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End-user storytelling with a CIDOC CRM-based semantic wiki

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Abstract:
This paper presents the current state of an experiment intended to use the CIDOC CRM as a knowledge representation language. STEM freshers freely constitute groups of 2 to 4 members and choose a theme; groups have to model, structure, write and present a story within a web-hosted semantic wiki. The main part of the CIDOC CRM is used as an ontological core where students are hanging up classes and properties of the domain related to the story. The hypothesis is made that once the entry ticket has been paid, the CRM guides the end-user in a fairly natural manner for reading - and writing - the story. The intermediary assessment of the wikis allowed us to detect confusion between immaterial work and (physical) realisation of the work; and difficulty in having event-centred modelling. Final assessment results are satisfactory but may be improved. Some groups did not acquire modelling abilities - although this is a central issue in a semantic web course. Results also indicate that the scope of the course (semantic web) is somewhat too ambitious. This experience was performed in order to attract students to computer science studies but it did not produce the expected results. It did however succeed in arousing student interest, and it may contribute to the dissemination of ontologies and to making CIDOC CRM widespread.

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Introduction

This paper presents the current state of an experiment intended to use the CIDOC CRM as a knowledge representation language inside a semantic wiki. The wiki is the infrastructure supporting the collaborative editing of a story (a book, movie, TV serial, biography, video game, etc.). This experiment is performed within a Semantic Web course for STEM (Science, Technology, Engineering, and Mathematics) freshers. This course is classically composed of lectures and labs, although the main assessment is based on a piece of collaborative homework –monitored and assisted by the author on a weekly basis. Students freely form groups of 2 to 4 members and choose a theme; groups have to model, structure, write and present a story within a web-hosted semantic wiki. Expected readers are the students themselves, and their social network.
The CIDOC CRM is used as an ontological core where students are hanging up classes and properties of the domain related to the story. In addition to challenges related to team work and collaborative editing, difficulties arise as a result of the rigorousness necessary in structuring and producing knowledge. The hypothesis is made that the CIDOC CRM is providing a stable and extensible basis; and that, once the entry ticket has been paid, the CRM guides the end-user in a fairly natural manner for both writing and reading of the story.
Due to the widespread use of Wikipedia and the open-source software MediaWiki, the initial shape of the website is designed by students as a set of articles linked together with the use of categories as a means to classify articles according to certain criteria. The main extension provided by a semantic wiki such as Semantic MediaWiki (SMW) is the notion of typed links, which enable users to generate structured information with a well-defined semantics. This second step moves students towards a 'Web 2.0' site. Most elements of a semantic wiki are represented in a semantic web language such as RDF in a straight-forward manner, using an obvious mapping: normal article pages correspond to individuals, categories correspond to classes, and typed links correspond to properties. Thus, the meaning contained in the set of wiki pages is composed of text in natural language (informal part) and of semantic annotations (formal part). Search is no longer limited to matching keywords against wiki articles, but can be expressed in a structured manner, yielding precise answers.
This paper reports on two years of experimentation. Section 2 states the technical background and section 3, our work hypotheses. Section 4 presents what we expect of semantic wiki, the CIDOC CRM and its implementation with a semantic wiki. Section 5 depicts objectives and contents of the course. Section 6 reports on wikis assessment, and attempts to interpret quantitative and qualitative results in order to identify the failures of the course and plan possible improvements.

Background

This section introduces semantic web technologies, semantic wikis, and ontologies that make main technical ingredients of this experiment.

Semantic web technologies

The W3C consortium introduces the Semantic Web with: ‘In addition to the classic ‘Web of documents’ W3C is helping to build a technology stack to support a ‘Web of data,’ the sort of data you find in databases. The ultimate goal of the Web of data is to enable computers to do more useful work and to develop systems that can support trusted interactions over the network (W3C, 2010).‘ A first step towards the Semantic Web is to associate metadata to content (called resource in the W3C terminology).

The (Semantic) Web infrastructure relies primarily on its ability to identify and localize resources. It is accomplished through the use of URIs (Uniform Resource Identifier). A URI lets a user attribute a unique identifier to a (set of) resource(s), initially located on the Web (URL, Uniform Resource Locator) but now extended to ‘things’ that are not on the Web, such as documents, persons … All W3C languages are rooted from the notion of URI and are also capable of expression and exchange in an XML syntax.

Once resources and other ‘things’ (some authors call them non-information resources) are identified, the Resource Description Framework (RDF) and RDF Schema (RDFS) provide users with a better representation and exploitation of metadata. RDF models metadata as 3-tuples (triples) which assert that a resource (identified by its URI) has a property (identified by a URI) which has a value identified either by URI, or given literally. For instance the book *The Hobbit, or There and Back Again* identified by its isbn *978-0618002214* has the property *dc:creator* (identified in the Dublin Core schema) which has the value *John Ronald Reuel Tolkien*. Although RDF triples may use a syntactic representation in XML, the data model is closed to semantic network rather than tree- oriented. RDFS adds classes and properties to RDF. RDF and RDFS are property-centred and are not a kind of entity-relationship model. Properties (and sub-properties) shall be seen as a function eventually constrained from a domain (rdfs:domain, the set of all permitted inputs to this function) towards its image or range (rdfs:range, the set of all resulting outputs). RDFS schemas (themselves identified by URIs) can be associated with an application domain, such as the Dublin Core for metadata management or Calendar for meetings. (Laublet, Reynaud, & Charlet, 2002) sum up W3C technologies: ‘XML can be seen as the syntactic transport layer, RDF as a basic relational language. RDFS provides primitives for representing structures or ontological constructs’.

The next step will be the use of ontologies. Ontology denotes a certain level of consensus and shared meaning that is essential to the exploitation of knowledge and resources within a domain. The W3C proposition, OWL (Ontology Web Language) built on RDFS, yields descriptive logic with XML syntax. Class definitions are much more complex with the use of logical connectors (intersection, union, disjoint, etc.). Properties can be defined as symmetrical, transitive or with the existence of inverse properties. These descriptions can be used by a reasoner to infer new knowledge based, for instance, on the subsumption of concepts.

The observation (Laublet, Reynaud, & Charlet, 2002) of two complementary visions for the Semantic Web still seems topical. The first road emphasizes the use of complex tools relying on formal semantics and powerful inference mechanisms, with a high cost associated with the building and maintenance of knowledge. The second way placed more emphasis on semi-formal representations, relying mainly on the user for operational exploitation. Our approach is resolutely of the second type, and privileges the implementation of a disciplined editing process rather than the use of a sophisticated tool.

Semantic wikis

Wiki (quick in Hawaiian) was defined in 1995 by its inventor, Ward Cunningham, as 'the simplest online database that could possibly work.' In a wiki, users write simple text following a small number of conventions. The system creates the HTML files and the necessary links automatically, so it is exceptionally easy for anybody to edit Web pages (Louridas, 2006). A powerful mechanism provides comprehensive versioning and change control for their content. The wiki keeps all changes in a history file and everybody can check what has changed, who changed it, when, and eventually can revert to earlier versions of wiki pages (Louridas, 2006).

Semantic wikis let users add semantic information to the pages. Semantic MediaWiki ***(http://semantic-mediawiki.org)***, a free semantic extension for the free wiki engine MediaWiki ***(http://www.mediawiki.org)***, lets users add properties to pages and define typed links between pages. For instance, the book *The Hobbit, or There and Back Again*, better known by its abbreviated title *The Hobbit*, was published on *21 September 1937* and this value can be associated to *The Hobbit* with the attribute *dc:datePublished*; *The Hobbit* is also linked with the page related to its author, *J.R.R. Tolkien* and this link can be typed with the property *dc:creator*. Each time a page is updated, the wiki [re]generates RDF triples with the page URI (e.g. *The Hobbit* page) as subject, attribute (e.g. dc: *datePublished*) or typed link (e.g. *dc:creator*) as properties, literal (e.g. *21 September 1937*) or URI (e.g. *J.R.R. Tolkien* page) as values. Semantic Web annotations go beyond familiar textual annotations and are intended primarily for use by document creators. Annotation requires a disciplined editing process that can be supported through the use of templates. MediaWiki templates have immense value for normalizing and simplifying display in any wiki (once users understand the template syntax in general and particular). Semantic templates are a method of including the semantic annotations through MediaWiki templates. Users specify annotations without learning any new syntax, annotations are used consistently, i.e. users do not have to look for the right properties or categories when editing a page (ontoprise, 2009).

Semantic search allows users to write simple (or complex) queries (e.g. *Book dc:datePublished between 1930 and 1939*) and retrieve precise answers. Searches can use taxonomies, based on the categories of the wiki. Semantic MediaWiki provides a simple browsing interface that displays all the semantic properties of a page, as well as all the semantic links pointing to that page. By clicking on these links, the user can browse to another article. This provides users with a kind of navigation through semantic properties.

Ontologies

(Uren, et al., 2006) believe that Semantic Web technology matters for knowledge management (KM) because KM often centres on documents and the business processes that build on them. The Semantic Web proposes annotating document content using semantic information from domain ontologies. (Uren, et al., 2006) state that semantic annotation formally identifies concepts and relations between concepts in documents - which is, in our opinion, one of the shortest understandable definitions of ontology. Despite the fact that ontologies differ fundamentally from conceptual models employed in databases, introducing ontologies to end users is much easier through an entity-relationship approach. Moreover, MediaWiki (and Wikipedia) popularized the presentation (and the editing) of individuals (e.g. a book, an actor …) through templates that are perceived (at least informally) as a conceptual model of individuals.

Ontologies are related to an application domain and the experiment presented in this paper is about storytelling, hence related to events, people, things, place, time …

Work hypotheses

This experiment has been conducted in a bid to enhance the opinion that STEM freshers may have about computing in order to attract them towards computer science studies. We reduced the 'universe of possible' by operating few choices that are presented in this section.

Team work

Team work is a technique often cited as a means of retaining students by creating programmes to keep them interested in computer science (Doerschuk, Liu, & Mann, 2008). In an effort to combat the high drop-out rate of first-year students in computing disciplines, the department of Computer Science at Illinois has instituted several programs designed to foster a sense of community among freshers, undergraduates, graduates, professors, and staff (Talton, Peterson, Kamin, Israel, & Al-Muhtadi, 2006). Increasing participation of women and minorities is also a concern for Computer Science departments. In particular, there are few STEM disciplines other than Computer Science in which women are worse represented. The content of the computing curriculum, especially introductory courses, is believed to contribute to the under-representation of women in IT. The National Centre for Women & Information Technology (NCWIT) suggests that women are more interested in using computing as a tool for accomplishing a goal than they are in the workings of the machine (NCWIT, 2007). The first hypothesis we made is that a (semantic) wiki is an environment that is both easy-to-use and suitable for collaborative work, and more attractive than programming or database courses.

Semantic web (Web 2.0) environments

The Semantic Web (Berners-Lee, Handler, & Lassila, 2001) relies on rich metadata, also called semantic annotations, offering explicit semantic descriptions of Web resources and built on domain ontologies. A 'semantic web application' is any software application that depends on Semantic Web technology for its execution. Today end-users are familiar with semantic web applications and this domain was considered a good starting point to awaken their interest. Within (social) semantic Web environments, beginners mimic experimented users' behaviour and habits in order to learn good practices. We supposed that first steps in Knowledge Management should be guided by mimicking working usages and performed in a familiar environment. Widespread use of Wikipedia and free diffusion of MediaWiki seems to us to provide a good starting point. Semantic MediaWiki (SMW) powers the MediaWiki sites with the ability to create semantic annotations. Then we choose MediaWiki + SMW as the environment, thus providing as much familiarity as possible to end-users.

Ontologies

One of the main concerns of semantic web application end-users is information retrieval (IR). According to (Corby, Dieng-Kuntz, & Faron-Zucker, 2004), IR (on the

Semantic Web) can be addressed according to three different points of view: developers of ontologies focusing on the representation of domain knowledge, annotators of (web) resources creating semantic annotations based on ontologies, and end-users asking ontology-based queries for searching (web) resources. These three aspects are also relevant for our storytellers and emphasize the need for domain ontology for storytellers. Among available high-level ontologies such as OpenCyc ***(http://www.opencyc.org/)*** and WordNet ***(http://wordnet.princeton.edu/)***, we selected the CIDOC CRM (Conceptual Reference Model) promoted by the ICOM CIDOC (Comité International pour la DOCumentation). The hypothesis is made that the CIDOC CRM is providing a stable and extensible ontological core; and that, once the entry ticket has been paid, the CRM guides the end-user in a quite natural manner for writing - and reading - the story. The CIDOC CRM has been published as the ISO standard 21127:2006 (ISO, 2006).

Summary

Summing up the choices we made (and benefits expected), we can say that - 1 - we selected a semantic wiki from among a range of Knowledge Management Systems (Maedche, Motik, Stojanovic, Studer, & Volz, 2003) - mainly for its ease of learning and use. Then, - 2 - we picked up MediaWiki and its semantic extension SMW, Semantic MediaWiki (Krötzsch, Vrandecic, Völkel, Haller, & Studer, 2007), mainly because the familiarity due to the widespread use of Wikipedia and the quantity of systems using MediaWiki (and SMW); Finally - 3- , among suitable ontologies, we chose the CIDOC CRM (Crofts, Doerr, Gill, Stead, & Stiff, 2010), mainly for its broad scope, free diffusion and associated resources such as documentation and presentation. We apologize for the fact that none of these choices has been dictated by epistemological reasons; we have preferred to stick to the 'Keep It Simple' principle, which obviously does reduce the scientific scope of this paper.

Semantic wikis and CIDOC CRM

From wikis to semantic wikis

A wiki is basically a set of pages interconnected with links. Neither the page content nor the links have a formally-defined meaning, but there is an underlying semantic to the statements syntax used in MediaWiki pages, especially in such a site as Wikipedia. One of the main indications is given according to the categories a page belongs to. Thus, a domain-familiar user is expecting to find some values related to properties that may be used for these categories. In a semantic wiki, these values (and the properties that the values are instantiating) are formally defined by the end-user, parsed when the page is published, processed and stored as RDF triples, and retrieved during semantic searches.

It is the choice of a common schema (ontology) that allows a user community to share meaning, and in the next section we will discuss the choice to use the CIDOC Conceptual Reference Model. The rest of this section will present an overview of the annotating process, using sometimes the Dublin Core as properties ontology (Dublin Core Metadata Initiative, 1999).

Figure 1. Excerpt from the English Wikipedia page http://en.wikipedia.org/wiki/The_Hobbit

The excerpt in Figure 1 is about the book *The Hobbit, or There and Back Again*. On the left, the content of this Wikipedia article is structured in several sections: introduction, characters, plot, etc. Each section contains formatted text including hyperlinks towards other articles of the English Wikipedia. This article belongs to a set of categories: 1937 novels, British novels, Middle-Earth books, The Hobbit, Dragons in fiction. Other articles about books may or may not follow the same structure. The editorial control is stronger when the article belongs to a portal (e.g. ***http://en.wikipedia.org/wiki/Portal:Middle-earth***).

In the middle of Figure 1, a so called Infobox presents structured information about this book: book attributes such as language, genre, publication date, etc. and links towards other Wikipedia pages such as author, publisher and so on. This Infobox is using a MediaWiki template (in this case the 'Infobox Book' template) that writers may (or may not) use when writing articles about books; readers are familiar with the Infobox display in general and may also know this template. Although the underlying semantics of a template such as 'Infobox Book' is generally understood and shared by the Wikipedia community, this agreement is tacit, not formalized (for instance, nothing is forbidding using this template for something that is not a book) and cannot be used by machines.

On the right of Figure 1, the MediaWiki code corresponding to the left part is displayed.

A 'Semantic Wikipedia' version of this article will use SMW features for textual and structured contents. Semantics of any value or of any hyperlink within the textual part may be added through a straightforward syntax, using two kinds of SMW properties (and RDF features as well): data type properties and page (object) properties. For instance, *21 September 1937* is a value of the Date property *datePublished* and the link towards *J. R. R. Tolkien* is an instance of the Page property *creator*. 'Semantizing' this textual part requires an annotator to carefully read and annotate the text with suitable properties of the domain ontology. This is a tedious task that can be simplified by the use of semantic templates instead of the MediaWiki template. Each of the fields used in the 'Infobox Book' template can be associated with a semantic property. A field used to input values is associated with a data type property, e.g. *language*, *genre*, etc. A field used to input hyperlinks is associated with a page (object) property, e.g. *author*, *publisher*. Semantic templates can be strongly linked with categories – for example, the creation of an instance of 'Book' category will automatically use the 'Book' semantic template. As mentioned in the Ontologies subsection, developers of ontologies will create and update templates, pages annotators will use templates for creating semantic annotations, and end-users will understand template structure while editing queries for searching resources.

Let's take a look at the MediaWiki code corresponding to the display of the textual part. It begins with:

```
'''''The Hobbit, or There and Back Again''''', better
known by its abbreviated title '''''The Hobbit''''', is a
[[Juvenile fantasy|fantasy novel]] and [[children's book]]
by [[J. R. R. Tolkien]]. It was published on 21 September
1937 to wide critical acclaim, being nominated for the
[[Carnegie Medal]] and awarded a prize from the ''[[New
York Herald Tribune]]'' for best juvenile fiction. The
book remains popular and is recognized as a classic in
children's literature.
```

Typesetting instruction such as bold or italics are using straightforward code, or are included within mark-ups. Links are double-bracketed with the displayed link name preceding the link with a pipe sign (|). As mentioned above, the annotator has to decide values requiring semantic 'tagging' such as *21 September 1937*, and then s/he has to double-bracket the value, preceding it with the correct data type property (e.g. *datePublished*). Links are already emphasized within double brackets. Some Wikipedia links are used to relate individuals such as a book and its authors; and only the required object property (e.g. *creator*) has to be inserted in front of the link. Other links may be used to highlight a word and give access to its meaning. In this case, the relationship is related to the highlighted word rather than the page itself and no semantic tagging is required.

The left of Figure 2 presents the display of a semantic version of the excerpt in Figure 1. Semantic annotations appear at the end of the page in the Factbox. The Semantic MediaWiki code is displayed on the right of Figure 2.

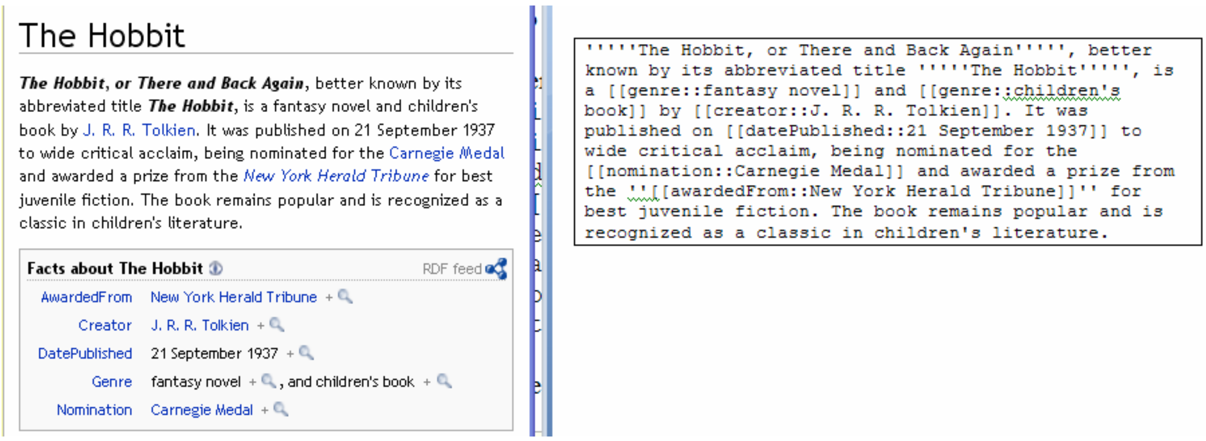

Figure 2. Semantic version of Figure 1 excerpt

The CIDOC CRM

Blogs or social sites such as Flickr use tags to relate user-defined meaning to site contents. Users tend to mimic others, reusing existing tags either to mark contents or to search along tags, and the tag cloud may reach a state called a 'folksonomy'. The same situation occurs in Wikipedia, where the category system is supposed to converge towards a taxonomy. Applied to a semantic wiki, this process should lead to the development of an ontology - a set of concepts (represented with classes) and a set of relationships between concepts (represented with properties). The experience reported in this paper was initially supposed to let end-users build their own ontology, related to the type of story they will tell, but last year, most teams suffered 'blank page' syndrome and failed to start. Hence, this year we provided users with an existing ontology extracted from the CIDOC Conceptual Reference Model (Crofts, Doerr, Gill, Stead, & Stiff, 2010).

E5 Event

Subclass of: E4 Period

Superclass of: E7 Activity
E63 Beginning of Existence
E64 End of Existence

Scope note: 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 phenomena. Such changes of state will affect instances of E77 Persistent Item or its subclasses.

The distinction between an E5 Event and an E4 Period is partly a question of the scale of observation. Viewed at a coarse level of detail, an E5 Event is an 'instantaneous' change of state. At a fine level, the E5 Event can be analysed into its component phenomena within a space and time frame, and as such can be seen as an E4 Period. The reverse is not necessarily the case: not all instances of E4 Period give rise to a noteworthy change of state.

Examples:

- the birth of Cleopatra (E67)
- the destruction of Lisbon by earthquake in 1755 (E6)
- World War II (E7)
- the Battle of Stalingrad (E7)
- the Yalta Conference (E7)
- my birthday celebration 28-6-1995 (E7)
- the falling of a tile from my roof last Sunday
- the CIDOC Conference 2003 (E7)

Properties:

P11 **had participant (participated in):** E39 **Actor**
P12 **occurred in the presence of (was present at):** E77 **Persistent Item**

Figure 3. Class definition for E5 Event.

Back in 1996, the CIDOC Committee of the International Council of Museums (ICOM) set up a working group aimed at achieving semantic interoperability for museum data. The resulting CIDOC Conceptual Reference Model (CRM) is intended to serve as a

standard data structure for all museums. In (Doerr, 2001), it is reported that the working group had evidence for a set of basic classes such as: Temporal Entities, Actors, Physical Objects, Conceptual Objects, Place, and Time, that was similar to Ranganathan's Fundamental Categories. Then, in the practical work, the CRM has been created discussing logical groups of properties that have to do with notions of participation, part-hood and structure, location, assessment and identification, purpose, motivation, use etc.
The application of this methodology has put Temporal Entities - and with it, events - in a central place. (Doerr & Kritsotaki, 2006) outline the importance of event-centric documentation for structuring cultural metadata and historical context. It should be noted that the CRM is also property-centred: classes are required to be either **domain** (the class for which the property is defined) or **range** (the class to which the property points or that provides the values for the property) of some property.
Although the CIDOC CRM is property-centred, the widespread use of entity-relationship models leads users to read entities (classes) description first. An example of class definition, extracted from the Definition of the CIDOC CRM (Crofts, Doerr, Gill, Stead, & Stiff, 2010) related to the E5 Event class is presented in Figure 3.

P11 had participant (participated in)

Domain: E5 Event
Range: E39 Actor
Subproperty of: E5 Event. P12 occurred in the presence of (was present at): E77 Persistent Item

Superproperty of: E7 Activity. P14 carried out by (performed): E39 Actor
E67 Birth. P96 by mother (gave birth): E21 Person
E68 Dissolution. P99 dissolved (was dissolved by): E74 Group
E85 Joining.P143 joined (was joined by): E39 Actor
E85 Joining.P144 joined with (gained member by): E74 Group
E86 Leaving.P145 separated (left by):E39 Actor
E86 Leaving.P146 separated from (lost member by):E74 Group
Quantification: many to many (0,n:0,n)

Scope note: This property describes the active or passive participation of instances of E39 Actors in an E5 Event.

It connects the life-line of the related E39 Actor with the E53 Place and E50 Date of the event. The property implies that the Actor was involved in the event but does not imply any causal relationship. The subject of a portrait can be said to have participated in the creation of the portrait.

Examples:

- Napoleon (E21) *participated in* The Battle of Waterloo (E7)

Or

- Maria (E21) *participated in* Photographing of Maria (E7)

Figure 4. Property definition for P11 had participant (participated in).

CRM properties have double names: one for each direction of reading. For instance, the participation relationship can be represented with the property P11. Its definition indicates that an instance of E5 Event (an event) can be linked to a participating instance of E39 Actor (an actor) with property P11 had participant; and conversely, an

actor can be linked to an event that s/he participated in with property P11B participated in (B stands for Backwards).
The CRM definition also provides users with properties descriptions. An example of property definition, extracted from the same document (Crofts, Doerr, Gill, Stead, & Stiff, 2010) related to the P11 had participant (participated in) property is presented in Figure 4.
The complete CRM comprises 89 classes and 138 properties, and was judged too big for our purposes. We are using a slightly extended version of the ‘reduced CRM-compatible form’ found in the Definition of the CIDOC Conceptual Reference Model (Crofts, Doerr, Gill, Stead, & Stiff, 2010). We added a dozen classes (and most associated domain properties), mainly in order to add E21 Person and E40 Legal Body, E31 Document, E38 Image, and to achieve a kind of ‘ontological closure’.

A CRM-based semantic wiki

Let’s take a look at how semantic wiki and CIDOC CRM fit together.
Each CRM class corresponds to a wiki category, e.g. E5 Event. Each individual (e.g. the Battle of Five Armies in The Hobbit) is a page belonging to the E5 Event category (as well as to other categories). Each category also holds the properties for which this category is the domain. Conversely, a backward property belongs to the category for which the category is the range. Thus *P11 had participant* appears as a member of the E5 Event category and *P11B participated in* as a member of the E39 Actor category.
The Battle of Five Armies, depicted in The Hobbit, was fought between the Goblins and the Wargs against the Men of the Long Lake, the Elves of Mirkwood, and the Dwarves on and near the Lonely Mountain. The Battle includes several parts: the siege of Thorin dwarves’ company by Men and Elves; the merge of Thorin’s company with Dain’s dwarves army; the theft by Bilbo Baggins of the Arkenstone, a dwarf heirloom; the union against the Goblins riding on the Wargs backs; the arrival of a large force of Eagles and of Beorn changed into a huge bear. The subject of the battle was the sharing of the dragon Smaug treasure, stolen from men and ancient dwarves' treasure.
According to (Doerr & Kritsotaki, 2006), CRM uses four fundamental principles:

1. Participation in an event
2. Part-whole relation
3. Reference (e.g. subject)
4. Classification

A semantic annotator will classify the Battle of Five Armies as an E5 Event (or an E7 Activity) as well as the sharing of Smaug’s treasure. The battle *P17 was motivated by* the treasure sharing. The battle *P117B includes* several parts (linked to the battle with the inverse property *P117 occurs during*). Each part is either an E5 Event with *P11 had participant* actors or an E7 activity with *P14 carried out by* actors.
The result of these annotations is displayed in Figure 5. Our implementation is in French, but classes and properties begin with the same codes as in English.

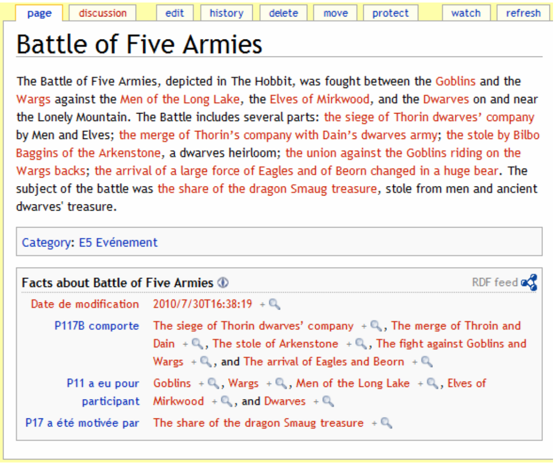

Figure 5. Semantic version of the Battle of Five Armies

Temporal entities (especially Events and subclasses) are intended to be a kind of key ring that holds different entities together. Most of these entities are persistent entities (sometimes called endurants). These are a few properties allowing two persistent entities to be linked together; thus usually requires using an Event - that is a temporal entity by nature. For instance, linking a ‘thing’ such as the book ‘The Hobbit’ with its creator requires creating the Event ‘The writing of The Hobbit’. The important task of the annotator is to carefully choose the class of this temporal entity, related to the nature of persistent entities that are tight with this ‘key ring’, e.g. an E65 Creation for the creation of conceptual objects, E12 Production for the creation of physical man-made things, E67 Birth for the birth of a human being, etc. Once the nature of the temporal entity has been chosen, precise properties such as *P96B gave birth* or *P97B was father to*, can be used to relate persistent entities together. More general temporal entities such as E63 Beginning of existence and E64 End of existence may be used for temporal reasoning about ‘things’.

A reader may be not interested to follow a path through these temporal events to know the relationship between persistent entities. For instance, a reader should like to go from ‘The Hobbit’ to its creator ‘J. R. R. Tolkien’ and may not be interested in the circumstances of its creation. So-called shortcuts can be used to ease the reading. A shortcut has a syntactic aspect, such as creator, intended to carry a meaning that is easy to understand; and a semantic aspect intended to provide the whole path for this shortcut is simplifying, such as P94B was created by → E65 Creation → P14 performed by. Hence using the assertion ‘The Hobbit’creator ‘J. R. R. Tolkien’ should be expanded in the instantiation of an E65 Creation and two assertions ‘The Hobbit’ P94B was created by ‘an intermediary E65 Creation’, ‘an intermediary E65 Creation’ *P14 performed by* ‘J. R. R. Tolkien’. Shortcuts may also be used to avoid the creation of instances bearing an obvious meaning in their name, such as Place or Time appellation. For instance, to relate the writing of The Hobbit with its creation date 21 September 1937, it requires having an instance of E52 Time-span class in order to use the property *P4 has time-span (is time span of)*. A shortcut to this latter property can be defined with the range Date (a primitive data type) instead of E52 Time-span. Simplicity and clarity may be achieved but we may lose certain reasoning features related to the properties of the ‘short-cut’ class.

Objectives and contents of the course

This course has been run four times over two years: twice in a Masters of Information Technology; and two times to 'fresher' students during the STEM Bachelor first year (STEM: science, technology, engineering, and mathematics). For the second edition of the course, we considerably increased the number of hours whilst significantly shrinking the content. The current version has 16 hours of lessons (half of which are spent on exercises); and 12 hours of labs. Tutoring via e-mail, and tutor intervention on student wikis are given on demand, without any limitation.
Appraisal of the course's first edition on the Masters leads us to hide the quagmire of Web 2.0 technologies as much as possible. Appraisal of the course's first edition to fresher students leads us to impose a CIDOC CRM reduced version as an ontological core, supporting knowledge representation modelling with an Entity-Relationship approach rather a semantic network approach.

Content of the current course

The course addresses the following topics:

- Entity-relationship (ER) modelling (6 hours):
  - ER modelling basics: entity, binary relationship, attributes;
  - Extended ER modelling: multiplicity, specialization, generalization.
- Technical presentation of MediaWiki software (3 hours)
- The CIDOC Conceptual Reference Model (10 hours):
  - Objectives, scope and terminology
  - Implementation of the CIDOC CRM in Semantic MediaWiki
  - How to use Temporal Entities
  - How to use Persistent Entities
- Story analysis with the CIDOC CRM (3 hours):
  - Documentation of structure relationships and their application in the CRM
  - Part-whole relationships: theory, examples and application
- Semantic searches: definition and usage (2 hours)
- Blank examination and correction (2 hours)
- Extra-lecture : Introduction to FRBRoo (2 hours)

Measurements of the current edition for freshers are both quantitative (thanks to wiki statistics) and qualitative (based on an assessment of level achievement for each wiki). After classification of course objectives, the rest of this paper is an attempt to interpret these quantitative and qualitative results in order to identify where the course is failing, and plan possible improvements.

A classification of objectives and difficulties

Course objectives can be classified at 4 levels. There is nothing scientific in the proposed classification, and it would probably be worthwhile re-examining this classification in the light of Bloom's taxonomy (Bloom & Krathwohl, 1956). However, although this classification was not made prior to the course it may be yet used to rework the course. This classification was established after the course in order to evaluate what has been understood and put in application. Regarding this point of view, this classification is much closer to the concept of 'capability level' as found in the ISO 15504 standard or the CMMI (Capability Maturity Model Integration, ***http://www.sei.cmu.edu/cmmi)***. The 15504 standard has a capability dimension, based upon a measurement framework comprising six process capability levels and their

associated process attributes (ISO, 2004) [Part 2, p. v]. Within the 15504, the extent of achievement of a process attribute is measured using an ordinal scale of measurement (ISO, 2004). We use the same scale of measurement of an objective regarding its application in the semantic wiki:
N Not achieved - There is little or no evidence of achievement of the defined objective in the assessed semantic wiki.
P Partially achieved - There is some evidence of an approach to, and some achievement of, the defined objective in the assessed semantic wiki. Some aspects of achievement of the objective may be unpredictable.
L Largely achieved - There is evidence of a systematic approach to, and significant achievement of, the defined objective in the assessed semantic wiki. Some weakness related to this objective may exist in the assessed semantic wiki.
F Fully achieved - There is evidence of a complete and systematic approach to, and full achievement of, the defined objective in the assessed semantic wiki. No significant weaknesses related to this objective exist in the assessed semantic wiki.
The ordinal points defined above shall be understood in terms of a percentage scale representing extent of achievement: **N** 0 to 15 % achievement, **P** > 15 % to 50 % achievement, **L** > 50 % to 85% achievement, **F** > 85 % to 100 % achievement.
This kind of measurement is not far from a competency assessment model that usually defines several levels of performance such as in (Bodner, 1999): 4. Not meeting requirements, 3. Partially meeting requirements, 2. Meeting requirements, 1. Consistently exceeding requirements.
Global and detailed objectives of each level are presented in the next section.

Level 1: Reproduction

At this level, the student is able to reproduce constructs from the wiki or from other wikis: pages, property selection and values assignment, file uploading, straightforward typesetting. S/he is able to enrich wiki data (content) but rarely its structure. Objectives are:

1. To understand the basic principles and syntax of MediaWiki and SMW
2. To understand the difference between category (class) and page (instance)
3. To understand the difference between attribute and relationship

Level 2: Customization

At this level, the student is able to create new constructs: categories, properties, templates. S/he knows how to update wiki presentation with customizing menus, wiki skin, etc. S/he is able to enrich wiki content and structure as well. Objectives are:

1. To understand the impact of a property quantification on user interfaces and wiki structures
2. To understand what the domain is, as well as the range of a property and consequences on use
3. To define and implement semantic searches

Level 3: Transformation

At this level, the student is able to evolve the wiki structure, by, for example, moving a category in the hierarchy, modifying property semantics or a template. To borrow an analogy from house building, at the previous level we were going ahead with interior decoration, while at the transformation level, we operate on the shell. S/he is faced with 'real' modelling problems, in which s/he must take decisions and apply heuristics. S/he is able to model the story domain with the CIDOC CRM and to implement it in a semantic wiki. Objectives are:

5. To understand the implementation of an n-ary relationship with binary relationship
6. To understand what event-centred modelling is
7. To define and implement inverse attributes (especially through semantic searches)

Level 4: Reflection

At this level, the student is able to reason within the different meta-levels and make the difference (somewhat intuitively) between knowledge abstraction levels and the technical implementation of a semantic wiki. S/he perceives the limits of implementing domain ontology inside a semantic wiki, reaching a true capability level on the Semantic Web. Objectives are:

1. To understand the ontological square.
2. To understand the problematic of 'property of property' and its implementation.
3. To understand interoperability issues as multilingualism.

Nota Bene: The Ontological Square is a four-categorical scheme that is obtained by crossing two formal distinctions […] - that between types (or universals) and tokens (or particulars) on the one hand, and that between characters (or features) and their bearers (or substrates) on the other hand (Schneider, 2008).

Wikis assessment

Intermediary appraisal and first improvements

An appraisal was carried out one month before the course deadline.
In terms of qualitative appraisal, using the levels and objectives presented in the previous section, 18 semantic wikis (for 36 active students) were assessed as follows:

- 1 wiki is in a state of neglect
- 1 wiki neither largely nor fully attains level 1
- 6 wikis largely or fully attain level 1, but not level 2
- 5 wikis largely or fully attain level 2, but not level 3;
- 5 wikis largely or fully attain level 3, but not level 4;

We found these assessment results fairly satisfactory, but we also felt that an improvement margin exists.
Wikis assessment allowed us to detect two main problems:

1. Confusion between immaterial work (corresponding to the concept of F2 Expression in FRBRoo) and (physical) realisation of the work (corresponding to concepts of F4 Manifestation Singleton and F3 Manifestation Product Type in FRBRoo).
2. A difficulty (related to the domain subject in some wikis, e.g. video games) in having event-centred modelling (instead, they used modelling with a persistent entity-centred point of view).

Thanks to a tutoring program intended to help freshers succeed with first-year study, we were able to add an extra-lecture and some tutoring labs.
The Functional Requirements for Bibliographic Records (FRBR) is a conceptual model of the bibliographic universe, describing the entities in that universe, their attributes, and relationships among the entities. The FRBR model was originally designed as an entity-relationship model by the International Federation of Library Associations and Institutions (IFLA); FRBR was first published in 1997, last amended and corrected through February 2009 (IFLA, 2009). The idea that both the library and museum communities might benefit from harmonising the two models led to the formation in 2003 of the International Working Group on FRBR/CIDOC CRM Harmonisation, which brings together representatives from both communities with the common goals of expressing the IFLA FRBR model the CIDOC CRM, and aligning (possibly even merging) the two object-oriented models thus obtained (Bekiari, Doerr, & Le Boeuf, 2009). The final model is called $FRBR_{OO}$.
In order to resolve the number one problem, we added an extra lecture, introducing a simplified view of $FRBR_{OO}$, and we gave strong directives that wikis should be updated in order to differentiate between, on the one hand, Work and Expression (abstract intellectual or artistic creation), and on the other, Manifestation and Item (physical embodiments of Work and Expression).
Since most wikis did already create a Work class featuring mixed aspects of Work, Expression and Manifestation, it was not easy to bring out a solution, and we adopted the compromise of asking students to create a new Work/Expression class to hold identifiable immaterial objects which cannot exist without a physical carrier, yet which do not depend on a specific physical carrier, and are capable of existing on one or more carriers simultaneously (Bekiari, Doerr, & Le Boeuf, 2009). The existing Work class was generally used as a Manifestation class (holding material aspects of the Work) and was acting either as the $FRBR_{OO}$ F4 Manifestation Singleton (a unique, physique object) or the $FRBR_{OO}$ F3 Manifestation Product Type (a publication, i.e., an abstract notion recognisable only through its physical exemplars).
Unfortunately, we noted during the final appraisal that these recommendations were put into practice only in 3 wikis (out of 17), and moreover, that they were only superficially understood. We plan to introduce the differentiation between Work/Expression and Manifestation/Item very early on in the next edition, to incorporate new classes into our customized CIDOC CRM and probably to hide the $FRBR_{OO}$ model.

Regarding the number two problem, we did not find a universal solution suitable to all kinds of stories: artists' group or single artist, film, TV series, video games, and cartoons. It therefore requires individual coaching, and dedicated directives have been given to students in order to put back wikis on the rails. Some wikis took a Wikipedia-like flavour, with most 'encyclopaedic' articles on persistent entities. There were few (or no) events, so that these wikis were lacking a thread for reading, and so were not pleasant to browse. When the theme had a strong plot, it was not difficult to guide students towards emphasizing the plot. They created main plot events, linked the participation of persistent entities to events, and introduced sequence and part-hood relationships between events. The wiki was much more attractive to read and generally reached the upper assessment level. Some wikis were 'encyclopaedic' by nature - such as video games or songs by a particular band, and the only solution we found was asking students to add a history to their wiki: the history of setting up the video game or the history of the band, for instance. This is a somewhat artificial solution, but it allowed students to understand what an event-oriented model is (which was the teacher's objective) and to reach the upper assessment level (which was the students' objective!).

Final assessment

Final appraisal was made at the end of May 2010. It was quantitative (related to wiki statistics) and qualitative (related to the level reached). We also attempted to see how far both problems above were (partially or totally) solved.

Quantitative assessment

Quantitative facts are given in table 1.
Regarding the mark (column 2), french work is always marked out of 20. The pass mark is 10. 12 denotes satisfactory work, 14 good work, 16 very good work and 18 excellent work.
URLs of wikis are given in column 1 but unfortunately for English readers, wikis are written in French.

Columns meaning is: 2 - Mark awarded; 3 – Actual number of students in the group; 4 - Percentage of female students in the group; 5 - Number of pages created; 6 - Number of classes added to the CRM core; 7 - Number of templates created; 8 - Number of valued properties; 9 - Number of used properties (CRM and domain-specific); 10 - Number of uploaded files; 11 - Number of wiki visits.

Site URL	Mark	Stu-dents	Wo-men %	Pa-ges	Cla-sses	Tem-pla-tes	Val-ues	Pro-per-ties	Up-loads	Vi-sits
~~*lesfrerescoen.referata.com*~~	~~*8*~~	~~*1*~~	~~*0%*~~	~~*5*~~	~~*0*~~	~~*1*~~	~~*3*~~	~~*1*~~	~~*0*~~	~~*55*~~
lesroismaudits.referata.com	*10*	*1*	*0%*	*0*	*0*	*1*	*26*	*1*	*0*	*127*
ncis.referata.com	13	*3*	33%	54	5	3	315	39	6	1264
oasis.referata.com	*13*	*1*	*0%*	*98*	*5*	*6*	*661*	*60*	*28*	*1524*
stargatesg-1.referata.com	13	2	0%	38	6	3	24	25	27	1554
warcraft3.referata.com	*13*	*1*	*0%*	*146*	*15*	*2*	*548*	*42*	*107*	*2568*
alien2.referata.com	14	3	33%	32	4	4	187	21	9	1603
lol.referata.com	14	3	100%	34	3	4	204	21	19	1428
skins.referata.com	14	2	50%	52	4	2	291	27	*26*	*1409*
stargatesatlantis.referata.com	14	2	0%	145	7	7	588	28	17	1266
masseffect.referata.com	15	2	0%	56	4	2	462	23	*41*	*1800*
starwars.referata.com	15	2	0%	49	6	5	277	24	16	1267
tintin.referata.com	15	4	100%	41	7	7	166	33	19	2100
charlieetlachocolaterie.referata.com	16	3	67%	69	8	13	618	37	25	2773
clamp.referata.com	16	2	100%	64	7	6	742	48	98	2600
finalfantasy13.referata.com	*16*	*1*	*0%*	*68*	*7*	*7*	*441*	*21*	*53*	*2795*
lost.referata.com	*16*	*1*	*0%*	*63*	*8*	*8*	*760*	*29*	*53*	*2782*
michaeljackson.referata.com	16	2	0%	55	7	7	694	62	41	1878

Table 1. Quantitative statistics

One wiki was abandoned; its data is crossed out. Data referring to those groups which were reduced to a single student (either from the outset or during the course) is presented in italics.

The number of visits – last column – denotes the students' activity. At the time of appraisal, it may include some 'real' visitors but most visits were performed by the contributing students. It is therefore no surprise to find that the final mark is roughly proportional to the number of visits.
The number of created pages – Column 5 – is also generally related to students' activity. However, three wikis (*oasis*, *warcraft3*, stargatesatlantis) have a large number of pages with a 'medium' mark. All groups adopted a copy-paste attitude: students imported a lot of pages from existing sites (generally from Wikipedia) and neglected the semantic counterpart required to turn these imported pages into semantic pages. They probably adopted a strategy of 'the more the better'. Although we regularly issued strong warnings to students that they were not putting in enough work, two of them resisted, continuing to fill their wiki with a lot of imported content but very few semantics. We supposed that they were unable to recognize that they had gone the wrong way and that they were unable to abandon the (useless) effort they had made.
The number of classes added to the CRM core – Column 6 – and corresponding templates – Column 7 – provide us with a good indication of how students understood what ontology is. Lectures and lab examples were always using CRM classes in order to facilitate CRM learning. A few classes were identified as missing – such as Film, Book, Actors, and Characters – and almost all groups added these missing classes to the CRM core of their wiki. Only a third of student groups took this problem further, specializing the CRM core to their domain, and thus taking on the role of ontology developers.
The number of semantic values – Column 8 – and properties used (belonging to the CRM core or added by students) – Column 9 – indicate that students were able (or not) to work as semantic annotators. Results are highly contrasted: a high number of annotations generally indicates a 'good' semantic wiki (for instance, the three wikis mentioned above failed to annotate imported contents). The wiki about two comic-strip albums 'Destination Moon' and 'Explorers on the Moon' (The Adventures of Tintin – very popular in France) is an example of a minimal but satisfactory semantic annotation activity. The four young women in this group (all of whom wish to become maths teachers) used templates to rationalize the semantic annotation activity. They added the required classes to the CRM core (Cartoon, Artist, Character, etc.) and developed templates for these new classes or existing CRM classes (such as Event or Place). Then, they analyzed the cartoon story and instantiated individuals of required classes with the corresponding templates. They imported very few materials (except images) from external sources, so that they have little text within pages and fewer semantic annotations than other wikis – but the semantic quality remains high.

At the time of intermediary appraisal, all best marks except one were attributed to groups in which students were either all female, or in which female students were in the majority (this is no longer true in the final appraisal). We delivered the intermediary marks to students in order to motivate them to improve their work, particularly in terms of the two main problems reported in the 'Intermediary appraisal and first improvements' section. Women's groups (regardless of their STEM majors) conscientiously did what the teacher asked, attaining the upper level and thus staying in the top position. Three 2-man groups (majoring in Computer Science) realized that they

had not produced what was required and started to work. They ended up with a good mark. Two single male students (majoring in Computer Science and awarded a very bad mark) started a strong interaction with the teacher during labs and/or through e-mails, and we pursued these exchanges over a period of one month, up until the project deadline. We mostly gave continuous and positive feedback to these young men and step-by-step, they reached each assessment level. Both young men initially chose to create their wikis alone, refusing to join a group, but it looks as though they needed some encouragement to perform the project. We supposed that they had never aimed for top marks, but since they (asked for and) received continuous encouragement, this was enough to motivate them to reach the best marks.
We observed that encouraging one another was very natural within those groups having a majority of women, and also that these groups spontaneously divided the work among team-mates. In groups having a majority of men, we observed that these were either composed of a single student or that a group leader emerged, who distributed (or performed, mostly alone) the work. The amount of work required for this project was do-able for a single person, and this strategy could work in this case, but this was neither what the teacher expected nor what he wished to develop.

Qualitative assessment

Qualitative facts are shown in table 2. URLs of wikis are given in column 1; columns 2 to 13 are labelled x.y where x represents the level and y the objective number within the level (see the section entitles ‘A classification of objectives and difficulties’); the last column represents the mark given to the work.

Site URL	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	Mark
lesroismaudits.referata.com	*L*	*P*	*P*	*P*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*10*
ncis.referata.com	F	F	F	F	F	P	L	L	N	N	N	N	13
oasis.referata.com	*F*	*F*	*F*	*F*	*F*	*L*	*L*	*L*	*N*	*N*	*N*	*N*	*13*
stargatesg-1.referata.com	F	F	F	L	L	F	P	P	N	N	N	N	13
warcraft3.referata.com	*F*	*F*	*F*	*P*	*P*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*13*
alien2.referata.com	F	F	F	F	F	F	L	L	N	N	N	N	14
lol.referata.com	F	F	L	L	L	L	P	L	L	N	N	N	14
skins.referata.com	F	F	F	F	F	F	L	P	N	N	N	N	14
stargatesatlantis.referata.com	F	F	F	F	F	F	L	L	N	N	N	N	14
masseffect.referata.com	F	F	F	F	F	F	F	F	F	P	N	P	15
starwars.referata.com	F	F	F	F	F	F	L	L	F	N	N	N	15
tintin.referata.com	F	F	F	F	F	F	L	L	N	N	N	N	15
charlieetlachocolaterie.referata.com	F	F	F	F	F	F	F	F	L	P	N	P	16
clamp.referata.com	F	F	F	F	F	F	F	F	L	P	N	P	16
finalfantasy13.referata.com	*F*	*F*	*F*	*F*	*F*	*F*	*F*	*F*	*F*	*P*	*N*	*N*	*16*
lost.referata.com	F	F	F	F	F	F	F	F	L	L	L	P	*16*
michaeljackson.referata.com	F	F	F	F	F	F	F	F	F	P	N	P	16

Table 2. Qualitative statistics

Data referring to groups reduced to one student is presented in italics.

17 semantic wikis (for 35 active students) were assessed as follows:

- 1 wiki (*lesroismaudits*) neither largely nor fully attains level 1
- 1 wiki (*warcraft3*) largely or fully attains level 1, but not level 2
- 1 wiki (ncis) largely or fully attains level 1, most level 2 objectives, and some level 3 objectives
- 5 wikis largely or fully attain level 2, but not level 3
- 2 wikis largely or fully attain level 2, and most level 3 objectives, except for inverse attributes
- 7 wikis largely or fully attain level 3, but not level 4

Looking at individual contributions for the 'best' wikis, we also note that 3 students individually attained level 4.
From the teacher's point of view, results are satisfactory but need to be improved. 7 wikis did not achieve level 3 objectives, indicating that modelling abilities were not acquired even though this is a central point in a semantic web course. The modelling part of the course lasts only 6 hours, and students not having majored in Computer Science do not have any modelling course in their curriculum. This part should be increased, and is probably lacking in exercises and case studies.
Only 3 students achieved level 4 objectives, indicating that the scope of the course (semantic web) is somewhat too ambitious. A slightly reduced version of this course was given in a Masters of Information Technology, yet did not yield better results, even though the students' technical background was much broader (ER modelling, database, XML). This probably indicates that semantic modelling and annotation (and team work) require much more non-technical skills (such as reading, writing, and collaboration) than computing studies.

Assessment of this course by students (not provided here, but available on request by email) indicates that most students were interested in the course content and appreciated the co-operative work although some of them (usually those not having majored in Computer Science) pointed out that performing the required work was too demanding in terms of time.

By-product results

Looking at the gender composition of those groups which reached a satisfactory level, we empirically remarked that groups partially or totally composed of female students were initially assessed at a significantly higher level than male-only student groups. A second-order result of this work - to be compared with other similar results, such as (Hardy, 2008) - may be that a course that relies on Web 2.0 technologies and uses group work is much more attractive to female students than classical programming courses.
A personal remark – and one we have stated in our professional life within a software company and as computing teachers as well - is that the technical aspects of computing, such as detailed design or programming are domains in which single male employees (or students) may be extremely motivated (usually yielding good performance) when they are competing against one another and regularly rewarded (via salary, distinctions and so on). Women in most cases work hard, collectively and consciously, once they

know what has to be done. Women generally tend to limit their technical investment when they felt that the work had reached a satisfactory level, probably in order to preserve other aspects of life (professional or personal). Since most software company managers are men, the former attitude is generally preferred although, in our opinion, non-technical aspects are at least as important to the success of software projects.
Wikis are very suitable environments in which to help students, because once a question or problem has been raised by students, teachers can provide remote feedback - either to build an operational example, or to solve the problem directly at the students' workplace.
Finally, it could be also noted that students are at ease interacting with teachers through emails and wikis, sometimes preferring this to face-to-face interaction - probably because they belong to generation Y, or the Net generation (http://www.businessweek.com/managing/content/mar2008/ca20080313_241443.htm). It may facilitate student-teacher interaction which – as ever - improves students' production and learning.

Conclusion

This experience was performed in order to show STEM students that computer science is not only related to pottering about a PC or geek programming, partly to attract female students to computer science studies. Day-to-day applications such as Internet, electronic commerce, multimedia, social knowledge building, were taken as a starting point in leading towards computing topics. Looking at student choices for the second university year seems to indicate that this 'marketing' did not produce the expected results, whilst non-Computer Science students generally maintained their initial choice. However, the part of the course presented in this paper reached a real students' interest and success, which may contribute to the dissemination of ontologies and the Semantic Web in general, and to the CIDOC CRM becoming widespread, in particular.

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