Building a tool for transversal analysis methodology in university degrees with TikiWiki and Morcego

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Abstract. *The present challenge to the Free Software culture may rely on the ability to become a layer that allows collaborations between programmers and final users and between institutional and non-institutional forms of organizations on very specific developments. This paper exemplifies one of this cases.*
We describe a collaborative project by Bastida, a research and innovation group from the University of Barcelona, and Arca, a free software development collective from Brazil. Bastida is developing a methodology to analyse transversallity in specific university degrees by mapping concepts from a wiki environment and Arca had developed Morcego, an application that allows 3D visualization of graphs, which was further adapted to visualize Wiki page connections in TikiWiki.
We begin introducing the logic of our collaborative project. In the following sections we sketch the proposed methodology in detail and we present the starting software platforms, then we list future work needed to be done and conclude by outlying the special characteristics of this project.

1. Introduction

Bastida is a Research and Innovation group in the University of Barcelona, one of its pilot projects is a methodology for transversal analysis in university degrees further detailed in Sections 2 and 3. After some preliminary results, we found it valuable to create a dedicated free software tool that would allow to: (1) share and make easier to apply the achievements and (2) to assure future developments, if considered interesting enough.

Naturally we first sought out to find free software projects that could be adapted for our needs. Our search lead us to TikiWiki[1], a very interesting project detailed in Section 4.1.1. We were particularly excited to discover one of TikiWiki's components, Morcego[2], a tool that could aid us by providing a 3D graph visualization framework as explained in Section 4.1.2. This lead to us to establish contact with Morcego's team, when we also found that one of it's developers is experimenting with collaborative tools in university degrees[3]. Since, we have been discussing how these free software tools could be used and possibly extended to aid us in our common goals.

The primary result of this collaboration is the project we first underly openly here, a proposed methodology to map and analyze the conceptual collaboration between disciplines and subjects in the higher education systems and the free software development planned to make it possible.

2. The need for a transversal collaboration in universities

After centuries of maturation, the universities, as institutions and as educational providers, seem to share common problems. One of these problems may be seen as a consequence of academic organization, strongly based in disciplines, that control the degree's curriculum in order to assure their survival. Some of the strategies are well known: strong incentives for differentiation between disciplines-based departments (to better define one's own exclusive field) and recurrent clashes when defining the degrees (and also defining each weight in it).

As a consequence, the quality of education may be affected, because learning and comprehension of any important subject can hardly be contained in separate disciplines, it overflows naturally between disciplines.

In these cases we may frequently find a common pattern: degrees with a very serious lack of transversality, where a lecturer hardly knows what others are talking about, where some concepts are repeated (sometimes in a complementary way, sometimes the opposite) while other important concepts shared by disciplines simply remain unknown by students because every lecturer thought the other would explain it.

On the other hand, there are forces now that are driving some change dynamics, example:the shake in european legal framework that may also have some repercussions in other countries (as Brazil).

The process of establishing a Common European Higher Education Area by 2010, that started with the Bologna declaration in 1999[1], signed by 29 countries, is now a wider project with 40 countries all over Europe. This process of harmonization means adoption of comparable degrees, establishment of a common system of credits and co- operation in quality assurance. That means, specifically , changes like the one's introduced in Spain, where every degree now has to be redesigned in order to show between 50-75% of common contents[2].

In Brazil we can see how this directive somehow influences universities. At USP Leste[18], recently created division of University of SÃ£o Paulo, for example, all courses share a common year, the ”basic cycle”, in which all disciplines will be the same no matter the course, in an effort to achieve transversality between degrees.

As a complementary result of these directives, the process seems aimed to stop this “fragmentation” based in degrees controlled by very specific disciplines or sub disciplines. The specialization will come later in postgraduate courses.

For the reasons mentioned above, there is pressure in most universities to build transversal curriculum's, but in the process of implementing this we soon realized that first of all we need to develop methodologies that help us to project a clear picture of the situation in each degree, before starting to change anything, and most of the tools we previously used seem very primitive.

An example of the former used strategies may be trying to arrange a common

[1] `http://europa.eu.int/comm/education/policies/educ/bologna/bologna.pdf`

[2] Real Decreto 55/2005 (21/1/2005)

meeting with (some or all) the lecturers to discuss ways to combine or reach common areas. The results normally show then that these efforts give, at best, a partial framework of the common areas, depending mainly in personal relations between lecturers and, at worst, a new field ground to power clashes between academic departments.

The problem we confront come from the starting point, the lecturers have no reliable information to start discussions about transversality, only students have it, only students have the overall picture of it, acquired by assisting to class. In the solution we sketch in following section, students input the information needed to assist academic departments in their analysis and get a reward by working in this collaborative effort, while it facilitates the analysis of the results by offering a clear visualization of the networks of concepts and their importance.

3. Proposed methodology for mapping this transversality

In this section we first underline the basis in which the methodology relies and then proceed to a quick explanation of it.

3.1. Background and basis of this methodology

The project we present here has its origins in a pilot project already initiated[3] by Bastida Research and Innovation group in the University of Barcelona. Now, after some positive preliminary results, we aim to build a tool that may simplify the introduction and analysis steps and disseminate the possibilities of this methodology from the basis of use of free software and documentation project.

We propose a methodology based on five main guidelines: starting from information built from student's perceptions as detailed in 3.1.1; Use of collaborative technologies to facilitate input and reliability of the information, as explained in 3.1.2; Achieve students collaboration by offering reciprocity, as further detailed in 3.1.3; Facilitate analysis by using a focused software platform that would allow direct visualisation of results, as shown in 3.1.4; To open development and application of the methodology by initiating it under a free software license as we will see in 3.1.5.

3.1.1. Starting from information built from student's perceptions

In the project we present here we start from a very simple point: students are the only ones to have objective and complete information about transversality. For this reason, any methodology must start from information they provide and their collaboration, but to assure it in a proper way (it will be a long and tiresome effort) we also need to give them something in return.

3.1.2. Use of collaborative technologies (Wiki) to facilitate input and reliability of the information

As explained above, the idea of letting students draw the conceptual framework from their perceptions (from their work on what they have seen in the classroom) would facilitate the objective, because, as Oleksandr Chernyshenko explains, "groups normally prioritize the information common to the group, the information that has been discussed before and introduced by consensus actors"[20].

[3] Started in October 2004 and due to finish in june 2006, with an REDICE 04 grant from the University of Barcelona.

On the other side, Esaley, R.F. et al. (2003)[21] in one of the few studies that analyzed a considerable number of established groups (24) out of the common experimental groups, concluded that the best working groups used on-line collaboration instruments. These authors make clear that groups that use these instruments show a low tendency to be locked in domination by particular members, and exhibit a major equality on participation. They conclude that these technologies, compared with the traditional face to face interactions, have a positive result for related and creative tasks but a negative result in decision-related processes.

On the other hand, Bales et al. (2002)[19] in their meta analysis of recent investigations over the effect of ICTs[4] in a group's decision taking process, explains that it is commonly accepted that in larger groups (as in our case) where the anonymity is preserved, ICT's may improve the process (although being slower).

For all these reasons we chose a "Wiki"[4] tool, because it facilitates the anonymity while speeding up the decision making processes through achievement of a fast consensus.

3.1.3. Achieve students collaboration by offering reciprocity

To accomplish the degree of collaboration required from students during a long term (1 year) it's important to offer something as a counterpart. In this case we think that direct participation in the project (introducing contents to make it available for other students) should be rewarded (in a commonly accorded % of the marks in all the subjects) while indirect participation (just reviewing the contents without introducing them) would be a reward by itself, as a way to use "commonly build" student notes for exam's preparation.

3.1.4. Facilitate analysis by using a focused software platform that would allow direct visualisation of results

A focused software platform would mean better usability. As we will explain later 4, we will start from an existing platform, but the idea is to make every additional feature not directed to the aimed objective invisible to the user. That would probably make the application easier to use and document by new users.

On the other hand, it's very clear that the objective of this project is to develop a medium layer, between brute capabilities of some tools and specific needs from universities. The idea then is to be very specific in use (trying to cover very concrete needs) and be very broad in utilization (trying to cover a wide range of users that have these concrete needs).

It's on this terms that we stress the importance of developing Morcego's layer, to facilitate real time visualisation of results.

3.1.5. To open development and application of the methodology by releasing it under a free software license

With that objective in mind, choosing a very narrow interest and trying to achieve a wide use of the tool in development, a free software license seems to be the logic decision, because it allows us to start with well known platforms and also means to allow easy adaptations and modifications to adapt to specific needs of different universities.

[4] Information collaboration tools

3.2. The proposed methodology

The methodology works in a simple way:

- During an academic year the students of a specific degree will start to identify and define the main concepts explained in each subject or course in a Wiki. Every concept has a separate Wiki page. The second step is to start linking the related concepts.
- After all this information is gathered, the system needs to analyze it by using social networks methodology, in order to build a conceptual map that helps to reflect the centrality of the different concepts (identifying from which subject it was drawn, eg: with different colors), the holes among them, the strong or weak relations (eg: from the number of links), and the importance/complexity of the concepts (eg: from the number of editings).
- After looking at this map, we would start working in specific difficult and transversal concepts (worked from different disciplines and from controversial points of view) by using a factorial analysis to rebuild each concept from the students opinion in order to separate the different dimensions of it as perceived by them.
- As a counterpart by their involvement, students would get higher marks directly by their active contribution (introducing and editing contents) and would access to ˇ201cjoint student notesˇ201d in case of passive contribution (using the platform without introducing contents)

4. Building the tools upon a free software code base

We first review briefly the two software platforms that we start from to outline then the needed developments to work with the methodology described in previous section.

4.1. Starting platforms

Many reports have been made of social-network software being used to collaboratively create and manage content. In our search for tools that could be adapted to our methodology we started looking for a free software based Wiki. A good choice would be one that has good visualisation and relation analysis tools. We came across two free software projects that fit nicely into our project:

4.1.1. Tiki CMS/Groupware

Tiki CMS/Groupware[1], also known as TikiWiki, is a powerful web-based Groupware and Content Management System (CMS), using PHP[5], ADOdb[6] and smarty[7]. It puts together a big set of on-line collaboration tools integrated in one big framework[22], resulting in very flexible software that attends most on-line collaboration needs.

Tiki's development community follows a social contract[8] based on Open Organizations Project[9], that aims to explain how to set up and maintain transparent, accountable and truly participative communities. Some of the basic concepts of Open Organizations are explained by Eric Steven Raymond, showing how freely distributing the sourcecode can improve software development processes[24]. This results in a software built by a large number of developers (285 as this paper is being written).

There are at least 5 case studies[10][11] of TikiWiki being used for learning management, other than initiatives not documented or linked to these, and 17 developers working on Tiki's learning management system. The methodologies proposed differ from ours, but this shows the capillarity Tiki has to diffuse an innovative learning methodology to other universities and schools by the use of free software.

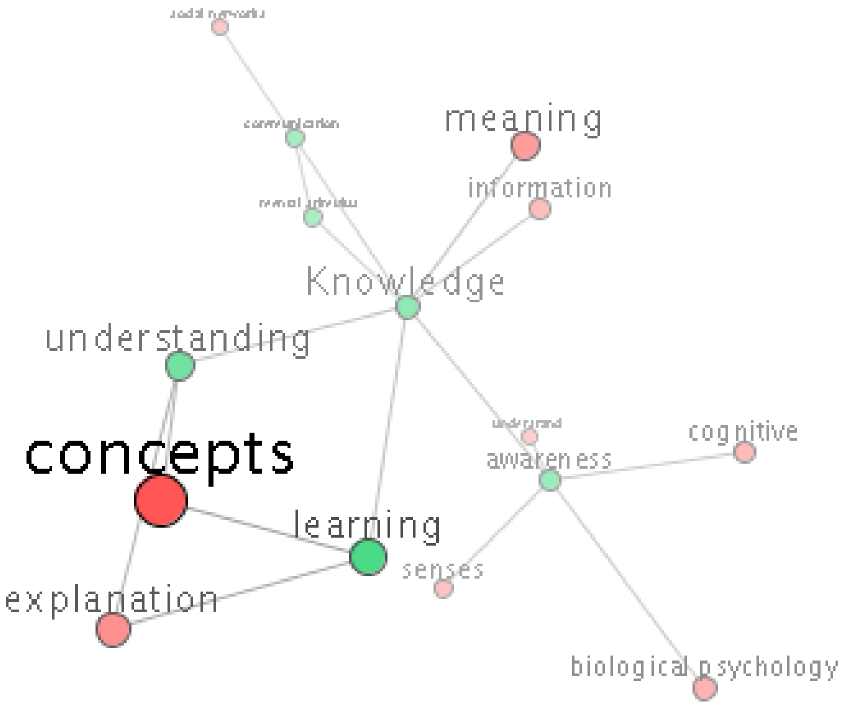

Figure 1: Morcego shows connections from a Wiki

4.1.2. Morcego

Morcego is a 3D graph visualization framework developed by Arca[12]l. It's members decided that they wanted something like Visual Thesaurus[13], but lacking experience with 3D engines and applets, they exchanged software development services through RentACoder[14] with a developer from India, who wrote the first prototype[15]. Building upon this code they evolved it into a framework that can be used to visualize graphs and navigate trough a graph's connections as illustrated in Figure 1.

It is composed of a XML-RPC[16] engine that is used to gather graph information and a Java Applet that draws and animates 3D structures representing the graph. It has some navigation features that allow a user to click on a node on the graph and see further connections from that node. The structure can be rotated, so that user can easily bring to focus the area of more interest, allowing analysis of small areas of a big graph. The nodes are positioned dynamically by emulating physical models of gravity, giving an organic sense to a graph that can be used to visualize influence a node has in a network. Morcego's framework was first integrated in TikiWiki to allow user's to visualize connections between Wiki pages.

It is used by Tiki's users to build nice 3D pictures of their Wikis and also to help visualization of hard concepts by teachers. We have been reported of Morcego being used in high-school classes in Canada and even one report of its use in a presentation to the Minister of Culture in Brazil, to help explain different topics and the methodology of a new digital inclusion project.

4.2. Further developments needed in each tool

4.2.1. Morcego's development

By making use of the dynamic graph balancing described earlier, we worked together to plan an innovative way to measure how nodes influence each other and to visualize network evolution dynamics. The principle is that since node positioning is made with a physical model, once graph has reached a stable configuration, the removal of a node would cause all system to move, and the resulting speed of some node on that instant would somehow measure the intensity of the influence the removed node had on that one.

Developing this idea, we plan to have two analysis ways, one objective and another subjective. For the first one, we interpret the resulting force as an ammount of influence, and so we can simulate, without showing to user, the removal of a node, and get a report on how much a node influences the network. On the second way we don't want exact numbers, but to give user a perception on the influence of a node. For that, we might remove the node, and after system get stable, add it again, so user will see the animation of network adapting itself for the absence/presence of a given node. With Morcego's current version this perception can be achieved by dragging a node around to see what follows that node, but it still needs a proper physical model - the current one is just an emulation that doesn't scale for other proportions.

In the methodology proposed by Bastida, there's one big graph, but we can also separate it in three layers: a graph of concepts, one of disciplines and one of students. With the proposed analysis method, we would be able to see independently how concepts, disciplines and students relate and influence each other.

While we apply this technique for analysing the importance of a node in a given instant, it's also important that we can see how this changes through time. For that, Arca has proposed a user interface that would include a draggable timeline bar, with control buttons like a video player, that would display the graph according to the time of an event and play an animation showing network evolution.

A separate area for analysis interface would show a report of both statistical data and detailed descriptions about number and type of connections and/or nodes made by a given student or discipline. The user would be able to press pause to make an analysis of an instant or mark a time interval to get a report, that can be exported to XML[17] format.

4.2.2. TikiWiki Development

While Morcego aims to provide powerful visualization and analysis of graph structures, all the future features described above will require that TikiWiki is developed to provide the proper information. Here we describe what will be necessary for Tiki to fit into the proposed methodology.

To start with, we identified how the entities involved in the proposed methodology can fit into existing Tiki structures, and how can these be adapted to support the methodology. Students can be represented by Tiki users, with no further developments needed. Disciplines can be groups, and for this we will have to implement Marc Laporte's ideas on Tiki groups[23]. Each concept, as already explained in 3, will be one wiki page, and we can use categories to determine what kind of contribution that page is (ex: only data/information/explanation, comparison between concepts,hypothesis, etc.).

Tiki has too many features we don't need, so we have to simplify it to achieve a cleaner interface, one that will focus user attention on methodology instead of tool. So, the second step will be to customize a Tiki installation, by making an installation profile and a custom theme. This way the software can be easily distributed to be reproduce the methodology in other universities and schools.

After this basic setup, we can start using the first version of the tool, while working on the analysis components. The next step will be to extract information and knowledge about network evolution, and for that Arca has proposed the implementation of Emerging

Connections (EC) support in Tiki. The idea of EC is to map every interaction between two nodes (that may be a user, discipline or concept, in our case) to support visualization in Morcego, indexed by timeline as described in 4.2.1. For example, every time two users edit the same page, one connection emerges (or is reinforced) between the users. If one if them has edited another page recently, a connection between these pages also emerges, having the degree of this EC to decay with longer intervals between editions.

5. Conclusions

The Free Software culture has achieved a commonly agreed success as a framework to develop joined efforts, mainly in technical primary and middle solutions. As an example just think in the typical cliché, that may picture a bunch of programmers working on a specific piece of software that helps to interact with other software. We may also find final projects but either they are big ones (that involve critical mass of people, so they attract enough developers) or little but specific ones (where users and developers can be hardly differentiated).

The next stage is now proving the capabilities of this Free Software Framework (FS Framework) to develop final and narrowly focused solutions, involving developers from very differentiated areas (not only programmers) and directed towards final users interested in results, not in tools. Success in this area would lead to an easy and quick predominance of FS Framework as a simple way of work, with the positive externalities it means in terms of free access and distribution of results.

On a very limited scale, our project is aimed towards this kind of collaboration. As we have seen, existing free software tools, specifically Morcego and TikiWiki, can evolve to support the creation of new methodologies to map transversality in universities degrees. The evolving free software community is also available to help most researchers, as was our case which resulted in collaboration between the Bastida group and Arca.

We believe this paper shows that there is much room for transversal collaboration between researchers and the free software community and we are eager to report on the evolution of our collaborative project to build upon the current versions of our tools, supporting the needs of our methodology.

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