which enable archaeological monuments and historic buildings to be plotted on maps, searches for sites by location, and heritage data sets to be included in geo-portals for environmental planning, tourism, research and other services.

CARARE metadata records include named places (such as Stonehenge or the temple of Dion) together with their street addresses and geographic coordinates, thereby adding a level of detail that is generally not available for books, archives and museum objects. The most valuable geographic information is in the form of digital geographic coordinates. Geographic coordinates presented as x, y and possibly z-values define the position of a monument or building in a coordinate system and allow their location to be plotted on a map. This adds value for end-users by enabling browses for content using a map, without the necessity of typing place names, and making it possible to discover content at the same location originating from different sources and at different times, mapping the cultural content, bringing together the architectural/archaeological heritage with museum objects and intangible heritage, defining the protected areas of monuments, calculating distances between sites, planning routes, creating visualisations and historical simulations, and developing mobile applications.

Following a review and analysis of the geographic information services, CARARE developed a pilot web-mapping system and made it available through the project website (Zakrajšek 2012 and 2013, CARARE, 2013). The pilot service is based on CARARE data accessed through the Europeana API (application programming interface) and coordinate data from the CARARE repository. It provides a demonstration for Europeana of the potential for browsing and searching data via a map interface, and of a mobile application and a route planning application that allows users to plan a walk along a route and be provided with information about the historic buildings and archaeological sites along their route.

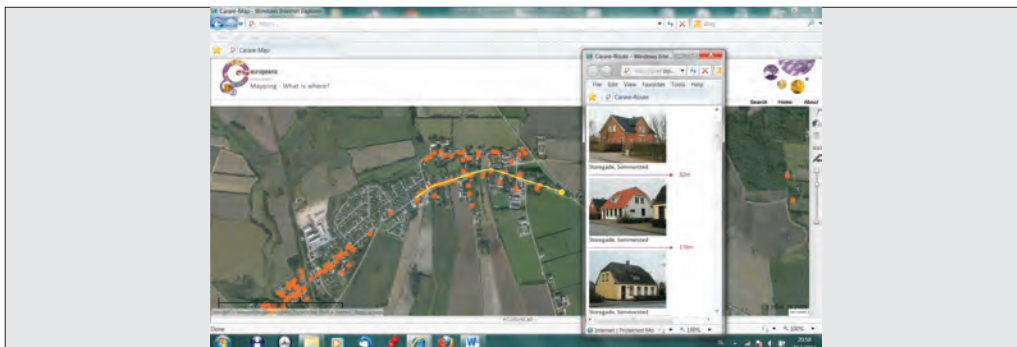


Figure 4: The route planning component of the CARARE map application
<http://carare.eculturelab.eu>



3.2 3D, Virtual Reality and virtual reconstructions


CARARE worked with Europeana to establish a methodology to enable 3D content to be offered to Europeana's users. 3D is created by archaeologists and architectural historians to record, analyse and present heritage sites and objects, and is an increasingly popular media format with general users. But 3D was a new media type for Europeana, and one of CARARE's goals has been to establish a methodology for providing 3D and VR content to Europeana.

Although increasingly popular, 3D is not yet standardized and a wide range of different technologies and formats are produced. In general, these require users to install browser plug-ins or viewers in order to see 3D content. In the context of Europeana, whose content is provided by large numbers of different organisations, the variety of 3D formats could mean that users are required to install many different plug-ins. To provide a more satisfying user experience, Europeana prefers content to be published in open and standardised formats that minimise the need for its users to download viewers.

Following analysis of the issues and the available solutions, CARARE recommended 3D-PDF as a user-friendly publication format while new technologies such as HTML5 and GML are evolving (Pletinckx and Haskiya, 2011; Pletinckx, 2011; *Three Documented*, 2012). 3D-PDF has been widely accepted as a good presentation format that allows 3D models to be encapsulated and presented to users with contextual information and links to viewpoints within models. The format has been adopted in CARARE and other Europeana-related projects such as 3D-ICONS and Protage.

Figure 5:
Middle Byzantine Church,
1200 A.D.,
Episkopi Manis, Hellas
© The Ministry of
Culture and Tourism
- 5th Eforate of
Byzantine and
Post-Byzantine Antiquities
(3D Digitization by CETI,
Athena Research Centre)





The PDF viewer is widely available and is often pre-installed in web browsers, which means that most users will not need to download a plug-in. There is already much content in PDF format available via Europeana. PDF is designed to allow multimedia content, including 3D, to be embedded inside documents. Since it became an open standard, authoring software has become available from several different companies which enable 3D models in a range of native formats to be converted and embedded into PDF documents. Another benefit of publishing 3D in PDF lies in the potential for interaction between descriptive text and views of a 3D model embedded on the same page, for example you can include a link in the text which goes to a view of a room or facade of a model.

4. Building the CARARE aggregation service

One of the first tasks for the CARARE project was defining the technical architecture of the aggregation service. The overall technical architecture for the CARARE aggregator included the MINT metadata mapping and ingestion tool developed by the National Technical University of Athens, and the MORE repository developed by the Digital Curation Unit of the Athena Research Centre. Both components were customized for CARARE involving the installation of the CARARE metadata schema, defining the workflow to support the transfer of packages of metadata from MINT and their ingestion to MORE, establishing preview services for content providers of their metadata in EDM, ESE and Europeana, enrichment services, statistical tools and quality assurance, and implementing an OAI-PMH target to enable harvesting of the content by Europeana (CARARE, 2011).

4.1 CARARE Metadata and the Europeana Data Model

Work in the CARARE project on metadata coincided with a period of significant change in Europeana, with Europeana initiating a process of evolution from using the *Europeana Semantic Elements* (ESE) metadata standard to the more expressive, and information-rich, *Europeana Data Model* (EDM, 2012).

CARARE established a domain-specific metadata schema (CARARE, 2012) as an intermediary between the native metadata held by its content partners and the schema used by Europeana, which was evolving throughout the three years of the project. The CARARE metadata schema makes use of established standards from the archaeology and architecture domain, in particular the MIDAS Heritage standard (MIDAS, 2012), the POLIS DTD (Constantopoulos et al., 2005), the LIDO schema (Coburn et al., 2010) based on the underlying conceptual foundation of the CIDOC CRM standard (*Definition*, 2010).

The CARARE schema is designed to allow content providers to map their source data to a rich schema while minimising the loss of semantics. The schema was installed in the CARARE MINT tool, which was used by CARARE partners to deliver their metadata. Partners could choose to deliver their metadata in CARARE schema format or use MINT to complete a mapping of their native metadata schema and then transform their records to CARARE format. Metadata was then ingested to the CARARE repository, called MORE, which provided a series of services such





as quality assurance and conversion of spatial coordinates into a common system, and transformation to EDM format before supply to Europeana.

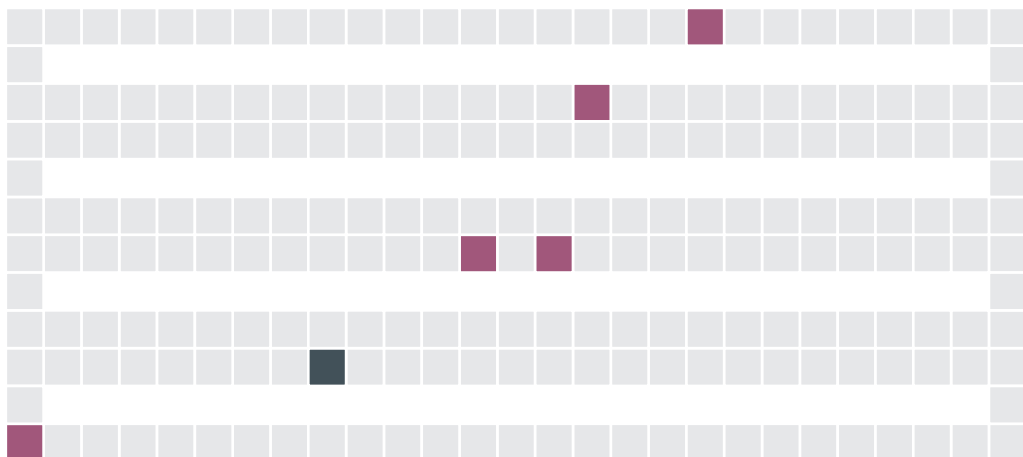
The CARARE team has worked very closely with Europeana throughout the project. CARARE was the first project to provide EDM metadata to Europeana as part of its live harvesting services and has acted as a 'test bed' for Europeana while work has been underway to implement EDM in Europeana's ingestion toolkit and user interfaces. A case study of the mapping between the CARARE schema and EDM is available on the Europeana professional site (EDM Case Study).

4.2 Repositories

The CARARE repository is part of a network of repositories underpinning Europeana. As part of the project many CARARE content providers have established repositories to enable them to supply their metadata to CARARE and Europeana via OAI-PMH or XML exports. Some partners have established national aggregation services for the archaeology/architectural heritage within their countries. These repositories provide a sustainable legacy for continuing the supply of content to Europeana in the future.

5. Conclusions

CARARE has been a highly successful project within the Europeana family. It has been a leading provider of content to Europeana, demonstrating the important contribution to be made by heritage agencies responsible for the conservation, management and promotion of archaeological and architectural heritage sites. CARARE developed an aggregation service for Europeana, playing a key role in establishing a workflow and methodology for content providers to enable them to make their metadata interoperable on a European level. Through its work, CARARE has built a network and community of people and organisations with an interest and commitment in making digital content for archaeological and architectural heritage interoperable and accessible to the broad public on a European level.



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