Learning through doing: an online game for appropriating ontological modelling methodology

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S37 Connectivity: linking and interpreting the archaeological record
Challenge

- **High** potential of ontologies (CIDOC CRM & CRMarchaeo) to help integrate archaeological data.

- **BUT:** Uptake of ontologies and the CIDOC CRM, however, remains relatively low.

- **Why?** The learning curve to understanding and applying ontologies by archaeologists is currently steep.
Primary difficulties faced by new CRM learners

- Subject matter falls between disciplines
- Subject matter presented too theoretically for many
- Lack of enough qualified teachers
- Lack of learning materials & learner oriented tutorials
- Lack of examples

Critical « do or die » period
Solution: Learn through Doing

A card game version of the CRM ontology to teach basic ontology concepts and the ontology itself

- make subject matter interesting to new learners
- make subject matter simpler to appropriate
- provides mean to immediately interact with/apply the concepts in the ontology (removed from learning technical applications)
- show the application of the ontology through real examples
Simplifying the representation of CRM for learning

E2 Temporal Entity

Subclass of: E1 CRM Entity
Superclass of: E3 Condition State
E4 Period

Scope note: This class comprises all phenomena, such as the instances of E4 Periods, E5 Events and states, which happen over a limited extent in time. This extent in time must be contiguous, i.e., without gaps. In case the defining kinds of phenomena for an instance of E2 Temporal Entity cease to happen, and occur later again at another time, we regard that the former E2 Temporal Entity has ended and a new instance has come into existence. In more intuitive terms, the same event cannot happen twice.

In some contexts, these are also called perdurants. This class is disjoint from E77 Persistent Item. This is an abstract class and has no direct instances. E2 Temporal Entity is specialized into E4 Period, which applies to a particular geographic area (defined with a greater or lesser degree of precision), and E3 Condition State, which applies to instances of E18 Physical Thing.

Examples:
- Bronze Age (E4)
- the earthquake in Lisbon 1755 (E5)
- the Peterhof Palace near Saint Petersburg being in ruins from 1944 – 1946 (E3)

In First Order Logic:

E2(x) ⊨ E1(x)

Properties:

- P4 has time-span (is time-span of): E52 Time-Span
- P114 is equal in time to: E2 Temporal Entity
- P115 finishes (is finished by): E2 Temporal Entity
- P116 starts (is started by): E2 Temporal Entity
- P117 occurs during (includes): E2 Temporal Entity
- P118 overlaps in time with (is overlapped in time by): E2 Temporal Entity
- P119 meets in time with (is met in time by): E2 Temporal Entity
- P120 occurs before (occurs after): E2 Temporal Entity
- P173 starts before or at the end of (ends with or after the start of): E2 Temporal Entity
- P174 starts before (starts after the start of): E2 Temporal Entity
- P175 starts before or at the start of (starts with or after the start of): E2 Temporal Entity
- P176 starts before (starts after the start of): E2 Temporal Entity
- P182 ends before or at the start of (starts with or after the start of): E2 Temporal Entity
- P183 ends before or at the start of (starts after the start of): E2 Temporal Entity
- P184 ends before or at the end of (ends with or after the end of): E2 Temporal Entity
- P185 ends before or at the end of (ends after the end of): E2 Temporal Entity

1 CRM class = 1 card
CRM Game Elements: 3 Decks

Classes Deck

Relations Deck

Instances Deck
CIDOC CRM Class Cards Deck

Front

Back

Color code

- Temporal Entities
- Actors
- Physical things
- Conceptual things
- Appellation
- Types
- Places
CIDOC CRM Relation Cards Deck

Front

1. **P19**
   - was intended use of (was made for)

2. **P31**
   - has modified (was modified by)

3. **P122**
   - borders with

4. **P123**
   - resulted in (resulted from)

Back

Color code

- **Blue**: Temporal Entities
- **Pink**: Actors
- **Brown**: Physical things
- **Yellow**: Conceptual things
- **Gray**: Appellation
- **Green**: Types
- **Green**: Places
Case-Study: Instance Cards Deck
Initial Tests & Feedback

- tested in classroom/workshop environments
- positive feedback from learners and teachers
- was helpful to learners to appropriate concepts
- was motivating to learners to attempt to apply CRM
Initial Conclusions Drawbacks

- Still requires a knowledgeable teacher
- Card format very intuitive but # of cards problematic
- Physical manipulation instructive but needs much space
- Time to produce a new game
- Effectiveness dependent on guidance in scenario
New Research Direction: CRM Online Game

- Translate CRM Game concept to an online, single player game
- Retain the positive features of the physical game
- Address drawbacks
- Open ended platform

CIDOC-CRM Game Online

The CIDOC-CRM game is an educational tool designed to help interested data modellers and mappers become familiar with the CIDOC CRM ontology in an intuitive way through doing hands on activities applying the classes, concepts and methods proposed by the CIDOC CRM on real cases.
New Research Direction: CRM Online Game

How?

- **Unity** platform for designing interactions, because popular, easy to use, sleek

- use of **simple, reusable spreadsheets** for generating all content and replicability
New Research Direction: CRM Online Game

- address needs of asynchronous learners
- Introduce Teaching tools in game
- Many more examples
- Mini games = targeted learning activities
- Easier production of new versions of the game for different user groups
The Case-Study provides a Story and a Dataset

- The **case-study** provides a story and a dataset for some specific targeted audience.
- The **story** provides a modeling context for learning.
- The **dataset** provides instances of entities and properties to model.

### Select a Case Study!

- **Julia Morgan Game**
  - **Architecture**
  - This study provides instances to build basic knowledge in how to use CDM classes and instances.

- **Asineu Church**
  - **Cultural Heritage**
  - This study provides instances to build basic knowledge in how to use CDM classes and instances for digital cultural heritage.

- **Excavations at Marmoutier**
  - **Archaeology**
  - The archaeological case study of Marmoutier provides instances to build basic knowledge in how to use CDM classes and instances in archaeological contexts.

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### Julia Morgan Game

**Description**

Born(3) in San Francisco(2), Julia Morgan(1) (1872(4)-1957) grew up in Oakland(7) in a spacious Victorian house(8). Gifted in mathematics and encouraged in her studies by her mother(5), Morgan was influenced to become an architect by her mother’s cousin, Pierre Le Brun (8), who designed(9) an early skyscraper(77), the
• **Game** = a structured playing environment, designed to build understanding of some aspect of the ontology

<table>
<thead>
<tr>
<th>Game</th>
<th>Level</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limbo</td>
<td>1-6</td>
<td>This game introduces the basic concept of instance of classes and the major branches of the CIDOC CRM class hierarchy</td>
</tr>
</tbody>
</table>

• **Levels** = further division of game into targeted smaller learning steps

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<tbody>
<tr>
<td>Limbo</td>
<td>1:</td>
<td>Event, thing, or place</td>
</tr>
<tr>
<td>Limbo</td>
<td>2:</td>
<td>Temporal Entities</td>
</tr>
<tr>
<td>Limbo</td>
<td>3:</td>
<td>Idea, Object or person</td>
</tr>
</tbody>
</table>
**Limbo Game Level 2: Temporal Entities**

**What you need to know...**

CRM Temporal Entities allow you to talk about things that happen through time with ever more precision. E2 Temporal Entity, allows you to talk about an event about which the only thing known is when it occurred either in absolute or relative time. Real world example of temporal entity are lacking, because this level of ignorance is typically not recorded in an information system. The class is useful for querying all other classes though.

**The Classes to Learn**

**E4 Period**
- **Superclasses**: E2 Temporal Entity, E3 Beginning of Existence
- **Subclasses**: E5 Event
  
  *This class comprises sets of coherent phenomena or cultural manifestations occurring in time and space. It is the social or physical coherence of these phenomena that identify an E4 Period and

**E5 Event**
- **Superclasses**: E4 Period, E3 Beginning of Existence, E7 Activity
- **Subclasses**: E6 End of Existence
  
  *This class comprises changes of states in cultural, social or physical systems, regardless of scale, brought about by a series or group of coherent physical, cultural, technological or legal

**E7 Activity**
- **Superclasses**: E5 Event
- **Subclasses**: E8 Forming E9 Destruction
  
  *This class comprises actions intentionally carried out by instances of E9 Actor that result in changes of state in the cultural, social, or physical systems documented. This notion includes

**E63 Beginning of Existence**
- **Superclasses**: E5 Event
- **Subclasses**: E64 End of Existence
  
  *This class comprises events that bring into existence any E7 Persistent Item. It may be used for temporal reasoning about things (intellectual products, physical items, groups of people, living beings)

**E64 End of Existence**
- **Superclasses**: E5 Event
- **Subclasses**: E6 Destruction
  
  *This class comprises events that end the existence of any E7 Persistent Item. It may be used for temporal reasoning about things (physical items, groups of people, living beings)

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**Limbo Game**: a game to introduce the notion of class instances and the major branches of the ontology to the player; here, learning about temporal entities.
Examples of E4 in CRM manual:

- Jurassic
- European Bronze Age
- Italian Renaissance

- Thirty Years War
- Sturm und Drang
- Cubism
Demo...
Successes & Setbacks

- Makes the game independent from teacher
- # of cards unlimited
- No space limitation in virtual space
- CSV makes it fast to produce a new version of the game
- More structured learning scenarios, constant feedback for learner

- Problem to connect to triple store for live reasoning on instances
- No developer, hard to create fancier features/develop quickly
Future Work

Technical

• cleanup code
• replace csvs with a database to build story/game/level elements and a triple store to place instance elements

Content

• More story content through partnerships
• Address new audiences on their terms

Pedagogical

• add already planned games and conceive new games
• test effectiveness of the learning technique in controlled environments/circumstances
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