

Q-BAT: A CUSTOMIZABLE VIDEOGAME FOR EDUCATION

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Abstract: This paper presents a videogame that can be customized by teachers to create materials for different learning purposes. It is a first-person 3D game that includes challenges the gamer must get through to successfully complete its mission. These challenges are formulated as questions, and can be edited using a simple web-based tool that saves a configuration XML file that is then read by the game. Every learning activity that can be designed as a sequence of questions can be carried out using our game, increasing the students' motivation and probably enhancing their learning experience. In this way, the game, together with the editing tool, can be considered a simple authoring tool for educational game-based activities.

1 INTRODUCTION

Nowadays, the use of videogames to enhance learning is a common practice (Jenkins, 2003) (Van Eck, 2006) (Vogel, 2006), especially in Virtual Learning Environments (Moreno-Ger, 2008).

There are two main approaches to the game based learning: using existing commercial games or developing ad-hoc games for specific learning objectives.

The first one is the lowest cost and least complex solution, although it is not possible to find games for every learning context and goal. It also has the advantage that commercial games are engaging and provide good game experience to the users. An example of this approach can be found in (Lacasa, 2009).

The second approach implies the development of a videogame from scratch, which is a very complex and expensive process, as it is briefly described in section 2. This is normally known as *edutainment*. (García-Tejedor, 2011) describes an example of this approach.

To make the development of videogames affordable for teachers and educational teams, it is necessary to have authoring tools that hide the specific design, art and programming tasks. This paper presents a new solution in this field: a customizable videogame that can be configured by teachers for different educational activities.

The next section introduces videogames development requirements showing the need for

specific authoring tools, and provides a brief analysis of existing ones. Section 3 describes our proposal: a customizable game that may be used for different educational purposes. Finally, some conclusions and future work are outlined.

2 GAME DEVELOPMENT AND AUTHORING TOOLS

The time and effort needed to create a videogame may vary notably depending on the game (from a three people team during several months to a 200 people multidisciplinary team during several years).

The main roles and skills needed are:

- *Designers*: they develop the idea and theme for the game, defining mechanics, game systems, characters, dialogs, etc.;
- *2D and 3D Artists*: responsible for concept art, sprites, textures, terrain images, user interface, models, animation, etc.;
- *Level designer*: they create levels, challenges or missions using specific programs, sometimes tailored by the programmers' team;
- *Programmers*: software engineers that develop videogames or related software, including physic engine, artificial intelligence, gameplay, user interface, etc.;
- *Sound engineers*: responsible for the sound effects and music.

Apart from such multidisciplinary team, lots of

different technologies and tools must be integrated to develop a videogame (see Figure 1). The main tools are game engines which are usually integrated with other middleware solutions to get dynamic physics based animations.

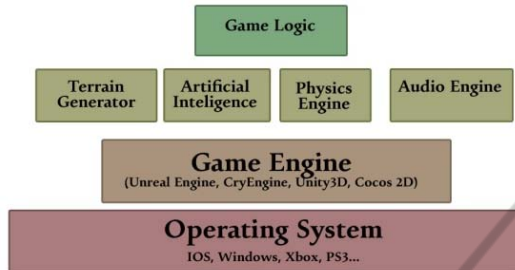


Figure 1: Tools for videogame development.

The idea underneath an authoring tool is simply to allow the development of videogames without having to perform all the tasks ordinary involved in such process.

Authoring tools vary depending on their *flexibility* (ability to create different games, that is, games with different stories, missions, characters, mechanics, etc.) and *complexity* (the technical skills required to use them). From using an existing videogame to developing an original one with a multidisciplinary team and common technologies, there are several options requiring different knowledge and skills (see Figure 2).

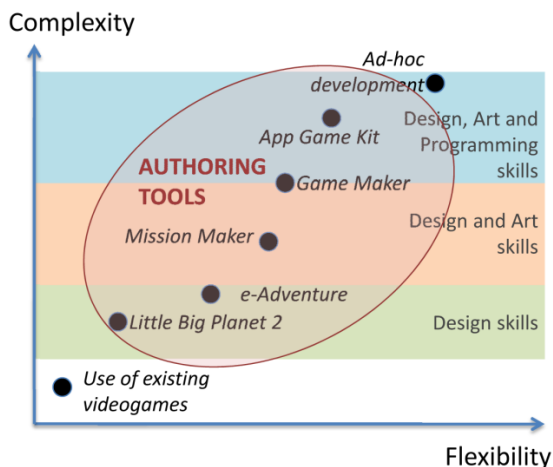


Figure 2: Authoring tools.

Most popular videogames authoring tools are not intended for creating educational videogames, and are not instructor-oriented nor consider educational aspects in the game development. Examples of authoring tools are:

- *Mission Maker*: a tool for students, it lets create 3D and first-person videogames. The

students can select elements from an extensive object library, create and animate 3D characters, import their own music, graphics and video and set rules for game play;

- *Game Maker*: using easy-to-learn drag-and-drop actions professional-quality games can be created, including backgrounds, animated graphics, music and sound effects;
- *App Game Kit*: With its own BASIC script language it makes it quite easy to code videogames for mobile platforms. This tool facilitates portability, but many technical skills are needed to create games;
- *Little Big Planet 2*: It is an authoring tool built into the game with the same name. It allows the development of custom game levels by using assets that are achieved while playing;
- *e-Adventure* (Moreno-Ger, 2005): It is an instruction-oriented authoring tool for educational point-and-click videogames, created with the purpose of reducing development costs for educational games. It takes into account educational features regarding assessment and adaptation. Besides, the games created with e-adventure can be integrated within Virtual Learning Environments.

In general, all the existing authoring tools are quite flexible but complex, as all of them required some skills in the field of game development process and technologies.

3 Q-BAT

Q-BAT is a simple educational authoring tool that provides a first person 3D game (Q-B) that involves as part of its plot a collection of challenges the gamer must get through. These challenges can be edited by the teacher just by filling in a web form. The questions and their answers are saved in a XML file, that is then used to customize the game. So, Q-B can be reconfigured to be used for different educational purposes, for instance to motivate and guide in autonomous learning, for assessment or to promote collaborative learning. In general, Q-BAT is suitable for any learning activity that can be organized as a collection of questions.

The advantages of Q-BAT are, on one hand, the simplicity of the teacher editing tool (the only teacher required skill is to formulate "interesting" questions), and on the other, the game genre, which has been designed in order to make the game experience immersive and engaging, focusing

primarily on this experience instead of educational aspects.

3.1 The Game

The objective of the game is to get out of a building before dying. To do so, the gamer must get through a collection of challenges. In his way to the exit, the gamer comes across some boxes which display the challenges to pass. Figure 3 shows one room of the game.



Figure 3: Fire room of Q-B.

Each challenge is presented as a minigame, containing a question and a specific game mechanic to provide the answer. Figure 4 shows an example of minigame: the answer is a number that must be provided by “catching” the light bulbs with the corresponding digits while they are on.

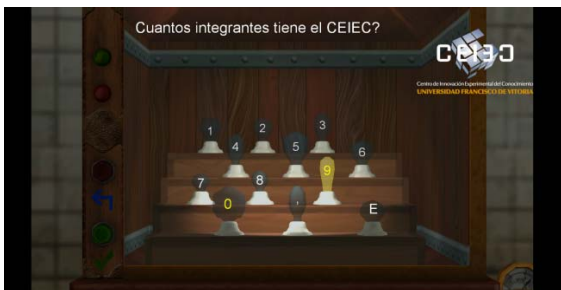


Figure 4: Example of a minigame.

The game has been developed using Unity, a game engine that enables versions for multiple platforms (PC, Xbox, iPad, web, etc.).

3.2 The Edition Tool

As said before, the edition tool is just a web form where the teacher edits the questions and provides the correct answers (see Figure 5).

By the moment, four types of questions are included:

- *numerical*: the answer is a number;

- *textual*: the answer is a name (or a text);
- *multiple choice*: five different options are provided as possible answers, one or more are correct;
- *matching*: five pairs of concepts must be related.

Several different minigames are provided for each question type, being selected randomly by the game manager when customizing the game. For instance, the minigame shown in Figure 4 corresponds to a numerical question.

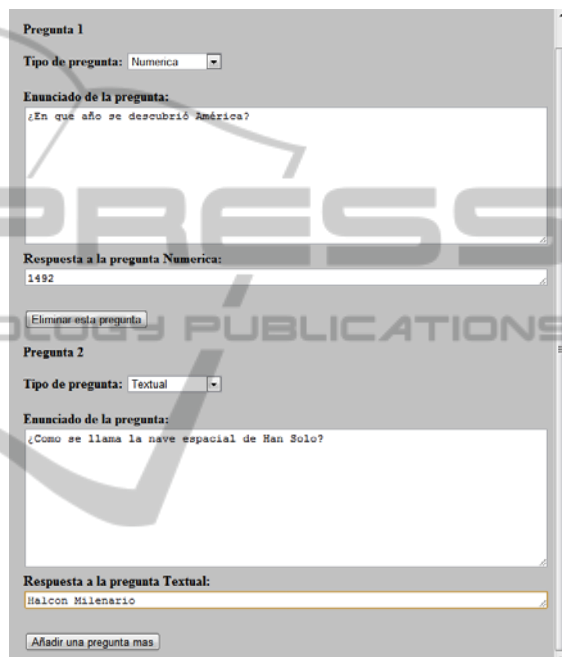


Figure 5: Editing tool.

3.3 The XML Configuration File

"Config.xml" is a file defined in xml 1.0 that allows the teacher to customize the game with the questions he desires. This file is structured with the following nodes (see Figure 6):

- `<questionario></questionario>`: are the opening and closing tags of the file;
- `<pregunta></pregunta>`: is the opening and closing of a question. An "id" attribute defines the number of the question;
- `<tipo></tipo>`: corresponds to the opening and closing tag of the type of question. It can be numerical, textual, multiple choice and matching;
- `<enunciado></enunciado>`: are the labels for the question's statement;
- `<respuestas></respuestas>`: contains all the answers to the multiple choice questions as

well as the first column of the matching ones;

- `<respuesta></respuesta>`: corresponds to each possible answer in multiple choice or matching questions;
- `<soluciones></soluciones>`: contains the correct options in the multiple choice questions, the right column in the matching ones, as well as the solutions to the numerical and textual questions;
- `<solucion></solucion>`: contains each of the possible solutions to the questions.

```

<?xml version="1.0" encoding="UTF-8" ?>
<questionario>
  <pregunta id="1">
    <tipo>Numerica</tipo>
    <enunciado>cuantos integrantes tiene el CEIEC?</enunciado>
    <soluciones>
      <solucion>9</solucion>
    </soluciones>
  </pregunta>
  <pregunta id="2">
    <tipo>textual</tipo>
    <enunciado>que significa las siglas CEIEC?</enunciado>
    <soluciones>
      <solucion>centro para la innovacion experimental del conocimiento</solucion>
    </soluciones>
  </pregunta>
  <pregunta id="3">
    <tipo>Relacional</tipo>
    <enunciado>Relaciona los siguientes conceptos</enunciado>
    <respuestas>
      <respuesta id="1">1</respuesta>
      <respuesta id="2">2</respuesta>
      <respuesta id="3">3</respuesta>
      <respuesta id="4">4</respuesta>
      <respuesta id="5">5</respuesta>
    </respuestas>
    <soluciones>
      <solucion id="1">1</solucion>
      <solucion id="2">2</solucion>
      <solucion id="3">3</solucion>
      <solucion id="4">4</solucion>
      <solucion id="5">5</solucion>
    </soluciones>
  </pregunta>
  <pregunta id="4">
    <tipo>Multirespuesta</tipo>
    <enunciado>Cual de las siguientes respuestas son las correctas?</enunciado>
    <respuestas>
      <respuesta id="1">uno</respuesta>
      <respuesta id="2">dos</respuesta>
      <respuesta id="3">tres</respuesta>
      <respuesta id="4">cuatro</respuesta>
      <respuesta id="5">cinco</respuesta>
    </respuestas>
    <soluciones>
      <solucion id="2">dos</solucion>
      <solucion id="4">cuatro</solucion>
    </soluciones>
  </pregunta>
</questionario>

```

Figure 6: Example of a XML configuration file.

4 CONCLUSIONS

The challenges of the twenty first century education make it necessary to incorporate new strategies and tools in the teaching and learning process. Videogames became a very interesting option, as they combine traditional game-based learning benefits with new digital media, more familiar to our students.

There are authoring tools for creating videogames easily, with low cost and in short time. But teachers usually lack the technical skills needed to use them.

We have developed a first-person 3D videogame that includes challenges that can be edited by teachers with a simple web-based tool. These tests can be used to introduce some educational aspects in the game, and so the same game can be used for different learning purposes. In this way, the game together with the questions editing tool constitute a very simple authoring tool for creating educational

videogames.

Q-BAT is so far a basic platform for researching purposes. Future work is focused, first, on validating the interest and usefulness of the Q-B game in supporting learning and teaching. Then new research lines will be opened, to include minigames with mechanics adapted to specific problems, to add “help” facilities during the game to provide information and educational contents, or to integrate Q-BAT within Learning Management Systems.

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