King’s Digital Lab

Digital researchers and data experts

We create digital tools to explore academic research in new ways.
Ciula and Smithies (forthcoming), Sustainability and modelling at King’s Digital Lab.

The rest of the slides in this section are adapted from Ciula and Tupman (2016), Session 7: Ontologies and Data Modelling. See also Eide and Ore (2018), Ontologies and Data Modelling.
Data Model: Formalized description of how to organize data in an information system.

Ontologies: Special kind of data models.

“An ontology is an explicit specification of a conceptualization. The term is borrowed from philosophy, where an ontology is a systematic account of Existence. For AI [Artificial Intelligence] systems, what “exists” is that which can be represented.”

**What is an Ontology?**

<table>
<thead>
<tr>
<th>Conceptualization</th>
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<td>Explicit</td>
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- Specific knowledge domain / limited scope
  - Realist vs pragmatic (see Pasin and Ciula (2009), Laying the Conceptual Foundations)
    - Metaphor → agreement - contract - compromise

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<thead>
<tr>
<th>Form</th>
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</table>
- Scope notes + examples + connections to other concepts
- Comparisons and extensions with other models
Components

- Access to expert knowledge
- Analysis (BEFORE formal description) → role of examples
- Formal translation → generalize examples
- Documentation
- Implementation (data storage)

Understand domain and specify basic properties
**Classes and Properties**

### Class
- Universal
- Functional concept
- Recall vs precision
- Intension vs extension

### Property
- Class level
- Interconnection of entities

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Formalisms

- Formal structure vs interpretation
- Ontology commitment vs formal restriction
- Ontology definition → formal definition + scope notes + examples

Structure

- Object oriented
- Set of classes + properties
- Hierarchies and inheritance
Formalisms

First Order Logic

Resource Description Framework (RDF) → Linked Data

- Uniform Resource Identifier (URI)
- Triple = Subject (node) + Predicate (property) + Object (node)
- SPARQL
- Directed graph
- RDFS
- Web Ontology Language (OWL) → Semantic reasoning
## Ontologies in the Humanities and Cultural Heritage

<table>
<thead>
<tr>
<th><strong>Encode meaning</strong></th>
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<tr>
<td><strong>Novel ways to integrate and re-use</strong></td>
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<tr>
<td><strong>Risk of oversimplification</strong></td>
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<td><strong>Digital Cultural Heritage</strong></td>
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<tr>
<td>● From texts (to describe or refer to non-textual resources) to relational statements connecting entities (e.g. artefacts, places, people, events)</td>
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Example from the Henry III Fine Rolls Project
Henry III Fine Rolls

Example from the Henry III Fine Rolls Project
Henry III Fine Rolls

Example from the Henry III Fine Rolls Project
CIDOC-CRM


- ISO standard ISO 21127:2006
- Museums, Libraries, Archives
- CIDOC CRM SIG

Event-centric core ontology

From museums documentation systems to wider application

Combined with other ontologies
CIDOC-CRM

Event-centric
- + thing, place, person, conceptual object
- Model museum object in context

Sub and super-classes

Scope-notes

Appellations

Examples

Types

Properties (domain, range ... )

...
CIDOC-CRM

E53 Place
Subclass of: E1 CRM Entity

Scope note: This class comprises extents in space, in particular on the surface of the earth, in the pure sense of physics: independent from temporal phenomena and matter.

The instances of E53 Place are usually determined by reference to the position of “immobile” objects such as buildings, cities, mountains, rivers, or dedicated geodetic marks. A Place can be determined by combining a frame of reference and a location with respect to this frame. It may be identified by one or more instances of E44 Place Appellation.

It is sometimes argued that instances of E53 Place are best identified by global coordinates or absolute reference systems. However, relative references are often more relevant in the context of cultural documentation and tend to be more precise. In particular, we are often interested in position in relation to large, mobile objects, such as ships. For example, the Place at which Nelson died is known with reference to a large mobile object – H.M.S Victory. A resolution of this Place in terms of absolute coordinates would require knowledge of the movements of the vessel and the precise time of death, either of which may be revised, and the result would lack historical and cultural relevance.

Any object can serve as a frame of reference for E53 Place determination. The model foresees the notion of a "section" of an E19 Physical Object as a valid E53 Place determination.

Examples:
- the extent of the UK in the year 2003
- the position of the hallmark on the inside of my wedding ring
- the place referred to in the phrase: “Fish collected at three miles north of the confluence of the Arve and the Rhone”
- here -> <<

In First Order Logic:
\[ E53(x) \supset E1(x) \]

Properties:
- P87 is identified by (identifies): E44 Place Appellation
- P89 falls within (contains): E53 Place
- P121 overlaps with: E53 Place
- P122 borders with: E53 Place
- P157 is at rest relative to (provides reference space for): E18 Physical Thing
- P168 place is defined by (defines place): E94 Space Primitive
CIDOC-CRM

```
<rdfs:Class rdf:about="E53_Place">
  <rdfs:label xml:lang="it">Posto</rdfs:label>
  <rdfs:label xml:lang="fr">Place</rdfs:label>
  <rdfs:label xml:lang="en">Place</rdfs:label>
  ....
  <rdfs:comment xml:lang="en">This class comprises extents in space [...] place determination.</rdfs:comment>
  <rdfs:comment xml:lang="it"> Questa classe comprende estensioni spaziali [...] determinazione posto. </rdfs:comment>
  <rdfs:subClassOf rdf:resource="E1_Entity"/>
</rdfs:Class>
```
CIDOC-CRM
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DIGITAL COLLECTIONS at the BRITISH MUSEUM