

# Learning by creating historical buildings in Second Life

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## ABSTRACT

The potential of Second Life as a teaching/learning platform was explored in the context of a multidisciplinary and international project spanning several courses. In less than three months students were able to achieve high quality recreations of historical buildings, learning about history, multimedia production and 3D modeling in virtual worlds in the process.

## Categories and Subject Descriptors

K.3.1 [Computing milieux]: Computer uses in education. J.5 [Computer applications]: Arts and humanities. H.5 [Information interfaces and presentation]: User interfaces.

## General Terms

Experimentation, Human Factors.

## Keywords

Virtual environments, Second Life, History, Education.

## 1. INTRODUCTION

The increasing diffusion and success of easy-to-use multimedia authoring tools, together with libraries of digital assets and community sites have enabled the creation of an ever increasing number of amateur multimedia products, whose potential for communication among the new generations is incredible [1].

Among the new platforms supporting these new forms of creativity, Second Life (SL), a multi-user participant-created 3D world,

has achieved a great diffusion, by offering off-the-shelf components (avatars, scripted objects and animations) that can be easily modified, reused and bought. Even if the quality of the graphics does not compare favorably with professional productions, the increasing diffusion of the platform presents new opportunities and the construction of virtual worlds interesting challenges from an educational point of view. A successful educational project in SL is for example the Kamimo Islands Project, for teaching languages [4]: the virtual environment makes possible the creation of an endless number of different situations and interpersonal relationships, where to learn different styles of language interaction.

Another field being explored is the use of virtual worlds for teaching about history, art, and cultural heritage. In particular several projects aim at creating a virtual counterpart of historical buildings of the present or of the past. In the reconstruction of historical buildings, especially for educational purposes, it is important to follow specific rules in order to ensure that such work is intellectually and technically rigorous.

We report on a teaching/learning experience performed as part of the course of study in *Informatica Umanistica* at the University of Pisa: in particular students were involved in the construction in SL of the Leaning Tower and of Galileo's laboratory. Informatica Umanistica offers an interdisciplinary curriculum where students receive a solid education in humanities together with the technological skills and methodologies to master the tools needed for processing cultural contents in different digital forms. Most of the students involved in the project specialize in a graduate level curriculum called 'Graphics, Interactivity, Virtual Environments'. Given their specific background, students have the necessary competences to be the main actors in the construction of artefacts in SL.

The project is multi-disciplinary: students learn about history, art, 3D modelling, interaction programming, and communication with new media. The project has been carried on with an international partner so that students have the opportunity to learn about different cultures and acquire language skills.

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## 2. THE PROJECT

The job market offers a growing number of opportunities for people skilled in 3D modelling applied in particular to the study and reconstruction of historical-artistic objects. Moreover, international research in humanities computing recognizes three-dimensional reconstruction of historical objects and buildings as one of the most important and challenging themes.

A one-year collaboration project has been established with the *Centre for Computing in the Humanities* of the King's College in London (CCH) aimed at developing these professional skills in the students of Humanities Computing. The project main objectives are to foster new advanced educational activities and to explore research issues in the use of virtual worlds in this field. The project consists in creating and running, jointly with the *King's Visualization Lab* of CCH, a shared work environment in Second Life.

This space, the *Digital Humanities Island*, is used as a shared platform for the educational activities of several courses: 3D Graphics, History and Gaming to start with. Other disciplines of the curriculum in *Informatica Umanistica* will be hopefully be involved along the way. This virtual space is used by the students of both institutional partners under the supervision of their teachers, following methodological guidelines established and agreed-upon.

In order to assess the utility, potential impact, and future perspectives of the project, a number of meetings, information exchanges and consultations have been carried out with public organizations (Fondazione Regione Toscana, Università di Pisa, CNR Pisa) and private ones (Opera del Duomo, Big Bang Solutions).

## 3. THE PRINCIPLES OF HISTORICAL RECONSTRUCTION

An important benefit of the collaboration with the CCH has been that we were introduced to the methodological principles that are currently discussed by the international community interested in the reconstruction of historical buildings and environments [3]. The reference for these guidelines is a document called the London Charter [1] that establishes internationally recognized standards with respect to the specific qualities of three-dimensional visualisation in historical research and education. The Charter touches upon several properties of such artifacts, namely: intellectual integrity, reliability, transparency, documentation, standards, sustainability and access.

The team from Pisa fully adopted the principles of the London Charter, particularly those recommending the importance of a tight connection between the historical research and the transparency of the applied methodologies.

In the reconstruction of the Leaning Tower and the Galileo Lab – the first monument in particular – the main issues addressed were the exactitude of the proportions and the amount of detail.

A choice was made that the correspondence between the virtual monument and the real one had to be carefully respected. This is not an obvious choice to make in SL. In fact, considering that the average inhabitant of SL is two meters high, usability requirements would suggest the creation of buildings with ceilings and doors higher than normal so that avatars can move in them

without problems. In this case, the principles of the London charter were given the precedence.

A similar trade-off concerns the amount of detail that can be afforded: a high quality and detailed reconstruction would require an exorbitant number of *prims* (primitive objects) and would slow down the rendering thus, again, compromising usability. This issue was especially critical in the reconstruction of the Leaning Tower.

Modeling a complex monument, as the Leaning Tower or Galileo Galilei's Laboratory, rises immediately various issues concerning the external communication of what we are doing: how to pass to the visitor the methodological validity of what is being made, by which means, in which circumstances? Some solutions have been found in the creation of explicatory panels, audio guides and interactive objects. Other solutions are however still under consideration and students often suggest them.

## 4. 3D Graphics

In preparation for the project the students attended a course in 3D Graphics, whose main goal was to project them out of the desktop metaphor in a new virtual world, the three-dimensional one.

The course has taught them first of all to see the three dimensions on a two-dimensional screen; then to move around in this space, to orientate, to manipulate objects. Once learned these basic notions, the next step has been the acquisition of modeling skills: the 3D modeling software (Blender in our case) is presented as a tool in the hands of the creator: like a scalpel in the hands of a sculptor who expresses his art and creativity by sculpting a block of marble.

The course has gone far beyond the modeling techniques required by Second Life, providing students with advanced 3D modeling skills: at the end, they were able to create a completely finished 3D environment. The results are notable and can be seen on the Digital Computing Island in SL.

## 5. BUILDING TOGETHER

### 5.1 The Digital Humanities Island

We took possess of the Digital Humanities Island [2] in October 2007 and started building shortly afterwards. The following buildings and spaces are being created:

1. An orientation centre, built on several stories, and hosting meeting and exhibition facilities.
2. A work area (*sandbox*) where students have the possibility of experimenting in the construction of objects and buildings

The historical buildings created on the island are the following:

1. The Tower of Pisa and the Miracles Square in the history
2. Galileo's laboratory: a virtual reconstruction of the laboratory of Galileo Galilei,

Other projects being done by the students of CCH include a reconstruction of the Tower of London.

### 5.2 Galileo's Laboratory

Galileo's laboratory was built taking as model the laboratory set up in the building of 'Vecchi Macelli' in Pisa by the Galileo Galilei Foundation.



**Figure 1. Galileo's Laboratory**

The students of the 3D Graphics course recreated the laboratory in SL, including some of the objects and experiments there contained. This task has been proposed as an intermediate assignment during the course. Students were encouraged to apply techniques and suggestions discussed in class. The lecturer acted as a supervisor, leaving the students free to express themselves according to their artistic taste and technical skills. Students were able to organize in subgroups and distribute the work evenly among them, each student contributing to the group according to his/her capacity.

The students of 'Introduction to historical studies' produced historical background information, about Galileo Galilei's life and work, his importance in the History of Science and his most important experiments. In addition to text, eleven audio files have been mixed and edited in a professional way with music and theme songs. They were made available in the SL Galileo's Lab and downloadable from the Galileo Galilei Foundation web site.

The interaction between students of the two courses has taken place in real and virtual meetings: the 3D Graphics students were formally introduced to the London Charter principles (that became a set of shared guidelines in the Digital Humanities Island) and the History students visited Galileo's Lab in Second Life while it was being built.

The project will continue next semester with the students of the 'Computer games' course, who will do the scripting for the animation of the experiments.

The chief architect for Galileo's laboratory has been Francesco Genovesi, an undergraduate student with previous experience as a SL builder.

A main issue in the construction and equipment of the laboratory has been the *affordance* of the objects and the environment, i.e., following Norman [6], the property they have to make their action possibilities of use readily perceived to an actor. In our case, the main problem was how to lead visitors to discover the valuable information provided about Galileo and the experiments, hidden in the laboratory, i.e. in pictures hanging on the walls and objects.

At this stage, Second Life does not have yet strong conventions as the Web. Apparently, everything that works is fine. Design is guided by common sense and a more or less educated personal taste, but usability guidelines are lacking.

A common solution is issuing notecards when entering a place or touching an object. But how to suggest in a natural way that

certain objects carry important information? Or lead visitors to discover which objects hold scripts and behaviour?

As Francesco puts it, explaining the problem of making visible clickable signs in the lab: *I have no conventions like for the web where text underlined is perceived as a link. So I am forced to write it clearly, risking redundancy. But this is still not enough. I also need to use some additional contrast, to make it more visible among the set of objects in the first room. For this, following the rule of contrast, I had to provide it with some movement. Now it will be the object perceived first. Clicking on the sign, I will receive a notecard explaining me how to visit the museum.*

And again: *While I am writing, I am trying to solve the problem of the outside rotating sign (shown in Figure 1). A novice to SL will most likely ignore it, and information on how to use it is received when he enters the lab. For this reason I am thinking of an automatic delivery of information when he goes through the entrance, but used only once, otherwise it will create annoyance, like spam.*

This project had a great educational result: improving computer skills, making clear how to communicate historical contents and, last but not least, learning about a crucial moment in European History.

### 5.3 The Tower of Pisa

The construction of the Tower of Pisa is part of a more ambitious project which has the approval of the organization who owns the rights of the image of the Square (the 'Opera del Duomo') and aims at visualising the phases of the construction of the Miracles Square in time. The first step has been the construction of the Tower of Pisa, in cooperation with the 'Opera del Duomo' and the technical supervision of Beatrice Rapisarda and Enrica Salvatori.

Given the complexity of the monument, a faithful and detailed reconstruction is really stressing the possibilities of Second Life as a modelling and rendering platform. A professional 3D model of the Tower was already available from the Opera del Duomo but could not be exploited for this project, due to its complexity. The Tower had to be built from scratch within Second Life in order to obtain the best result compatible with the rules of this specific virtual world.

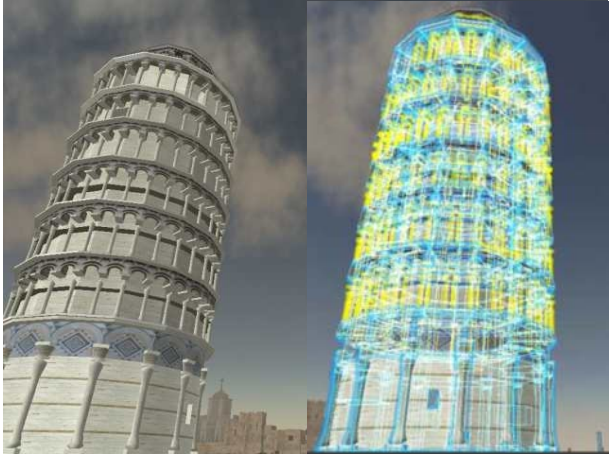


**Figure 2. Rea creates a polygon with a 9-meter radius.**

SL for example does not allow to build cubes larger than 10×10×10 meters, or cylinders with a diameter greater than 10 meters. The problem was solved with the help of an available tool

that allows the construction of objects of larger sizes, by seeing them composed of smaller solids. Figure 2 shows the creation of a polygon with a 9-meter radius.

Another issue is the amount of detail. Every land in SL has an upper limit on the number of prims that can be rendered. Since we could not afford an island dedicated to the Tower, with no other buildings in it, a limit to the number of prims was established beforehand for the Tower (approximately 2,500).



**Figure 3. The Tower of Pisa and the complexity of the model**

The result is a careful compromise between the number of *prims* used and the requirement of fidelity to the original. The general impression was achieved by careful planning of the prims and exploiting a number of different textures produced ad-hoc to supply additional detail, even a 'unused' effect, in a way that gives justice to the beauty of the monument. The snapshot to the left of Figure 3 gives an idea of the high quality of the result, even at an intermediate stage of the construction; the one to the right suggests the complexity of the model.

The graduate student Elisa Ciregia did this work as her thesis project. Here is how Elisa (Rea in Figure 2) describes what she has learnt from her experience in building the Tower:

*I always had considered the Leaning Tower an artistic marvel worth of great notice. Never however I had noticed that it was not only beautiful, but also interesting from the engineering point of view. My task was to reconstruct it in a virtual world by respecting the real proportions, therefore I started searching the planimetry and I was lucky enough to find it at the Faculty of Civil Engineering of the University of Pisa. By studying the charts, I was able to appreciate differences that are impossible to notice with your eyes: the heights, the radiuses, and the thickness of the walls, for example, are different from one stage to the next. The work of recreating the Tower proved to be more difficult and interesting than expected. When one is used to see each day the same thing is not incline to appreciate its special properties: thanks to photographs that I used to reconstruct the textures of the Tower, I began also to appreciate the diversity of the capitals, the engraved figures, monstrous and marvellous at the same time, the writings, the materials used which are really diverse.*

## 5.4 The orientation centre

With the exception of management meetings and occasional encounters on the island, so far the students did not take full advantage of the international community set up in collaboration with CCH. At the time of this writing we have just completed the orientation centre of the Digital Humanities Island, where joint meetings and seminars will be run. The centre hosts the following spaces and facilities:

- An orientation space, equipped with suitable signs and boards, to direct visitors towards the work in progress on the island (including those not permanently visible for lack of space) and to inform them of the activities of Informatica Umanistica and the CCH.
- A space where to organize joint seminars, classes and meetings, with suitable equipment (blackboard, slide projector, movie player, camera), where to experiment with new forms of e-learning involving students from Pisa and London.
- A space for the presentation of completed projects, with accompanying information on the motivations, aims, methodologies used, and authors.

## 6. CONCLUSIONS

The project has been unexpectedly rewarding, considering the short time frame and the high quality of the results achieved. The experience shows that students learn, by being actively engaged in the construction of the virtual world, how to deal with scientific as well as technological constraints. In particular they learn in a collaborative setting how to create virtual objects and environments, become aware of new usability and communication issues that arise in connection with virtual worlds and are stimulated to improve their culture and appreciation of history and art.

## 7. ACKNOWLEDGMENTS

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