Semantic Web Technologies for CrossCult

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Talk Outline

- Introduction to CrossCult
- The CrossCult Knowledge Base
- Semantics-enabled reflection
- CrossCult Services
- CrossCult Mobile Apps
The Project

**CrossCult:** Empowering reuse of digital cultural heritage in context-aware crosscuts of European history

- **Call:** EU H2020
- **Topic:** REFLECTIVE-6-2015 - Innovation ecosystems of digital cultural assets
- **Type of Action:** Innovation Action
- **Timeline:** 36 months, March 2016 – February 2019
Our Team

- An Interdisciplinary Team

- Computer scientists, social & humanities scientists, SMEs and venue representatives working collaboratively
Consortium & Partners

Main Partners

Associate partners

Venues
- Archaeological museum of Tripolis, GR
- Roman Spa of Lugo, ES
- National Archaeological museum of Spain, ES

Cities
- Chaves, PT
- Valetta, MT
- Luxembourg City, LU,
- Tripoli, GR
- Argos-Mycenae, GR

NGO
- DIAZOMA - GR

SMEs
- Postscriptum, GR
- Mediapro, ES
- ARCTRON 3D, DE
- Empty Museums Design, ES
- Pyro Studios, ES
Project Aims

- History is a mesh of interrelated facts and concepts
- Historical data is commonly presented in silos
- Spur a change in the way European citizens appraise History
- Reflection on History focusing on cross cultural/border/gender aspects
4 Pilots - 8 Venues

- **Pilot 1**: Large multi-thematic venue (National Gallery, UK)
  - Connections among people, places and events through Art
  - Reflection through personalisation
- **Pilot 2**: Many small venues (Lugo ES, Chaves PT, Montegrotto Terme IT, Epidaurus GR)
  - Theurapetic use of water
  - Reflection through socialisation
- **Pilot 3**: Small venue (Archaeological museum of Tripolis GR)
  - Role of woman in society
  - Reflection through enrichment
- **Pilot 4**: Multiple Cities (Luxembourg City, Valletta)
  - Migration
  - Comparative reflection
The CrossCult Platform
Talk Outline

- Introduction to CrossCult
- The CrossCult Knowledge Base
- Semantics-enabled reflection
- CrossCult Services
- CrossCult Mobile Apps
The CrossCult Knowledge Base

- A semantic knowledge base capable of interrelating a wide set of disparate digital cultural heritage resources.

Requirements

- A Semantic “glue” of common Concepts and Relationships
- Scalable and Extensible
- Cater for Pilot Specialisations
- Facilitate Interoperability and Linking to External Resources
- Maximum Reuse of Existing Standards when possible
- Support the needs of the Knowledge Base
  - Semantics : Entities / Concepts
  - Inference and Linking
The CrossCult Knowledge Base

- Venue Ontology
- User Ontology
- Semantic Enrichment - DBpedia
- Upper – Level Ontology
- CrossCult Specific Semantics

- FOAF
- Dublin Core
- CIDOC - CRM
- SKOS

- Ontology size: 11,484 axioms, 2186 individuals
- CCKB size: 1,201,533 axioms, 282,010 individuals
Upper-level Ontology: Overview

- A conceptual layer delivering formalisms that describe the “world” of CrossCult
  - Enables augmentation and enrichment
  - Semantic-based reasoning
  - Linking and retrieval across disparate data resources
- Core subset of CIDOC-CRM elements
  - Well-defined and interoperable semantics
  - Specialisations relevant to cultural heritage
  - Extensible to meet project-specific requirements
- Incorporates elements from SKOS and Dublin-Core
Upper-level Ontology Core Elements

Reflective Topic:
Topic or subject theme that drives the user’s reflection – Specialisation of E89 Propositional Object

reflects:
Sets a reflective topic as the primary subject of reflection of a physical or conceptual thing
Reversed and extended definition of P129 is about
The Semantics of Reflective Topic

- **Reflective Topic** encompasses all those connections that can be made to
  - create a network of points of view,
  - aiding reflection and prospective interpretation over a topic,
  - enabling interconnection between physical or conceptual things of man made or natural origin.

- **is reflected by**
  - any physical object or immaterial thing, which can accommodate a true paradigm of reflection within a given reflective proposition

- **can be experienced as**
  - a composition or sequence of narrower Reflective Topics
The Semantics of Reflective Topic

In this rocky landscape, Apollo is together with the 9 muses. We know it is them, because some Muses hold their attributes, like a scroll, kithara, lyre, mask, globe). You might have heard of the famous female poet Sappho, 7th century BC. Sappho is a very special case, because not only she is educated, but she is also educating other girls.
The Venue Ontology

- Applicable across Pilots, CIDOC-CRM driven
The User Ontology

- CIDOC-CRM compliant
- Extended with
  - FOAF entities
  - project-specific entities
- Captures concepts used to describe
  - Demographic characteristics
  - User interests, knowledge, comments, etc.
  - Personality traits
  - Visiting style
The CrossCult Classification Scheme

- A faceted classification of terms addressing the need for an additional level of vocabulary semantics
  - subjects/keywords, used to enrich the descriptions of physical objects, places and reflective topics
  - types (e.g. of multimedia objects, dimensions, etc.)
  - periods of time
Integration of CCCS terms in CCKB

- Vocabulary terms as instances of `skos:Concept`
- Terms describing types classified under `E55 Type`
- Terms used in the descriptions of objects/places/reflective topics classified under `E89 Propositional Object`
Pilots Digital Cultural Resources

<table>
<thead>
<tr>
<th>Pilot</th>
<th>Cultural Heritage Resources</th>
<th>Data Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilot 1</td>
<td>Paintings from the National Gallery collection</td>
<td>Semi-structured</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Consistent descriptions</td>
</tr>
<tr>
<td>Pilot 2</td>
<td>Monuments/objects from the four archaeological sites</td>
<td>Unstructured</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Variable level of detail</td>
</tr>
<tr>
<td>Pilot 3</td>
<td>Museum exhibits from the Museum of Tripolis</td>
<td>Unstructured</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Consistent descriptions</td>
</tr>
<tr>
<td>Pilot 4</td>
<td>Points of Interest (POIs) from Luxembourg &amp; Malta</td>
<td>Semi-structured</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Consistent descriptions</td>
</tr>
</tbody>
</table>

- Methods that can handle diverse types of data
Data Structuring Method

OWL Individuals

XSLT Transformation

Automatic Statement Generation

Semi-Automatic Database Construction

Manual Data Extraction

XML Schema

Data Layer

Where HISTORY meets IT
Talk Outline

- Introduction to CrossCult
- The CrossCult Knowledge Base
- **Semantics-enabled reflection**
- CrossCult Services
- CrossCult Mobile Apps
Reflection through enrichment

- A selected set of ontology individuals were enriched with links to standard and well-known Semantic Web resources such as:
  - DBpedia
  - Getty AAT

- using appropriate properties from:
  - OWL (owl:sameAs)
  - SKOS (skos:closeMatch)

- using Named Entity Linking:
  - manually (by experts)
  - automatically (with DBpedia Spotlight)
Reflection through enrichment

Unusual worship, enchanting myths, mystical ceremonies, powerful city-states, eminent sanctuaries, important historical and political events compose the image of Arcadia in antiquity. Ancient Arcadia is the land of gods. Half goat, half man, Pan is the famous Arcadian God of mountains and bucolic life, who had his hideout in Mount Mainalon, running in the ravines playing his pipes with the escort of the nymphs.

When night fell, the priest led Apellas through the shrine lit up by many little lanterns, walking through a portico where several people were sleeping on the floor. The priest explained that the god would appear to them in their sleep, and heal them or give them advice on healing. A bit fearful of coming into contact with a deity, but willing to recover his health, the young man lay down on a pallet and some blankets, and soon fell asleep.
Reflection through association

- Semantics-based association between
  - pilots’ cultural heritage resources
  - special days/events

Method

- Named Entity Linking of reflective narratives and events descriptions with DBpedia entities
- Semantically modelling special days/events
- SPARQL queries to retrieve the associations
Reflection through association

In this rocky landscape, Apollo is together with the 9 muses. Sappho is a very special case, because not only she is educated, but she is also educating other girls.

Franz Grillparzer’s “Sappho” premieres in Vienna.

Marble pedimental plaque depicting an assembly of the nine Muses with Apollo Pythios in a rocky landscape. Some of the Muses are accompanied by their attributes (a scroll, kithara, lyre, mask, globe). An excellent relief work of the late 3rd c B.C.

Education Apollo and the Muses

http://media.tripolisarchaeologicalmuseum.gr/images/im_000.jpg
Summary of SW-related Contributions

- CrossCult ontologies & vocabularies
  - Contributions to CrossCult
    - Homogeneous semantics-based representation of pilots data
    - Support for reflection and reinterpretation objectives
    - Support for the development of CrossCult services
      - Personalisation, recommendation, association discovery, etc.
  - Applicable to any CH project/venue with similar needs
  - Formal Semantics for Reflection
  - Tool for creating alternative presentations of venues’ collections
Talk Outline

- Introduction to CrossCult
- The CrossCult Knowledge Base
- Semantic Data Modelling
- Semantics-enabled reflection
- CrossCult Services
- CrossCult Mobile Apps
User profiling

- **Image-based profiling**
  - preferences, personality, …

- **Question-based profiling**
  - interests, levels of knowledge, …

- **Location-based profiling**
  - implicit preferences from trajectories

- **Game profiling**
  - personality

- **Interaction-based profiling**
  - usability preferences
User tracking

- **Interaction tracker**
  - user’s in-app interactions with the content

- **Geolocation tracker**
  - user trajectory data

- **Location tracker**
  - location data
Recommendation

- **Person recommendation**
  - Form teams out of sets of users, with unrestricted criteria on the user profiles

- **Association recommendation**
  - Rate associations according to user interests
  - Using word embeddings learnt via Artificial Neural Networks

- **Item recommendation**
  - Recommend POIs or exhibits according to the user’s interests

- **Path recommendation**
  - Recommend paths based on user’s interests and preferences
  - Different path-finding algorithms working on a graph representation of a venue or city

- **Recommendation feedback and learning:**
  - Neural networks aiming to learn from the success or failure of any recommendations made in the past
Context analysis

- **Venue monitoring service**
  - Gather and aggregate the observations on all the users to produce knowledge about the whole venue

- **Relevant dates service**
  - A particular case of association discovery, with calendar-based queries and annotations of historical events and yearly commemorations

- **Trending topics service**
  - Collect information from Twitter and relate trending topics to venues/collections
Social networking services

- **Experience management service**
  - Manage runs of CrossCult apps and the sets of participants.

- **Chat service**
  - Text-based communication between app users

- **Microblogging service**
  - Build on-the-fly sporadic social networks for app users to express questions, feelings & opinions, to foster and record conversations, etc.

- **P2P communications**
  - Collaborative downloading and content sharing

- **Content moderation**
  - Handle user-generated comments that need to be moderated
Visualisation

- Visualisation of associations, maps, timelines and 3D content
  - state-of-the-art libraries embedded in mobile apps
- Micro-augmentations
  - Provide stimuli to re-capture the user’s attention to an app, when prolonged idling requirements are detected
- Ontology management frontend
  - Allow users to create, explore, manage and visualize ontology data
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Pilot 1: Large multi-thematic venue

- London National Gallery
- Reflective topic:
  - Connections among people, places, events through Art
- Method:
  - Reflection through personalisation
- Features
  - Personalised routes to explore the collection based on personal interests
  - Enrichment with links to external resources
  - Multi-faceted search
  - "Create your gallery room"
Pilot 1: Screenshots

Welcome to the Nation Gallery CrossCult experiment

This app is designed to allow you to explore the National Gallery and reflect on the paintings you discover. The app will also try to build a profile for you in order to recommend paintings to you based on your inputs and activities.
Pilot 1: Profiling
Pilot 1: Exploring the NG

Winter Landscape probably 1811, Caspar David Friedrich

Description
Friedrich combined landscape motifs with religious symbolism, and this picture represents the hope for salvation through the Christian faith. In the foreground a crippled man has abandoned his crutches and isos against a rock with his hands raised in prayer before a cross. The rocks and evergreen trees may be interpreted as symbols of faith, and the visionary Gothic cathedral emerging from the mist evokes the promise of life after death.

There is a second version of this picture in the Museum für Kunst und Kulturgeschichte, Dortmund.
Pilot 1: Recommendations

In 1816 the French government instituted a Prix de Rome for historical landscape. Prize-winners travelled to Rome, where they could develop their skills as landscape painters. Many other Northern European painters, including Jean-Baptiste Camille Corot, also journeyed to Italy, attracted by the dramatic landscapes and strong light of Southern Europe.

Your recommended paintings:
- A Valley
- Winter Landscape
- The Oak in the Valley
- View of the Forum in Rome
Pilot 1: Create your gallery room
Pilot 2: Many small venues

- Ancient spas of Lugo, Chaves, Montegrotto Terme, Epidaurus
- Reflective topic
  - Theurapetic use of water
- Method
  - Reflection through socialisation
- Features
  - Storytelling
  - Quiz games about associations, which users play in teams
Pilot 2: Stories linked to heritage items

A bit of a story...

The big building that they saw close to the bridge was a spa, a building using mineral-medicinal waters into pools, fountains and channels, where people went mainly to treat their diseases. Although it was known that these waters have healthy proprieties because their minerals and temperature, they couldn’t forget the importance of deities associated to them. So, there were several sacred spaces with altars and basins, where people left their gifts: both before taking the waters and after the healing treatments. The boys remembered to have seen shops outside displaying various objects for the water deities: little altars, statuettes, reliefs, bottles, glasses...
Pilot 2: Connections & Quizzes

The most renowned visitor to Epidaurus was the Emperor who ordered the construction of a wall across the island of Great Britain to defend from the inhabitants of what is now Scotland. Who was that?

- Augustus
- Nero
- Julius Caesar
- Hadrian
Pilot 2: Crowdsourcing associations

Hall of fame

<table>
<thead>
<tr>
<th>Name</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andreas</td>
<td>213</td>
</tr>
<tr>
<td>Martín</td>
<td>73</td>
</tr>
<tr>
<td>lug087</td>
<td>63</td>
</tr>
</tbody>
</table>

Your initial score: 0

Please share any thoughts about the game contents

Did you miss any connections in the game?

Does any of the venues relate to places near your home?

Do you think any of these venues related to others in different European countries? Why?
Pilot 2: Tools to design new experiences
Pilot 3: A small venue

- Archaeological Museum of Tripolis
- Reflective topic
  - Role of woman in society
- Method
  - Reflection through enrichment
- Features
  - Profiling games
  - Personalised presentations of the collection
  - Reflective narratives
  - Association with other related cultural heritage resources
Pilot 3: A small venue
Pilot 4: Two cities

- Luxembourg & Valletta
- Reflective topic
  - Migration
- Method
- Comparative reflection
- Features
  - Personalised outdoor exhibition & a game
  - Discover historic topics (e.g. migration) connected to physical locations
  - Share thoughts/stories and contribute to a public history
A walk through Belval’s past and present
GPS to help you find your position with respect to your surroundings
Identify nearby Places of Interest
Follow visual clues to unlock stories
- Unlock the story
- Discover the connection of the place to the past

The city of science: “Cité des Sciences”: A place of industrial transformation
Read about the place’s history
Rate your perception of the place
Reflect

Answer a question connecting the past with the present
Add your own story
Tag your thoughts
Read other visitor’s comments
Playful navigation
View your achievements
- View your journey
- Pick the history threads you want to explore
- Customize and get help
Thank you! Questions?

For more information about the project, visit

http://www.crosscult.eu

The CrossCult ontologies are available at:

https://www.crosscult.eu/en/resources/datasets/