Semantic Web Technologies for CrossCult

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Where HISTORY meets IT

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

UNIVERSIDADE DE VIGO

UNIVERSITY OF MALTA
L-Università ta' Malta

UCL

THE NATIONAL GALLERY

LUXEMBOURG INSTITUTE OF SCIENCE AND TECHNOLOGY / LIST

CNRS CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE

GVAM MOBILE GUIDES FOR ALL

TEI AΘHNAΣ TECHNOLOGICAL EDUCATIONAL INSTITUTE OF ATHENS

UNIVERSITÀ DEGLI STUDI DI PADOVA

uni.lu UNIVERSITÉ DU LUXEMBOURG

ΠΑΝΕΠΙΣΤΗΜΙΟ ΠΕΛΟΠΟΝΝΗΣΟΥ UNIVERSITY OF PELOPONNESE

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

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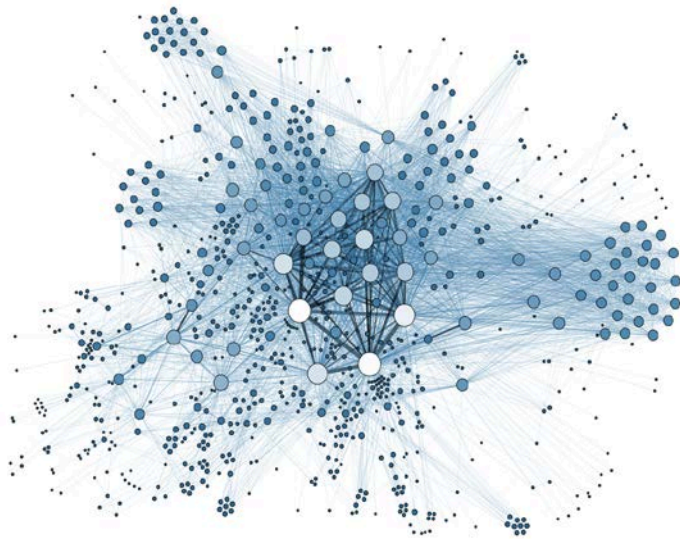
- History is a mesh of interrelated facts and concepts
- Historical data is commonly presented in silos
- Spur a change in the way European citizens appraise History
- Reflection on History focusing on cross cultural/border/gender aspects

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
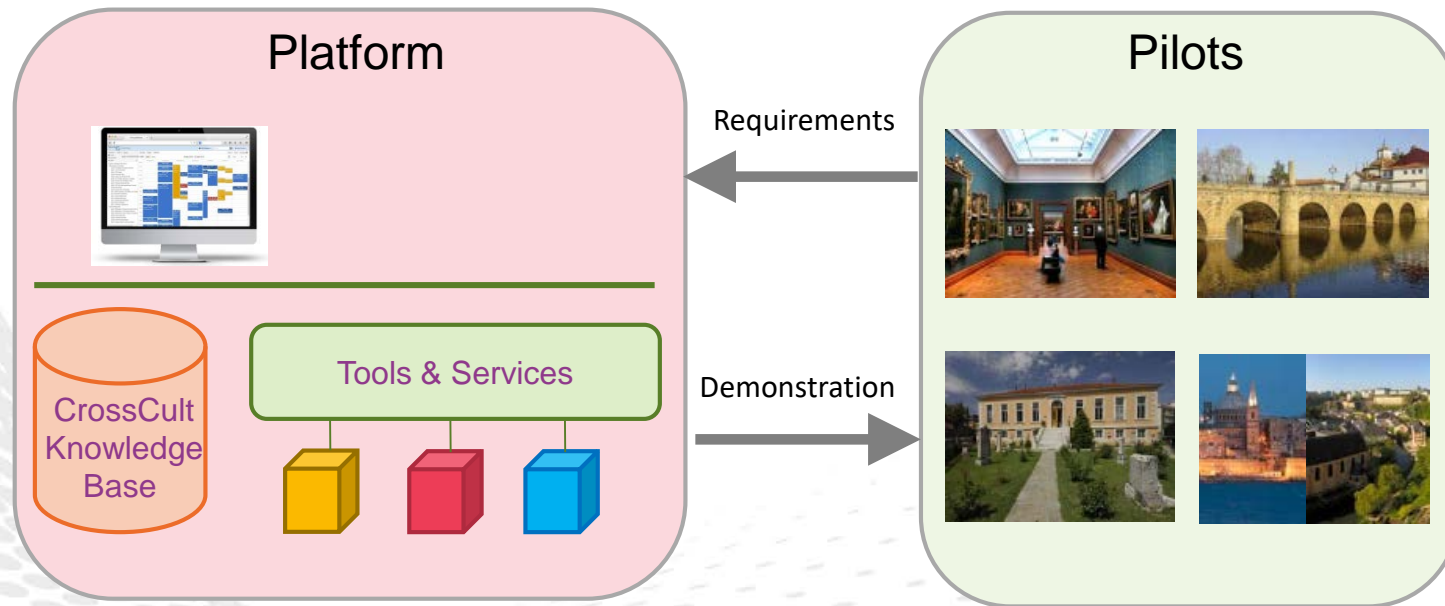
Talk Outline

◆ 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 | CCCS Vocabulary | A A T |

Semantic Enrichment - DBpedia

Upper – Level Ontology

CrossCult Specific Semantics

| FOAF | Dublin Core | CIDOC - CRM | SKOS |
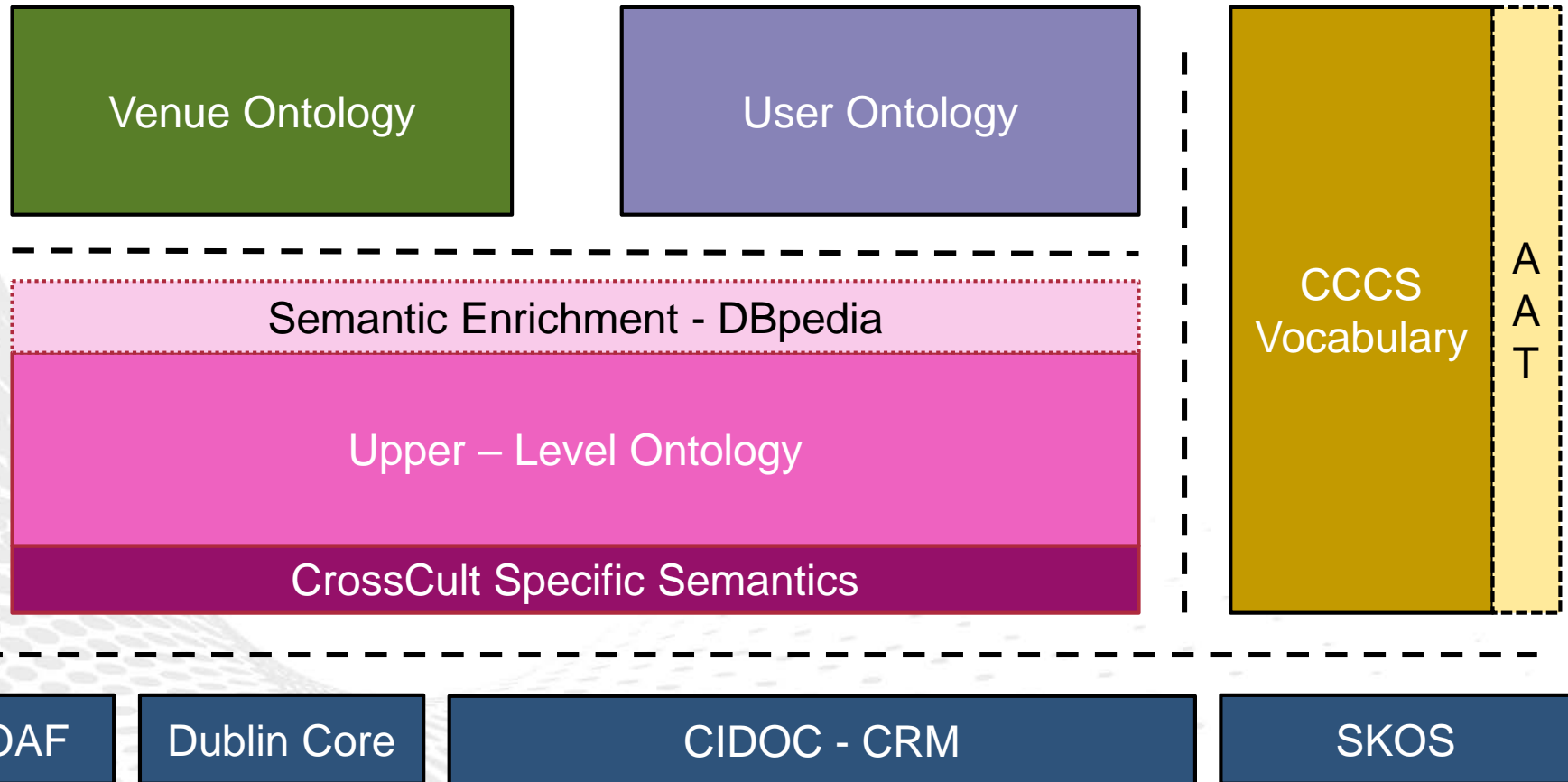
- ◆ **Ontology size: 11,484 axioms, 2186 individuals**
- ◆ **CCKB size: 1,201,533 axioms, 282,010 individuals**

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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
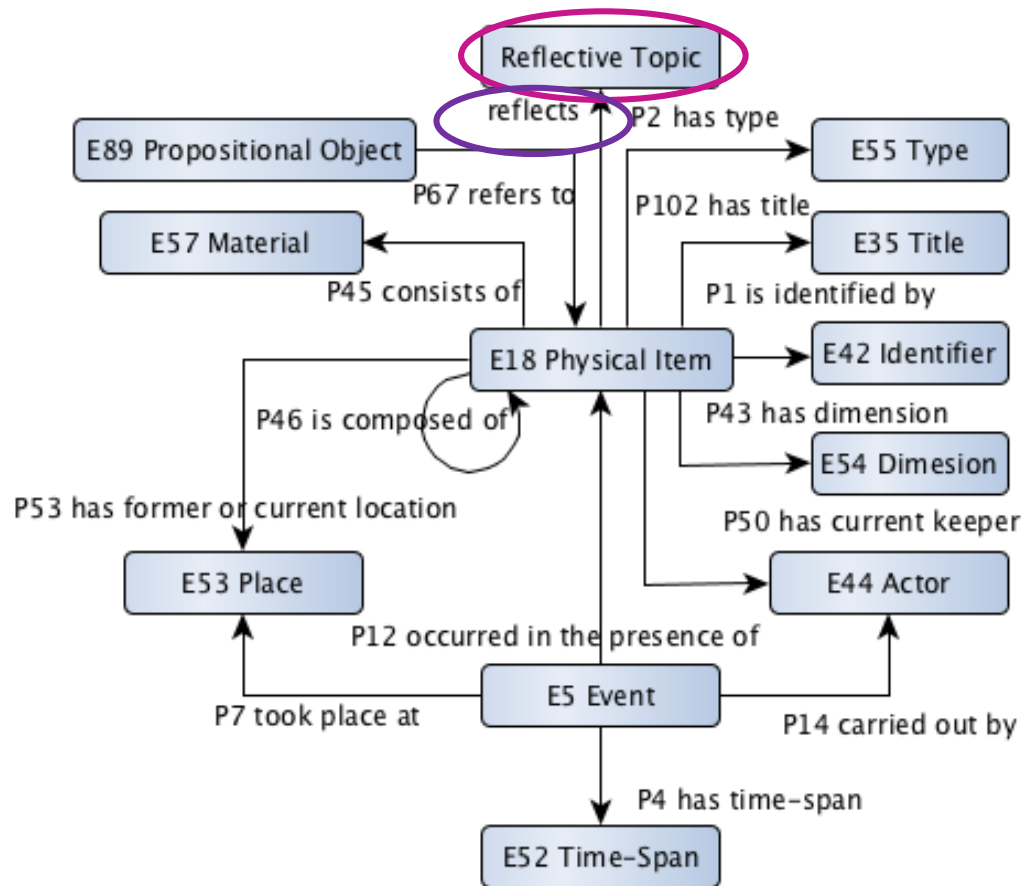
Reflective Topic:

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

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The Semantics of Reflective Topic
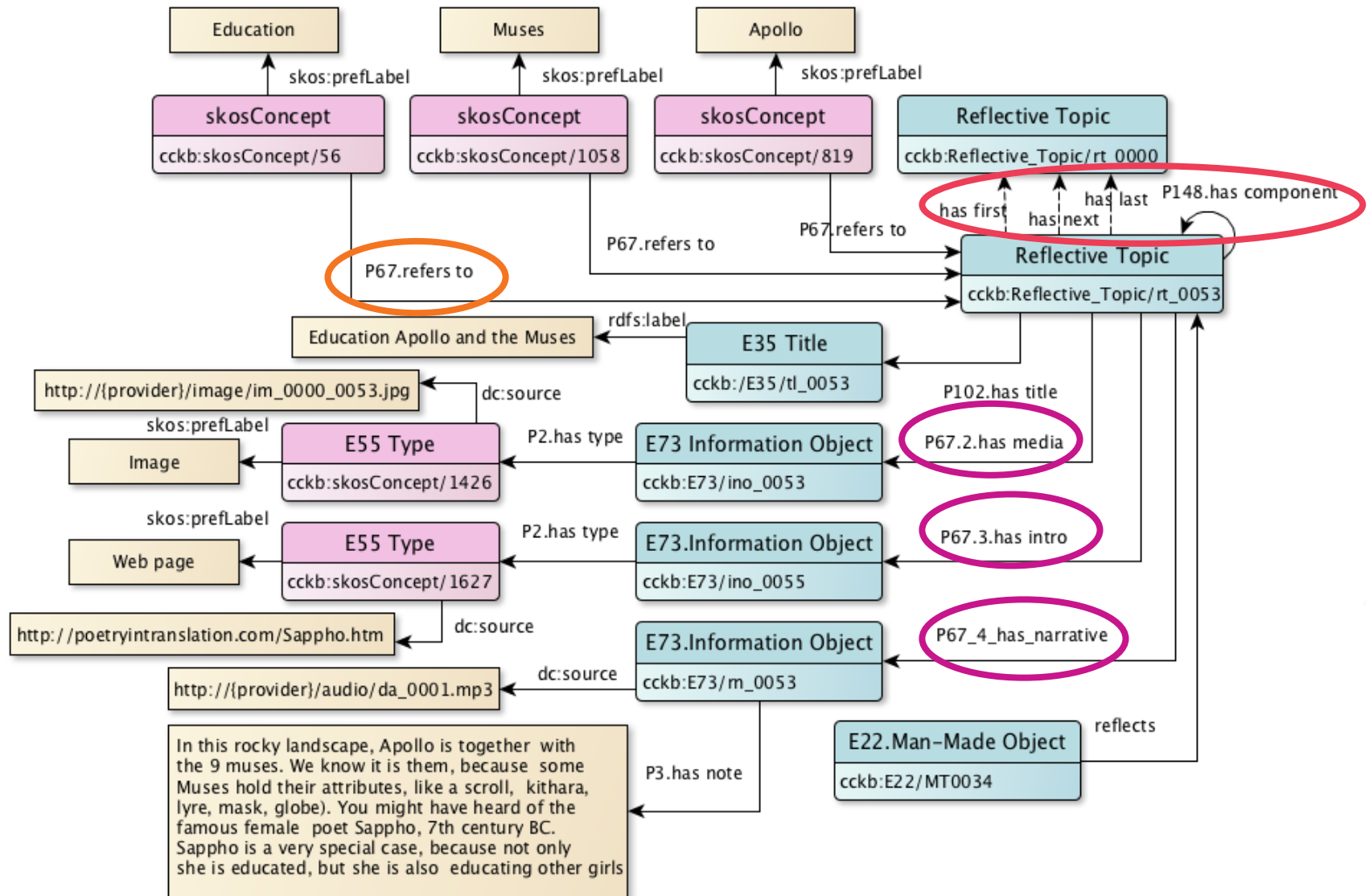
The Venue Ontology

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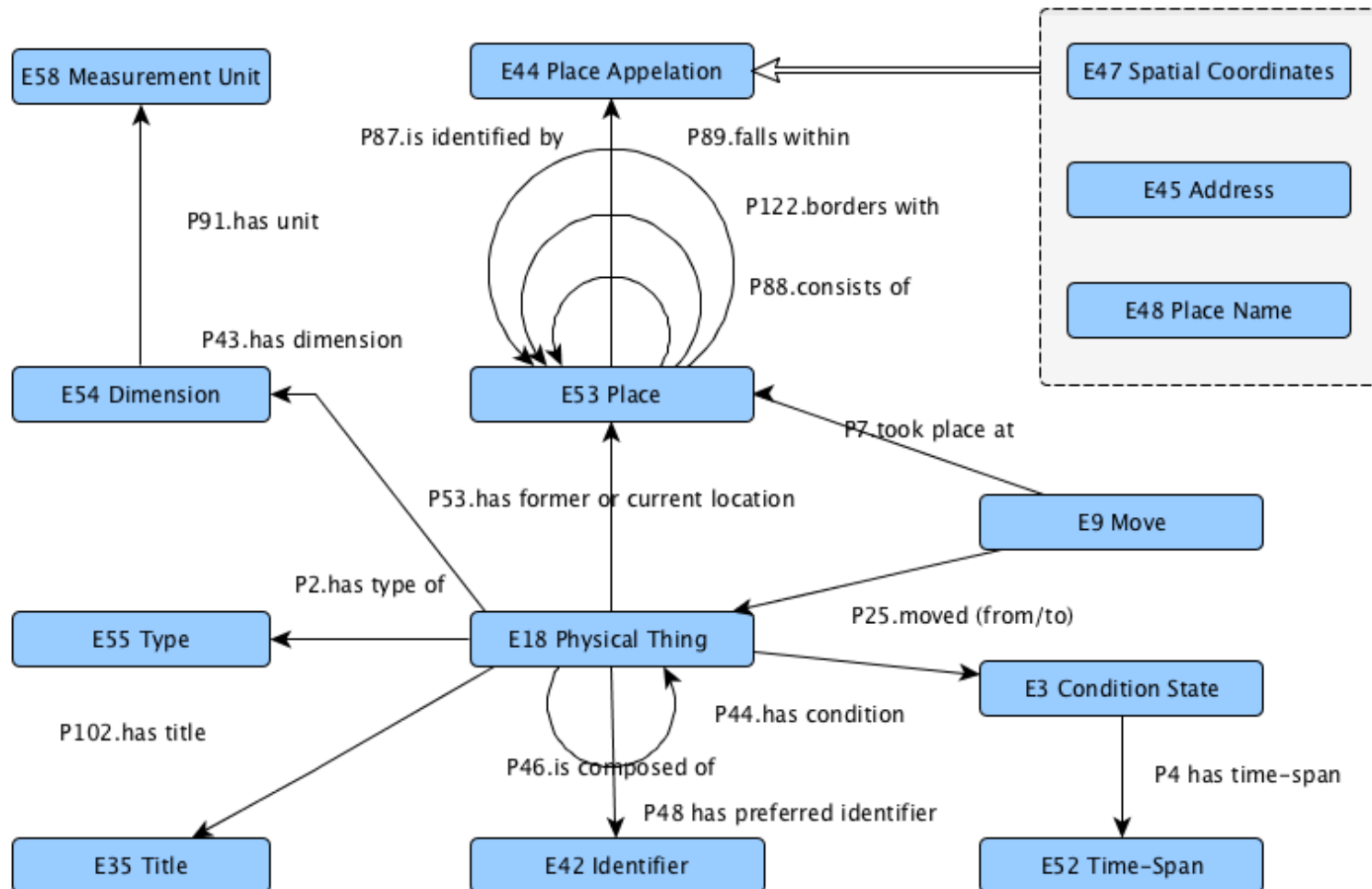
The User Ontology

- ◆ 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

CCCS

Sculpture

Monument

Person

Painting

Reflective topic

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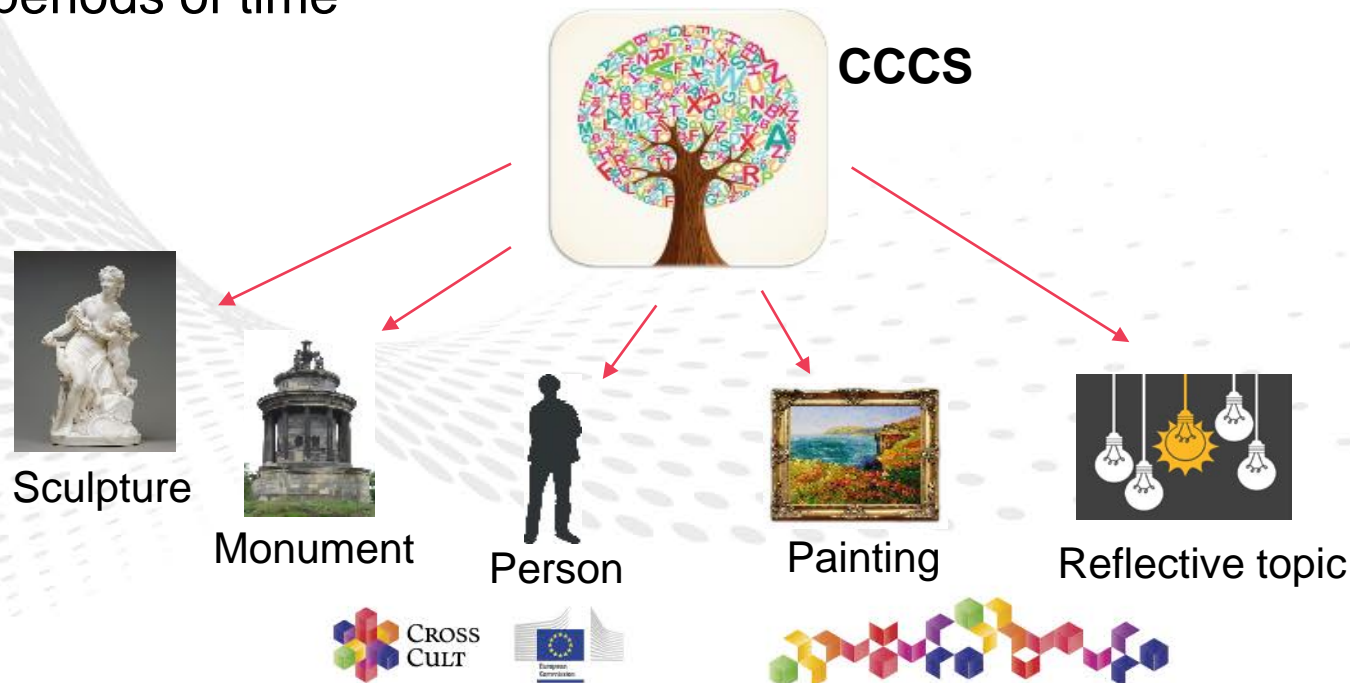
Integration of CCCS terms in CCKB
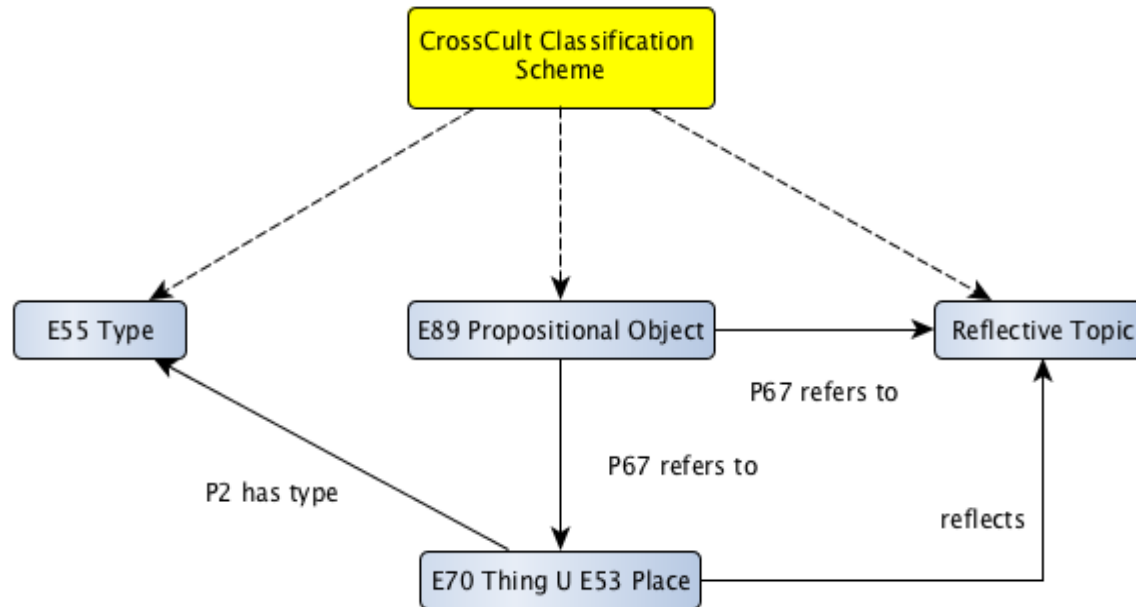
- Vocabulary terms as instances of skos:Concept
- Terms describing types classified under E55 Type
- Terms used in the descriptions of objects/places/reflective topics classified under E89 Propositional Object

Pilots Digital Cultural Resources

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

◆ **Methods that can handle diverse types of data**

Data Structuring Method
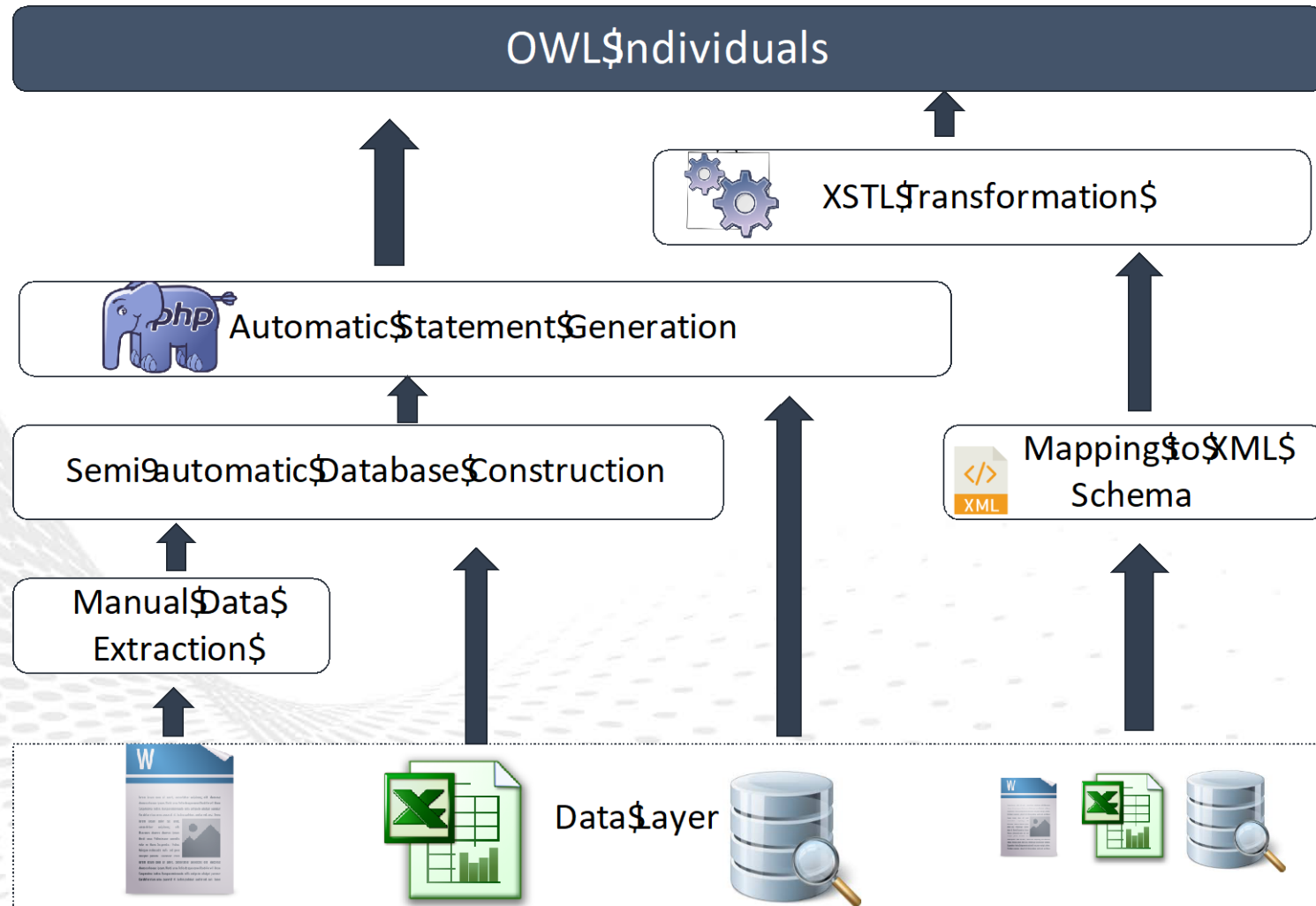
OWL Individuals

XSTL Transformations

Automatic Statement Generation

Semi-automatic Database Construction

Mapping to XML Schema

Manual Data Extraction

Data Layer

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
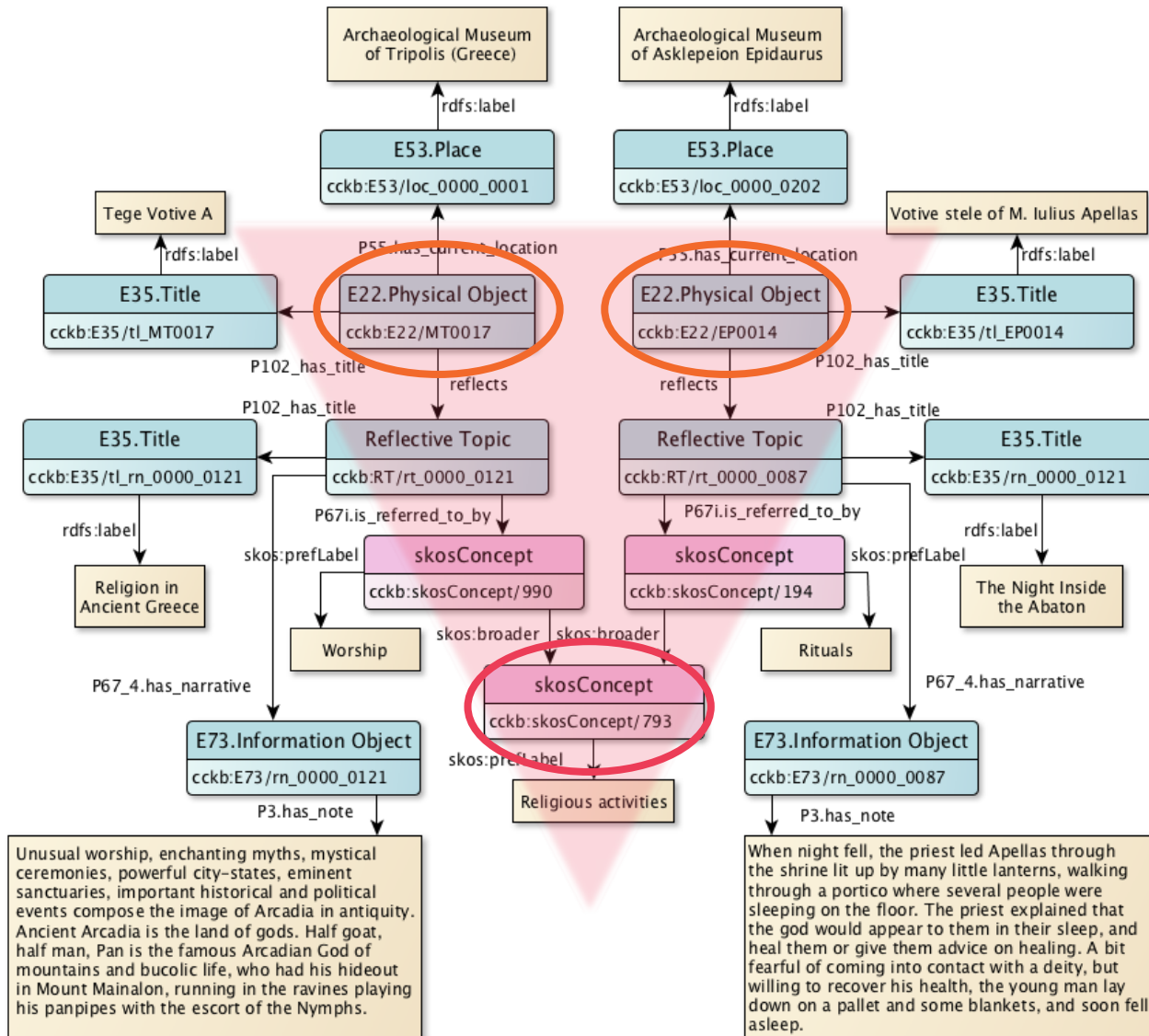
Reflection through association

- ◆ 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
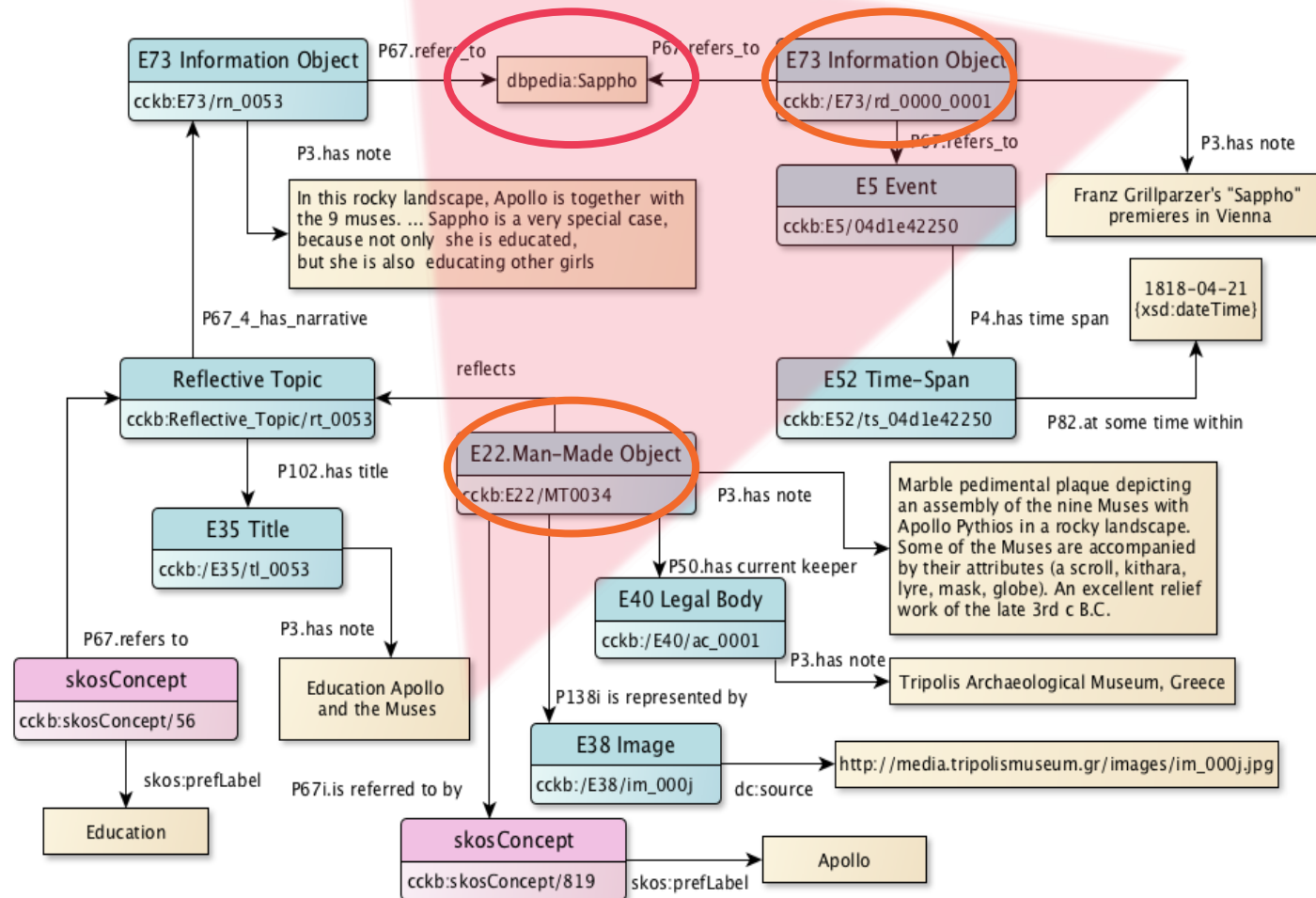
Summary of SW-related Contributions

- **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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◆ **CrossCult Mobile Apps**

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
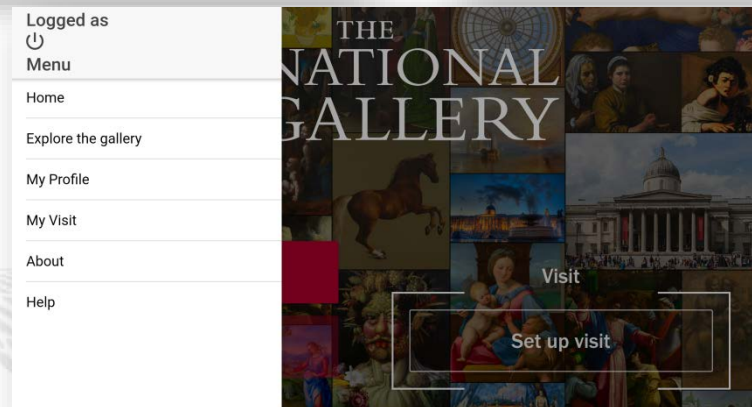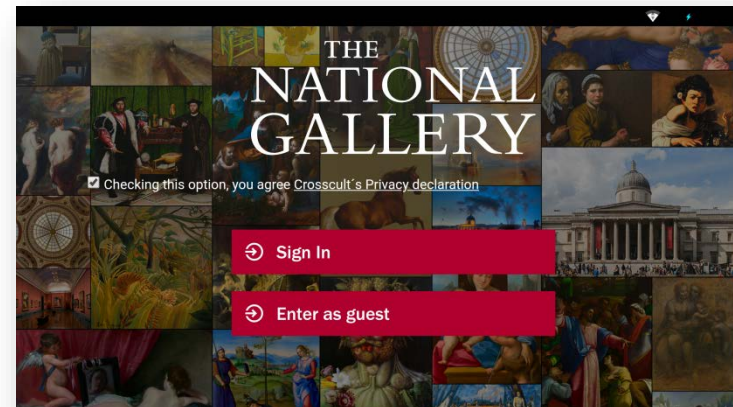
Pilot 1: Profiling
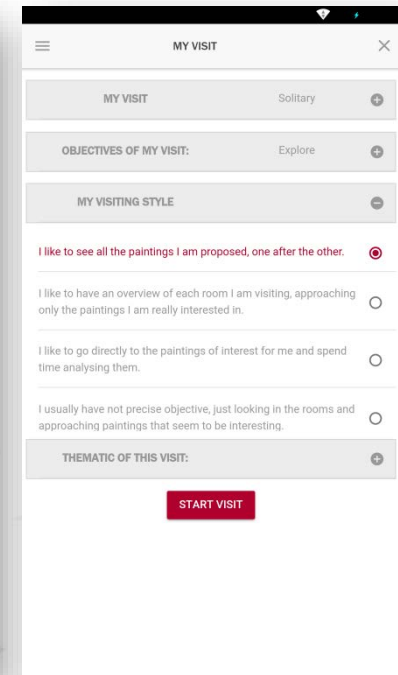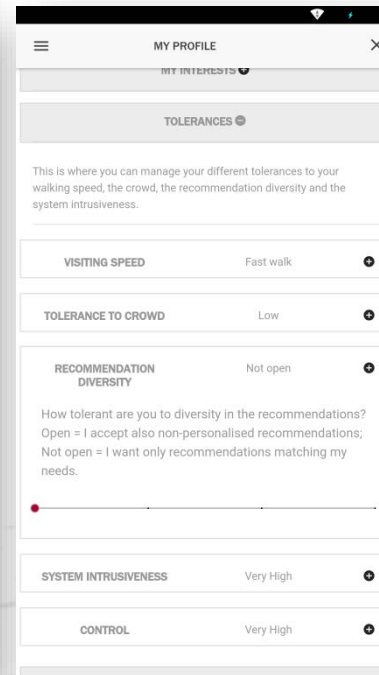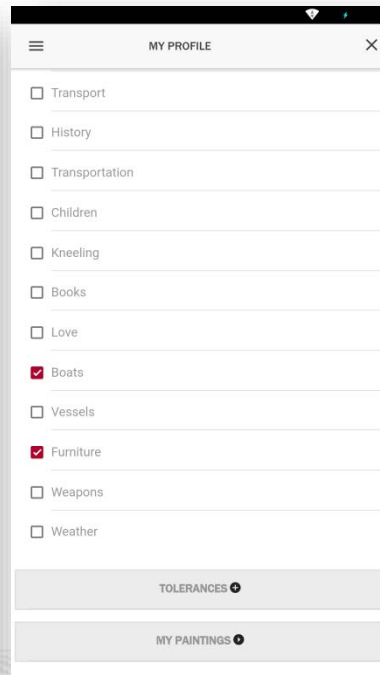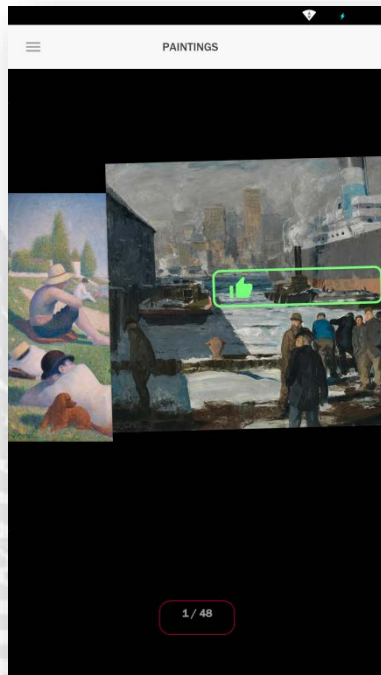
Pilot 1: Exploring the NG
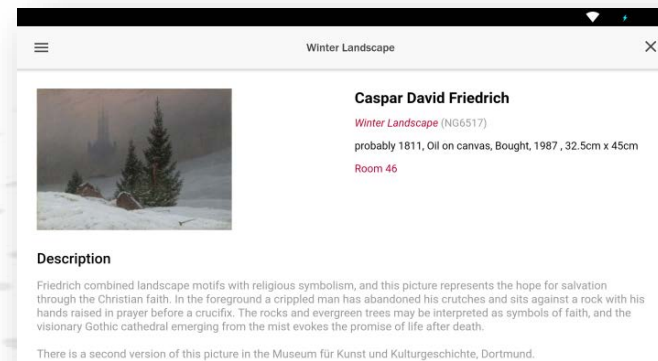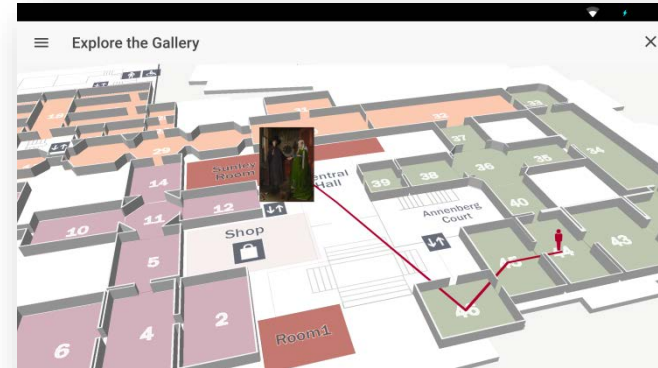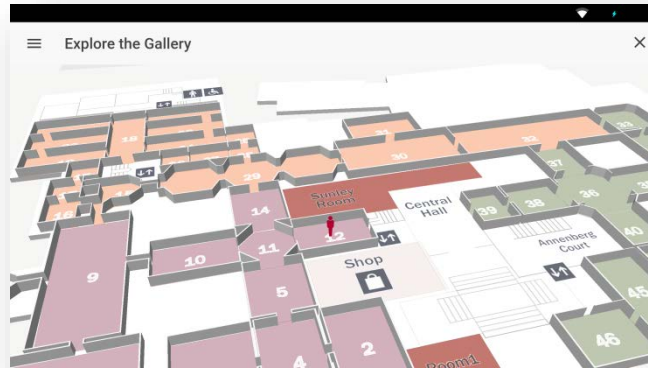
Pilot 1: Recommendations
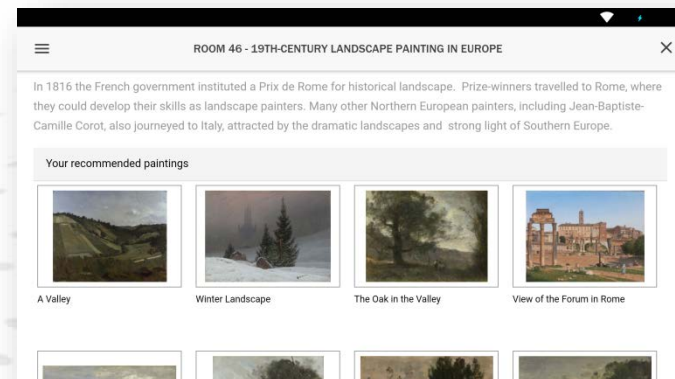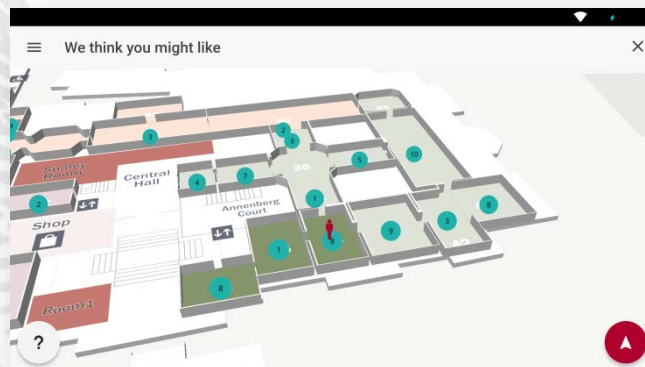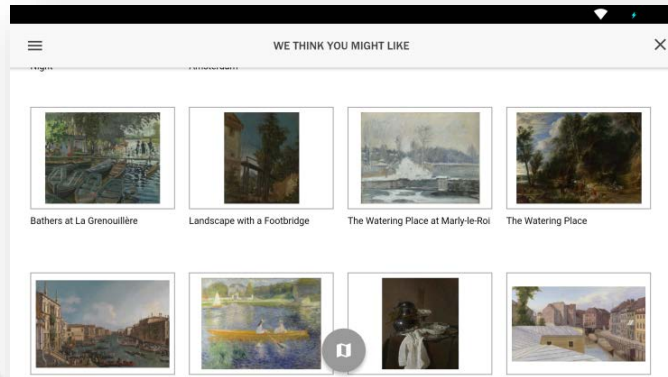
Pilot 1: Create your gallery room
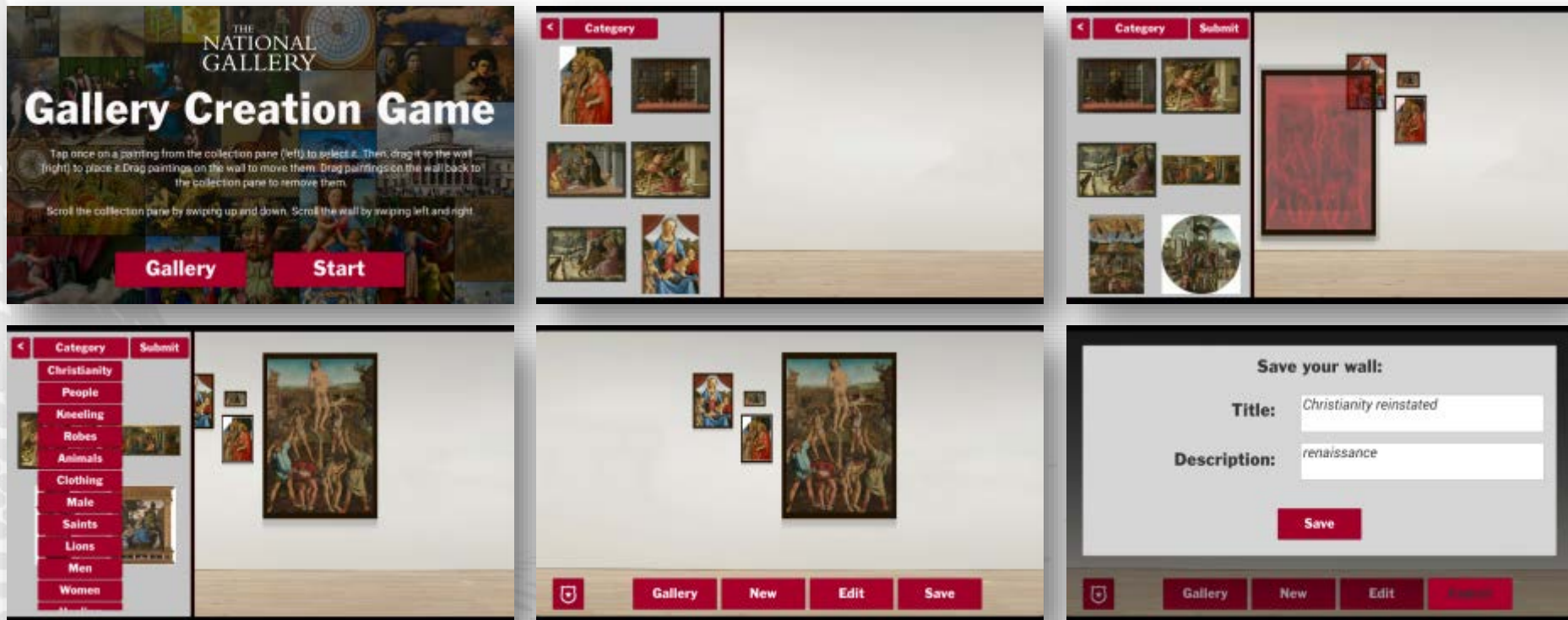
Pilot 2: Many small venues

◆ 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

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Pilot 2: Stories linked to heritage items

A bit of a story...

CLOSE

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...

Design of the Roman wooden cup discovered in the archaeological dig of the Roman healing spa of Chaves – Vaz et al.
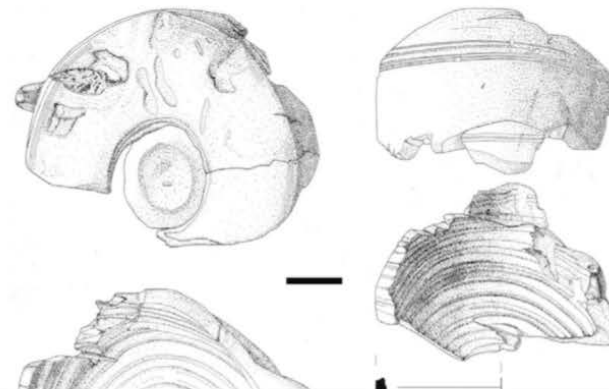
Pilot 2: Connections & Quizzes

44
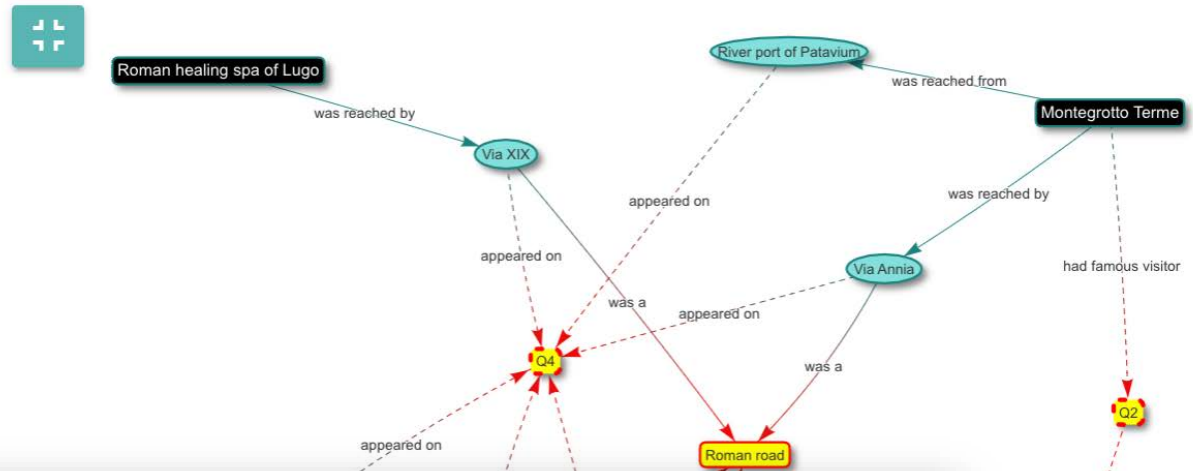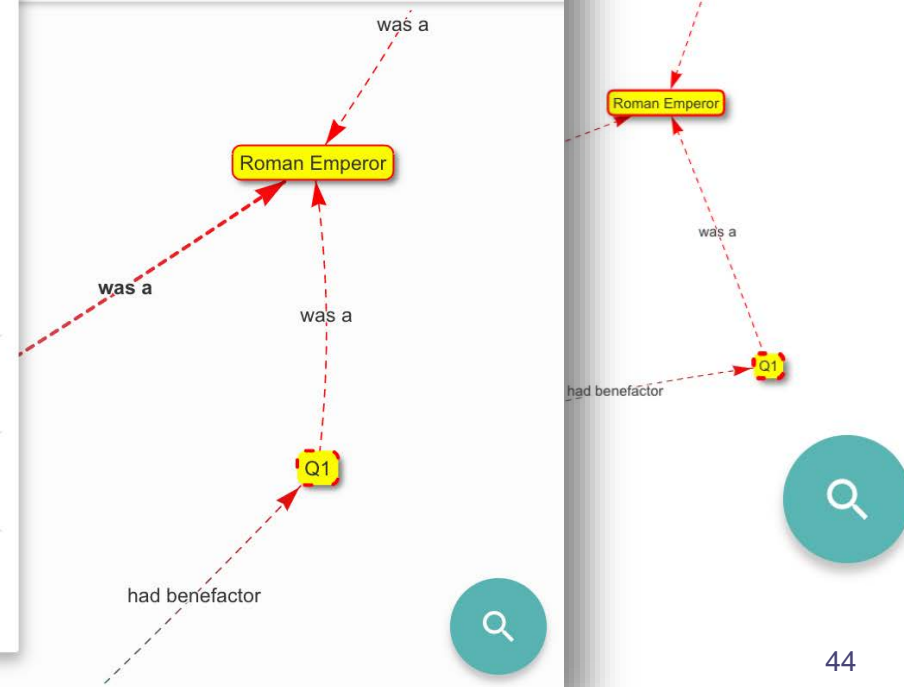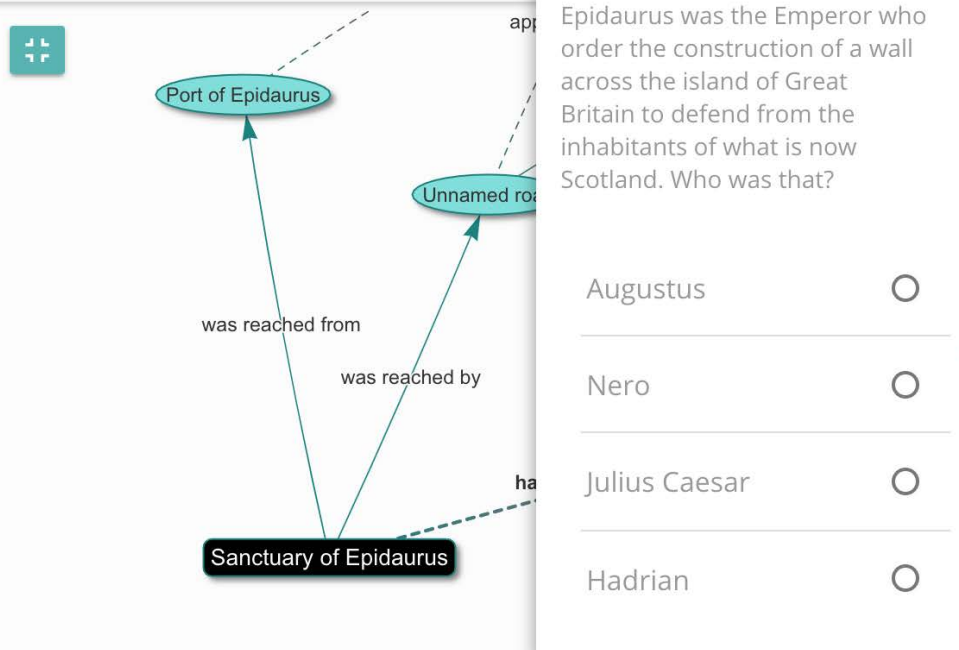
Pilot 2: Crowdsourcing associations

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

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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 your find your position
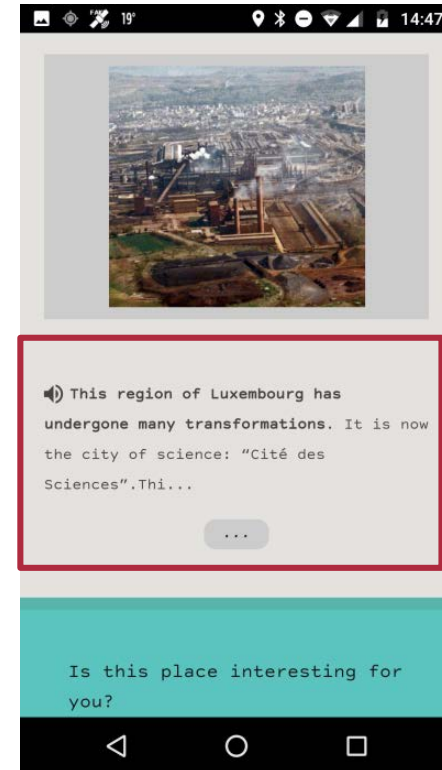with respect to your surroundings
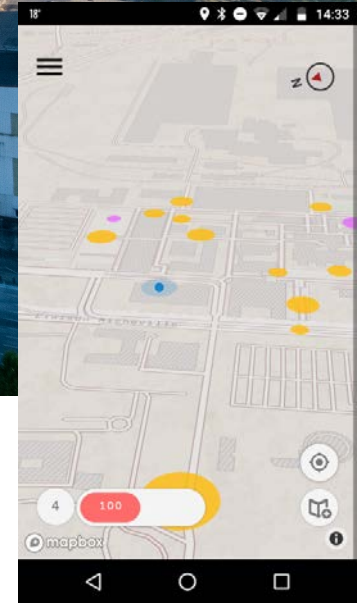
Identify nearby Places of Interest

Follow visual clues to unlock stories

◆ Unlock the story

◆ Discover the connection of the place to the past

◆ Read about the place's history

◆ Rate your perception of the place

◆ Reflect

◆ Answer a question connecting the past with the present
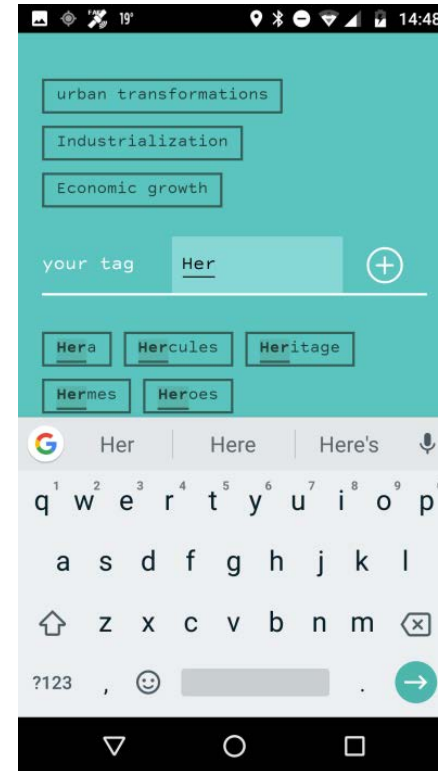
◆ Add your own story
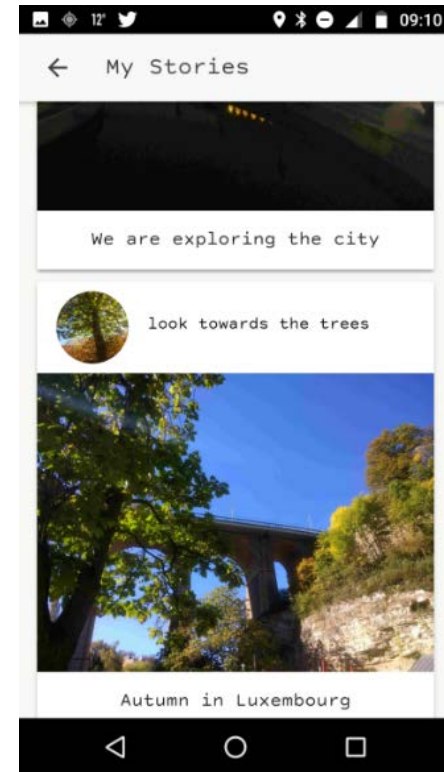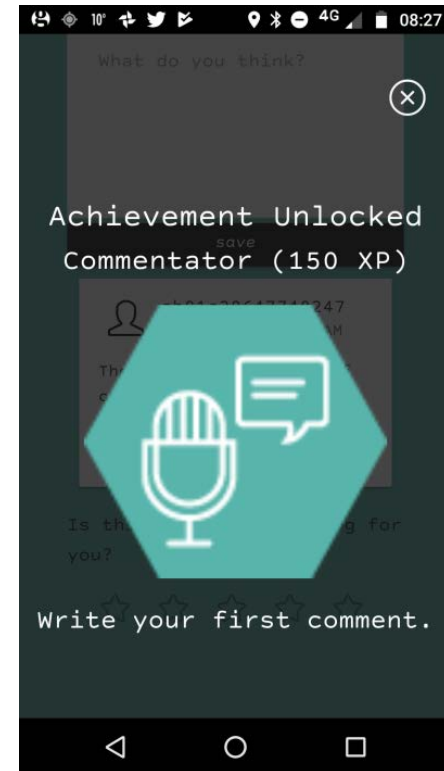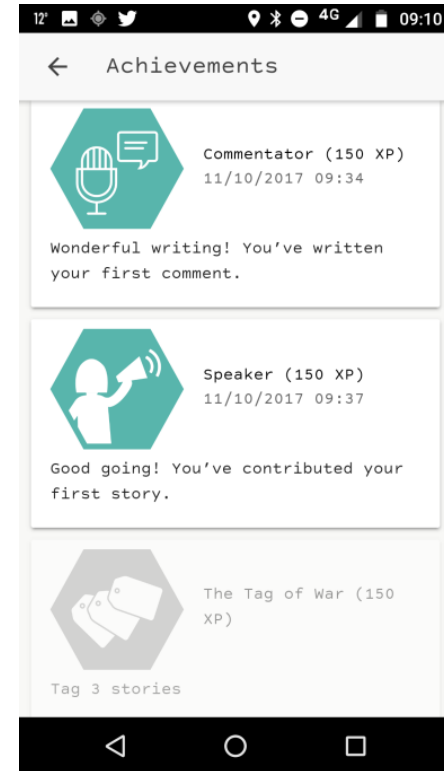
◆ Tag your thoughts
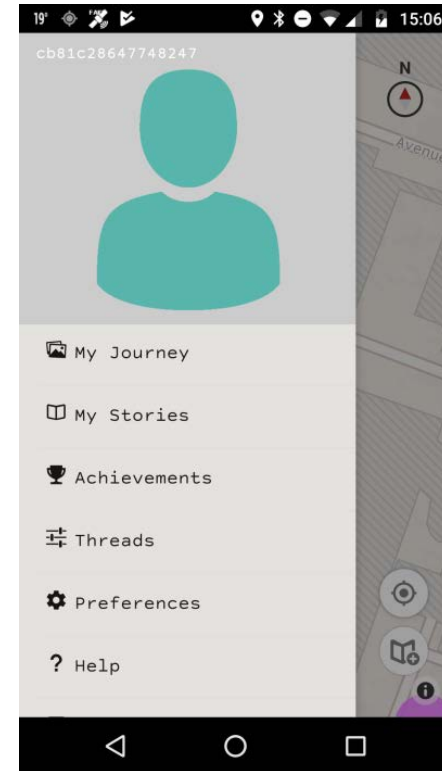
◆ Read other visitor's comments

◆ Playful navigation

◆ View your
achievements

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◆ 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/