DESIGN AND CREATION OF A SERIOUS GAME: LEGENDS OF GIRONA

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Abstract

In this paper, we present work carried out by GreTICE, a University of Girona research group specialising in information technology and communication in education, which is involved in the design and creation of a *serious game* called "Legends of Girona" to be used in the classroom as a teaching resource. This game has been created in collaboration with GiLab (Graphics & Imaging Laboratory), which is also based at the University of Girona. The game is aimed at pupils between the ages of 10 and 16 (i.e., from late primary school to the first cycle of secondary school.

The project evolved from CONTIENE (*Content Intelligent Applications of Virtual Reality. Technical perspective and global illumination* - TIN2007-68066-C04-01) which was funded by the Ministry of Education and Science (MEC) as part of the National Plan for information technology. This project developed into a new one, TIN 2010-21089-C03-01 entitled "Digital content for serious games: creation, management, rendering and interaction" (CICYT-MEC).

In educational terms, the objective of the project is to study the use of videogames as an entertaining teaching resource. We conducted a study into the preferences of young children and teenagers in order to get data that would be useful for the design of the game. From the analysis of the responses, a comprehensive report was prepared that indicated how the game could be improved.

The chosen theme was the *Legends of Girona*, based on traditional stories from the city. The main character in the game is able move between present-day Girona and medieval Girona, and takes part in different adventures in the context of each legend. This idea allowed us to develop a motivating proposal (with adventures, movement in open spaces, interaction with the scenario, etc.) that meets educational objectives that are both general (decision-making, problem-solving, resilience, concentration, etc) and curriculum-specific (history of medieval Girona, French invasions, etc.). With these ingredients, we began to write a script that would form the backbone of the game.

Based on the script, the technical team began to make a number of decisions regarding, for example, the game engine, the 3D representation of present-day and medieval Girona and the application of the advances they have made in their research into lighting applied to video games.

From that point forward, the pedagogical team and the technical team have worked in parallel and in constant coordination leading to the completion of the graphic design and 3D modelling of characters and scenes, the 3D reproduction of Girona, the character movements, soundtrack, recorded dialogues and the implementation of all these elements into the game engine.

After a process of internal testing and reviews, we carried out a small survey to test the degree of satisfaction among players who tested a beta-version of the game. The initial assessments are very positive.

The full text of the paper gives more details on the analysis of the data.

Keywords: Serious games, video games, innovation, technology, research projects.

1   INTRODUCTION

Information and Communications Technology has introduced an enormous number of changes in education since the 1970s and one area that has generated perhaps the greatest controversy is video games. In general, society often views these multimedia products in a highly unfavourable light: gamers spend too many hours playing; the games themselves are sexist and violent; playing such games results in a lack of attention to other, more important activities, such as study; and so on.

These are some of the typical criticisms, often accompanied by alarming news items of fatal outcomes for gamers who spend hours and hours in front of a screen.

Fortunately, this rather alarmist consensus has dissipated in recent years and, although we cannot generalize, there are an increasing number of experts who support the idea that video games can help develop certain skills that can be useful to people in general and, in particular, for teaching and learning.

In February, 2009, the European Parliament gave their approval to a report written by Dutch MEP Toine Manders [9], which stated that video games can stimulate the learning of concepts and skills - such as strategic thinking, creativity, cooperation and innovative thinking - and encouraged schools and parents to recognise their educational potential. This report epitomises the changes in social attitudes towards video games. Although still considered, above all, to be a form of entertainment, video games are increasingly associated with education and learning new concepts and skills. Such is the view, for example, of Egenfeldt-Nielsen [3] who used the term *edutainment*, to define the kind of products that are designed to entertain while educating.

In a similar vein, there is the idea of *serious games*. The term emerged in the U.S.A. in the 1980s, and refers to games that, in addition to providing pure entertainment, are specifically designed to help users learn something, to manage resources or conduct simulations. The idea is based on the traditional educational principle that using games increases the motivation of participants to learn something new. Thus, *serious games* can be found that are designed, for example, to promote awareness of a particular issue, to raise social or political issues, to deal with business issues, health problems and so on. In this sense, our project concerns a serious game.

One of the more prominent researchers in this field is James Paul Gee [5] who has defined 36 learning principles that can be achieved by using video games. Another is Begoña Gros [6] who argues that video games are children's entry point into the digital world. Gros examines the relationship between the use of digital games and learning and concludes that the use of certain video games develops various skills, such as decision-making, organizing resources and inductive reasoning, all of which are skills that promote educational and learning processes in children. Marc Prensky [11], who analyses how video games are valued in society, provides a number of positive guidelines to inform parents about the video games used by their children and to promote their rational use. Recently, Nick Bilton [1] analysed how video games can affect people and concluded that the use and mastery of such games affects the brain and can help us to become more skilled at certain tasks. The 2011 Horizon Report, by Johnson *et al* [7], noted that learning based on games - which comprise a large proportion of the use of new technologies - would reach a peak within two or three years, i.e., at present. The report adds that the use of video games in education helps to foster collaboration, problem-solving and communication, as well as experimentation and exploration of identities and even failures. It is clear that some of the issues referred to in the 2011 Horizon Report echo those described by Manders in his report to the EU parliament.

Furthermore, in this context, there is the newly emerging concept of *gamification*. This is the process whereby game mechanics and game thinking are applied to non-game situations in order to make them more fun and engaging. In this way, the learner/player is psychologically predisposed to acquire new skills as part of a game, and he or she does so motivated by the dynamics of the game. Kapp [8] describes gamification as an attitude and as a learning strategy and points out that using this technique increases student motivation, resulting in a greater degree of involvement; the end result is that academic results can be improved. The concept of gamification highlights the social aspect of playing games in general: games are always played with someone else. Today this concept is widely applied in the business world in order to improve economic performance and employee satisfaction. Applied to the world of education, gamification can bring elements of cooperation and collaboration among students that will help them to achieve their learning goals. One of the objectives of gamification, according to Jane McGonigal, [10] is to help simplify what appears to be complicated and to make it as easy to save the world in real life as it is in online games.

2   OBJECTIVE OF THE PROJECT

The main objective of our project is to design and create an entertaining video game that can be used as an educational resource. In short, to make a serious game whose principle design goal is not simply entertainment. In our case, the main objective is education. The players of this new game are pupils at late-stage primary education and the early stages of secondary education.

In order to achieve the overall objective, we began by defining a number of preliminary goals:

- to establish a method for collaborative work between the two participating research groups, one from the field of technology and the other from humanities;
- to obtain information regarding the gaming preferences of the children;
- to analyse and study the data gathered;
- to design and create a prototype of the video game.
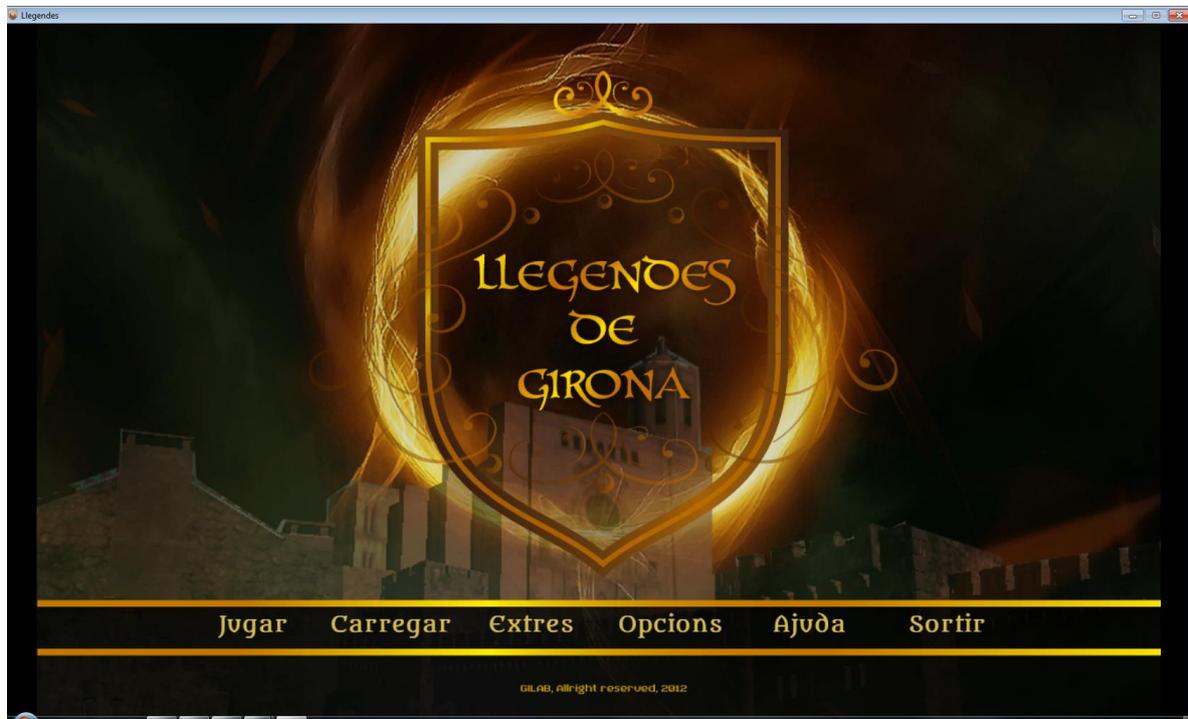
Fig. 1 shows the home screen of the game.

Fig.1 Home screen of the game

3   DEVELOPMENT OF THE PROJECT

In 2009, our research group, GreTICE, was given the chance to collaborate with the GiLab research group, also based at the University of Girona, in a project to create a video game, that is to say, a *serious game*. Creating a video game is a laborious task and collaboration between technical staff and teaching staff is essential to our project. Development of the project began with a project called CONTIENE (*Content Intelligent Applications of Virtual Reality. Technical perspective and global illumination* - TIN2007-68066-C04-01) which was funded by the Ministry of Education and Science (MEC) as part of the National Plan for information technology. This project developed into a new one, TIN 2010-21089-C03-01 entitled "Digital content for serious games: creation, management, rendering and interaction" (CICYT-MEC).

In terms of the educational approach, the project is based on studies into the use of video games as an entertaining teaching resource, one of the lines of research areas at GreTICE, the University of Girona. The pedagogical team conducted a study into the gaming preferences of young children, the results of which could be used to design the future game. The data for this study was gathered by means of a questionnaire distributed among a number of schools in Catalonia which contained questions on the children's gaming habits (hours played per week, what time of day they played, whether there were agreed rules in the family regarding the time spent playing games, and so on); questions relating to aspects of the games the children valued most (e.g., graphics, soundtrack, freedom of movement, etc.) and questions about the educational aspects of the game (whether they felt they learned anything from video games). At the same time, a number of teachers were surveyed for their opinion on video games and on their willingness to use them in their classrooms. We also

needed to explore the potential additional videogame features that depend on the type of console being used, as this determines the interaction between user and interface. Therefore we created a second questionnaire designed to collect information on the console and on the user/console relationship. A complete analysis of the responses (Cornellà Canals, Estebanell, Ferrer & Guiu, 2009) indicated the elements that needed to be taken into account at the development stage of the videogame we wanted to create.

The next step was to find a theme that was motivating (as all good games must be) and educational - so that the final product could be used in the classroom. The theme chosen was the *Legends of Girona* which is series of historical and mythical stories concerning the city of Girona. Initially, the basic idea was that the game's main character could move between present-day Girona and the Girona of legend (in particular, medieval Girona), taking part in a different adventure connected with each legend. This choice allowed us to develop a motivating proposal (with exciting adventures, movement in open spaces, interaction with the scenario, etc.) that meets educational objectives that are both general (decision-making, problem-solving, reaction capacity, concentration levels, etc) and curriculum-specific (history of Girona, how people lived in medieval Girona, when French invasions occurred, etc.).

Using all these ingredients, we began to write a game script that would serve as the backbone of the game. This was a lengthy process since it implied such diverse aspects as writing the story, defining and describing the game's characters in detail (appearance, clothing, behaviour, etc.), writing the dialogues between characters and describing all the scenes, both indoor and outdoor. To do this, we used *Celtx*[1], a free scriptwriting application which made the task much easier. This application allowed also us to collect and organize all the documentation - text, images and drawings - that referred to the historical setting of each of the legends.

Finally, we had to decide where to start, i.e., which part of the game to develop first. This decision was made easy by the fact that the overall game was divided into a number of different legends - each of which represented a different adventure. We simply had to decide which legend to develop first, which in this case was the legend of *St. Narcissus and the Flies*. Basically this legend is about the role of Girona's patron saint, Saint Narcissus, in liberating the city from the French army, thanks to the miraculous intervention of swarms of flies that attacked the French soldiers.

The technical team now began to take some important decisions in the development of the game, for example, which game engine to use. They decided on an application called *Unity*[2] which allows users to create games for various platforms, including the web. They also began to work on the 3D representation of both present-day Girona and the medieval Girona in which the legend of St. Narcissus of the Flies is set. In this phase, they were able to apply the results of their research and the advances they have made in the field of lighting applied to video games.

From that point forward, the pedagogical team and the technical team worked together in constant coordination and carried out the following tasks:

- graphic design of characters and scenes
- 3D reproduction of the city of Girona; (Fig. 2 shows a scene in present-day Girona and Fig. 3 shows a scene from medieval Girona)
- 3D modelling of characters and objects
- movements of the characters
- soundtrack of the game
- recording of dialogues
- all the elements incorporated into the game engine

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[1] https://www.celtx.com/index.html

[2] http://unity3d.com/

Fig. 2. Present-day Girona

Fig. 3. Medieval Girona

After an initial process of internal testing and revisions, carried out by the technical and pedagogical teams, a group of young people were asked to test a beta version of the game. The evaluations and opinions of these testers were collected in a survey (described in the following section), which was used for a final analysis that would enable us to get the first prototype of the game ready for distribution.

4 EVALUATION OF THE PROTOTYPE

4.1 Evaluation questionnaire

Potential players of our product were asked to test it and their opinions were gathered from a survey in which, after a few brief questions about their personal details and their experience of using video games, the testers were asked to evaluate a number of specific aspects of the game: e.g., graphics, gameplay (i.e., the specific way in which players interact with the game) and playability (or ease of use), the soundtrack music, etc.

All the items included in the survey were agreed upon by the pedagogical team and the technical team, ensuring that the data obtained covered both technical and educational aspects. In this way, we hoped to obtain sufficient indication of the adjustments to the prototype that would be required before deciding on the marketing of the game.

We chose to carry out the survey online so that testers could complete the questionnaire from any online computer. It was important, however, to verify that players responding to the survey had in fact played the game for long enough to be able to give reliable responses. For this, we prepared game areas where testers were monitored by a person designated by the research team.

4.2 Sample size

At the time of writing, the survey has collected a total of 58 responses. Further responses are still being gathered. Although the sample is relatively small, the responses are quite similar, with little deviation and this suggests that the survey was well prepared and that the results are reliable".

4.3 Survey Results

In this section, we will summarise the results of the main sections of the survey.

Of the 58 testers who responded to the survey, 66% were male and 34% were female.

Although the survey was aimed at young people aged between 10 and 16, the majority of respondents, 63%, were aged 15 or 16.

Nearly half of respondents can be considered to be regular 'gamers' (43% said they played video games for more than an hour a day).

The respondents' first impressions of the game appear to be quite positive which suggests to us that the product is very close to what our original objective. For example, 93% said they liked the game; 88% said they would recommend it to a friend and 90% said they would like to use the game in their school or institute.

Although people who play video games do so basically because they are fun, 63% of the respondents said they thought that they could learn things from our game. When asked what they could learn from the Legends of Girona video game, the most popular answer was 'facts about history'.

The testers were then asked for an evaluation (from 0 to 5, with 5 being the most positive rating) of certain elements of the game - both technical and educational - in order to find out which aspects worked well and which did not. The average ratings are shown below and the overall results are quite good: Out of 15 different elements, only one received an average rating of 3, which was the lowest rating; seven scored between 3.5 and 4, and the remaining eight all received average ratings above 4.

The average ratings for different elements of the game were as follows:

Element of the game	Average rating
how the game works	3.9
general evaluation of images, scenes and characters	3.7
the adventure, the game plot	4.0
playability	3.5
game stability	4.1
use of commands and controls	3.6
the instructions given	4.1
general quality of images	3.6
quality of present-day Girona graphics	4.3
quality of medieval Girona graphics	4.2
voices	3.9
music	4.1
texts	4.4
speed of response when required to act	3.8
correct treatment of failures by central character	3.0

Table 1. The opinion of the Testers: average scores from 0 to 5, with 5 being the most positive evaluation, for different elements of the game

Finally, testers were asked for a global evaluation of the game and the average rating given by the testers was 4.

The testers were also asked to make suggestions about aspects of the game that they thought could be improved. The commonest suggestions were: to improve the graphics; to provide the option of a male or female central character (at present, players can only choose a male character); to include other characters, i.e. townspeople to appear in and around the streets of present-day and medieval Girona, and finally, to make the game area more spacious, allowing more freedom of movement for the character to go anywhere the player wants to go.

4.4   Overall assessment of the results obtained

Despite the fact that testers' opinions were generally positive and the evaluation scores were fairly high, a closer look at the evaluation of certain aspects indicates room for improvement, i.e. certain tweaks to the game that need to be carried out.

Among other things, we will analyze how the game deals with mistakes made by the main character (i.e., when the player fails in his/her task) as this was the aspect that received the lowest score. Probably the fact that the player is simply returned to the last checkpoint is not a good solution. Especially in the more difficult parts of the game where the player can easily try and fail several times as this will always cause the player to have to restart over and over again from the same place.

We will also analyze the game's ease of use. Although it was given a higher than average rating of 3.5, we believe this aspect can be improved since making the game easier to use will increase motivation and reduce boredom.

Another of the aspects that had lower rating was the use of the commands and controls. Although this game uses the classic combination of keyboard and mouse, the possibility of providing more control through, for example, a gamepad should be considered.

Finally, it should be remembered that only the first of the legends of this game has been developed so far. The complete set will include a total of seven legends, i.e., seven adventures. Therefore, gathering and analysing the data of these initial surveys will provide us with valuable information. Our starting points when developing the rest of the legends in the game will be more advanced than the point at which we began to develop the first legend. All in all, the learning process provides constant feedback to the process as a whole.

5 CONCLUSIONS

Video games are just one expression of the profound changes society is experiencing: technological advances, the importance of images and multimedia, the control and processing of information, interactivity, speed and access to digital resources, etc. Video games have become one of the main sources of fun and entertainment for children, young people and adults. The results of our preliminary study [2] on video games confirmed that it is possible to use video entertainment within a formal educational environment for educational purposes. We therefore set out to develop one. The process of creating a *serious game* is laborious and requires close collaboration between technical and pedagogical teams working together.

Testing and evaluation, which involved a large number of people, provided the information needed to make the final adjustments to the game and prepare it for possible exploitation and/or marketing. Figure 4 shows the poster presentation of the prototype of the video game, Legends of Girona.

Figure 4. Presentation poster of the video game, *Legends of Girona*

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