MULTILINGUAL MEDIA COMPONENTS DIRECTLY EMBEDDABLE IN OPEN EDUCATIONAL RESOURCES IN SCIENCE AND TECHNOLOGY

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Abstract

The aim of this paper is methodological. Is there a protocol that helps to export directly, without translation, part of the media explanations of a course to another in a different language? Animations without text or audio comments need a wrap around context and to be supported by as much structured metadata as can be modelled in the production process. Learning design is used as a developmental approach in the work discussed in this paper.

Keywords: OER, methodology, metadata, multilingual, Compendium, CompendiumLD.

1 INTRODUCTION

1.1 The big picture

Open educational resources (OER) are expected to be produced, used and reused worldwide ([1]; [2]; [3]). As for direct use, the majority of these resources seem limited to English-speaking audiences. In part, because the early production of OER was from legacy material written in English [4] and developed in English-speaking organizations, whose motivation to produce OER continues. Also English-speaking countries are amongst the largest producers of OER, and include some of the best repositories. On the other hand, some potential producers of non-English resources may wonder if it is worth the effort invested, to produce OER content in cases of small linguistic or cultural communities. This lack of motivation is also applicable to the translation reuse process.

In the medium term, these drawbacks can lead to the production of resources within a few disjointed cultural environments. Cross reuse will depend on the facilities for translation and re-contextualization. A proper strategy of production should take this into account from the beginning.

1.2 A case study

The main questions in this article arise from a practical teaching experience, with broader goals. The first author teaches the course "Logic and Discrete Structures" at the UNED (National University of Distance Education, Spain). This is a distance teaching university, where the learning process is supported on a VLE (Virtual Learning Environment). The above course is part of the first year of the Bachelor in Computer Science. There are about 1200 students enrolled.

From the regular teaching of this course, one of the goals is to create several open courses in Spanish, hosted in the official OCW repository at UNED. The other main objective is to export and adapt this content to be directly embeddable in OER in science and Technology in other environments (e.g. the LabSpace (http://openlearn.open.ac.uk) within OpenLearn at the Open University).

At this point some questions arise: is it possible to redesign the subject more explicitly to facilitate the selective export to other languages? Is it worth the effort, in terms of cost-effectiveness? Which components can be (easily) reused? Is there any methodology for these kinds of tasks?

2   DEFINING THE OBJECTIVES

2.1   Context

Wikicommons [5] is a project whose approach is close to this: it was created in 2004 to host the files that were likely to fit into the pages of Wikipedia in different languages. It is targeted at content sharing. In 2011 this repository holds 11 million multimedia files. The majority are in the form of photographs, along with static charts and diagrams, and animations of low granularity (animated gif, etc.). Some animations, despite being so simple and short, show a strong coupling of comments and annotations within the animation itself.

OER Commons (oercommons.org) is also a similar project, focused on e-learning. However, the granularity of the components is higher here. The emphasis is on the process of subtitling and translation. Amongst what is offered are interactive simulations of the individual components, which are more easily reusable (with just translation of its menu).

The situation is similar in all the largest repositories of open courses. Resources are presented with a medium-high granularity. In the case of OpenLearn, initially the smallest units of OER were tagged as having a study time of three hours [4]. The reuse of individual components is not promoted. It is true that educational films are being subtitled in English, even in several other languages after initiatives such as dotSub. But this tendency is not observed in the production of conceptual animations, where the coupling is very high in the production process.

2.2   Objectives

We shall focus on the resources supposed to be directly embeddable as components in other different languages. Moreover, our study will focus on STEM areas (Science, Technology, Engineering and Mathematics). In this way we have a rather common mathematical language, in addition to a rather common pictorial language.

> In this simplified scenario, the objectives can be stated as: *"systematize the production of media components in STEM areas directly embeddable in other language resources to be effectively selected and reused".*

The discussion in this paper aligns with work focusing specifically on OER for the computer science discipline area ([6]; [7] and [8]). In particular, we have worked on collections of conceptual animations to develop definitions and propositions of technical issues. Attention is paid to the relationship between three structuring levels: the dependencies or contextual structure of a collection, the inner structure of an animation (their parts: definition statement, example, counterexamples ...) and the most specific graphical grammar for every one of these stages of a single narration.

3   THE CASE STUDY: TOOLS AND CHAIN OF DECISIONS

3.1   Tools

So far, the tools used in carrying out this work are: Compendium (compendium.open.ac.uk), Keynote and Quicktime or Screenflow (for editing/recording animations) and some simple XML editors.

Compendium [9] provides a flexible graphical environment to tag properties and relationships between nodes of a graph. It has been used to produce mind maps, conceptual maps, arguments, discussions, notes, collaborations, etc. Some of the features we have found most useful are:

- ⋏ Node types and relations that can be customized for a specific purpose. CompendiumLD [10] is an adaptation dedicated to the edition of learning designs.

- ⋏ Nodes can store many different data links. In particular, a node can link / contain a map composed of other nodes and relationships, allowing multilevel descriptions

- ⋏ Nodes can be projected / shared by different maps

- ⋏ Every action is recorded in a database, local (Derby) or remote (MySQL). This allows cooperation among several designers.

- It is possible to export part of a map or the whole design as a textual XML format: the list of nodes (with their respective identifiers and attributes, like type or category), their position and other graphical information, and all the relations established (as couples of identifiers of nodes)

In addition, version 2.0 beta 1, enabled a node to be a video-map node: on a selected video that plays in the background you can gradually add nodes and relationships in order to build up an explanation, discussion or annotation. The subsequent reading of this video-map node will show the video and the dynamic construction of the annotated map. If no video is selected, the node behaves as a map node, though displayed dynamically. In these cases, the XML file includes the time of every event.

3.2 Designing a course to be partially reused in another language

This ongoing experience has required a much more detailed redefinition of the course "Logic and Discrete Structures". We enumerate the four main steps in this process:

- Dependency graph of definitions and statements: the contextual structure
- Assignment of icons to conceptual nodes: an intuitive snapshot of the contextual structure
- Assignment of animations to some conceptual nodes: the internal structure
- Exporting animations as well as contextual and internal structure

3.2.1 Dependency graph of definitions and statements: the contextual structure

Amongst the other alternatives are Graphical Learning Modeller or LAMS v2.0, CompendiumLD has be chosen however, to explicitly define the learning design of the aforementioned course. Thus, the design itself is likely to be compared, analysed or processed automatically by interactively working on its XML export.

The learning design has been complemented with a map of conceptual dependencies: that is, which other nodes, and how, they are required in a definition or proposition. This graph has also been modelled on CompendiumLD. Fig. 1 is a simplified, partial version, of one of these maps.

Rationale: we expect part of the course to be exported as a collection of animations, preferably small to medium size without inner text or audio support. Then, it is important to define a context that can be linked as metadata.
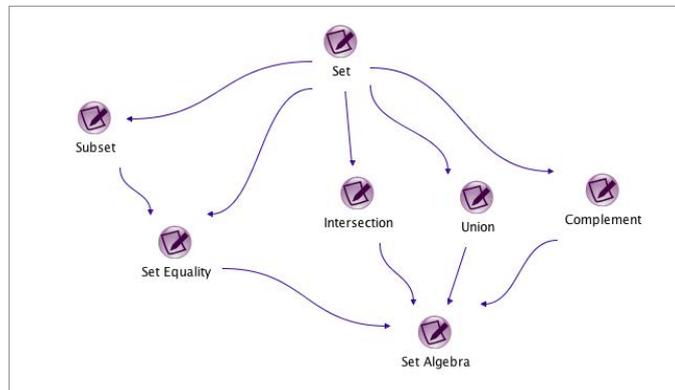

Fig.1: Conceptual dependencies

3.2.2 Assignment of icons to nodes: an intuitive snapshot of the contextual structure

CompendiumLD allows one to choose a specific image for each node, instead of the common icon that displays the status or purpose of that node. Here the challenge is to choose icons or diagrams conveniently and intuitively highlighting the contents of each definition or proposition. Figure 2 shows the gradual replacement of general icons for other more descriptive versions.

The result should be a visually navigable map and summary of the interdependence between concepts. This graph can itself become a map that is displayed dynamically, using the new facilities of CompendiumLD. The XML export could, after some programming, be interactively browsed.
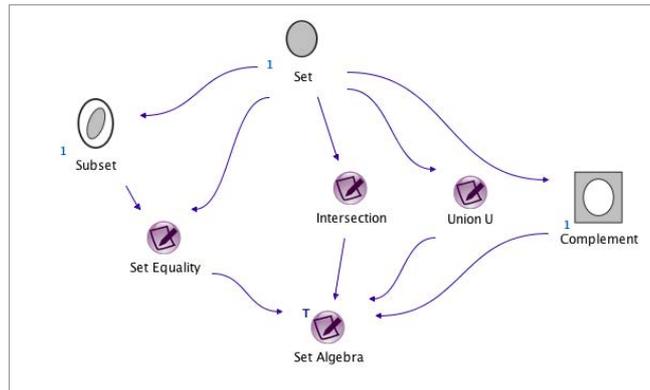
Fig.2: Assigning descriptive icons to nodes

3.2.3 Assignment of animations to nodes: the internal structure

Design and purpose of still images and videos

In this step we proceed to construct a narrative for each important node to explain dynamically its concept. In fact, this and the preceding stage happen in a sort of refinement cycle. The static diagram should become clearly understandable after seeing the narration, as a still image associated with a video. That way the animation is used to refine an intuitive, static and graphical representation of the concept. The role of this image is mnemonic in some way, discharged of details by the flow of the narration.

To close the cycle, the animation of a concept can use as graphic elements the icons of their components concepts. But this approach needs to access the dependency schema in case we do not recognize these iconic components.
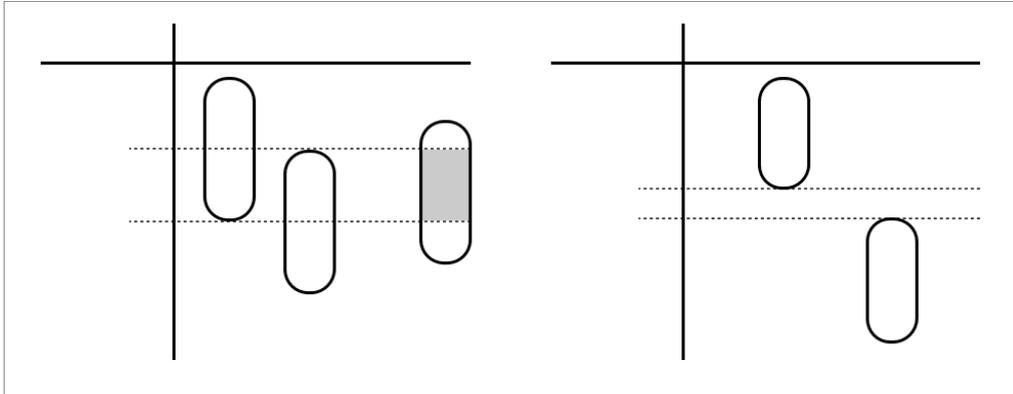

Fig. 3: Icons for logical consequence and unsatisfiable set of formulas, respectively

In any case, these types of contextualized maps and narratives do not collect all the details of a subject. Usually, a wrapping translated documentation should be provided. However, this media skeleton, if only keeping the significant details, can be quite useful to recall and relate and diagrammatic reasoning.

Fig. 3 shows two abstract representations, respectively for logical consequence and unsatisfiability. They have become quite meaningful for students after watching the corresponding animations. They formed a good basis to answer a number of questions by intuitive diagrammatic reasoning.

Some general considerations on the inner structure of narratives

In every abstract animation we have attempted to isolate some different stages by its purpose: presenting the definition, examples, counterexamples, and so on. So there is a possible structure of smaller animations, goal-oriented, that can be combined to build the final narration. A formal markup language can be used to describe this internal structure. In some way it is a parallel path to initiatives as OmDoc.[11]

To recap, so far we have tried to capture the common context of animations (when produced by the same team) as well as their internal generic structure. This framework, when exported with animations, allows a consistent modern navigation: between documents and its inner structural links.

On the design of the stages of an animation

The deepest level is about the expressivity of the smaller narrative steps that make an animation. These are clearly domain-dependent. In the context of STEM materials, the goal is to graphically emerge (or refute, or clarify) some more complex concepts from others. Here, some patterns are systematically used: generalization, particularization, definition from relations (as elements of the domain or range of the relationship with a certain property). It is a complex task that we are trying to explain simply.

CompendiumLD has revealed itself as a valuable tool to discuss these abstract graphical patterns: after producing a sequence, it can be placed as a background in a video-map node, where other annotating nodes can be dynamically added.

3.2.4   Exporting animations as well as contextual and internal structure

Following the stages described above, some collections of media support material have been produced. They are packaged together with the global dependency map, and map annotation for each animation. All of them are in the default XML format exported by CompendiumLD.

4   EARLY RESULTS, VALIDATION AND FUTURE WORK

This is ongoing work at an early stage of development. The mathematical, constructive nature of the course allows for good content modelling: the first level of our description. CompendiumLD is an appropriate tool for this and the other tasks addressed, although to become familiar with it requires a steep learning curve.

Definitions, positive and negative examples, hypothesis, dilemmas, … are, in principle, our general blocks to build animations. As found widely in any technical text. Some interface tricks have been established to define when these blocks begin and end and determine their function. Perhaps a sentence or two for the interview could be added here?

This month of October, 2011, begins a massive exposure of the material to the students of UNED, for a period of four months. We hope the comments help us to evaluate at this second level, the success in the differentiation of the blocks. As well as the order between blocks or the appropriate number of positive and negative examples necessary to narrow a concept, without lengthening the animation.

The pedagogical impact of the narratives depends on the success of the language of the third level. How do we manage to explain an example, or to gather all the references to concepts in a definition? We shall focus on the aforementioned general steps: particularization, generalization, selection of the domain of a relation, etc. We have prepared some questionnaires to assess the proper selection of symbols or graphic resources for these tasks. To this end the CompendiumLD video-map nodes (will be useful) for each smaller chunk of animation, where it appears with annotations.

As yet we have not addressed the more technical applications of this approach: the transformation of XML Compendium exports to a more specific vocabulary or the development of applications that allow one to enjoy surfing these animation packages and metadata.

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