Serious Games: Between Training and Entertainment

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Abstract— **The game industry has suffered an impressive explosion of popularity, becoming the largest entertainment industry in the world. Games have become a sophisticated extension of the reality and an interesting way for complementing human mind utopias. Training software allows the trainee to immerse in quasi-real controlled situations that could be measured by trainers. In this work we discuss the duality existing between the training based on a serious game and a simple game, based on state of the art technologies. Then we show a training system for telecommunications technicians based on a combination between serious games and "traditional" e-learning platform.** *(Abstract)*

Keywords-component; games, serious games, e-learnning, training software.

I. INTRODUCTION

The term Serious Game sound like a contradiction; play is about simulation, a game is fun, pleasant and free. Then the question is: How can a game be serious? To take something seriously means that you are talking honestly and it is well known that in a game you have to lie, knowing that you are lying. It differs from a "true lie" because all the people involved in the game know that you are lying, because it has been arranged from the beginning [4]. However, if the game is used with a specific finality, beyond the game itself, then we can say that is a Serious Game [7].

Generally speaking, the game searches for the satisfaction of the player [5]. Any additional consequence is far beyond the game finality. It means that the use of this recreational experience with a learning goal, then we are talking about serious games [7]. This special kind of game has shown an especial interest in the consequences of the game, conceiving those experiences as training processes or development guides [3]. Playing is a quite fun way of training, is the way as a lion learns hunting. Without training games, perhaps a young lion will not survive, or die while learning. Another example of this kind of "Serious Games" is combat pilots, because you cannot train a pilot in a real combat without a high risk of losing human lives or pay a high cost. A previous simulated training process is quite important, before passing to the real life. Simulation conditions are quite real, but simulated. If the plain crashes, nobody gets hurt. One of the characteristics of a serious game is that the goal is a serious one; they are not designed for leisure or entertainment but for learning.

Otherwise, conventional training software does not consider the user preferences or interest. They presume that if a user is using the software, then he needs to learn about such issue. For this reason, there is no interest for developing an "emotional" interface. Perhaps boring is one of the premises of this kind of software, converting these developments in a digital version of a traditional lecture imparted in a classroom. Finally the result is a new format for teaching, not a change in the learning process where the human contact is lost and the potential of new virtual media is not exploited.

In this paper, we discuss about the use of the concept of serious game for training, try to suggest some differences between serious games, training software and entertainment games. We describe some characteristics of a serious game and show a serious game for learning telecommunications and an evolution of such game in a training tool used for training technicians in Radio Frequency related activities in the field.

The paper is organized as follows: Section II, discuss aspects of training software and serious games; in section III, we discuss the evolution from entertainment games to serious games; in section IV, we propose some characteristics of a serious game; in section V, we briefly describe a serious game previously presented [5]; in section VI, we describe a training tool based on serious games and finally the conclusions and further work.

II. FROM TRAINING SOFTWARE TO SERIOUS GAME

A training program or conventional education, like used in lectures, typically use a behaviorist approach; i.e. the system guides the student through a series of pre-defined steps which goal is to take the student in a "A" grade of knowledge or competence and lead him to a competence "B", guiding the student through a series of steps or data that lead to the same final point, using almost always the same predetermined way. Behaviorist approach knows the learning goal and the shortest way to guide the apprentice to reach the goal.

On the opposite side, the constructivist approach gives more relevance to the learning experience than the way from A to B. The learning experience is more important than the knowledge itself. The learning goal is important but not the most relevant. The ways to reach the goal have the same importance than the goal. The apprentice experience during the learning process is quite important as the learning itself.

Then, the serious game is proposed as a tool with a constructivist approach, where the immersion grade is high enough as in real training process. Besides, the player (apprentice) is influenced with an emotive load and surprising situations, exploiting the advantages of virtual media and gaming technology, with it sensorial richness.

The basic idea is that serious games act in similar way as entertaining games. A good example of this kind of games are Flight Simulators, originally designed for pilot training but later used also for entertainment to add other aspects such challenging missions. The difference is only the goal of the game: Training or leisure.

III. FROM ENTERTAINMENT GAME TO SERIOUS GAME

An entertainment game just seeks the experience of playing itself. If some abilities are acquired with the game, is not relevant. Meanwhile, a serious game has a challenge or an objective (or a dream), consisting on generating knowledge from the user experiences.

In this way, in a serious game, the practitioner must lead their own process. Is sitting in front of a computer and his dialog is with a computer, not another person. Besides, insert the user in a context or simulated situation, which have as a characteristic to be based in real facts and try to emulate real situations with good fidelity. Perhaps, this is the main difference between a serious game and an entertainment game. A serious game needs real data and

accurate results, similar to those got by a player in the real world; meanwhile an entertainment game does not.

Likewise, a serious game requires a high interaction grade; the user is leaded to participate with a high grade of control, making it impossible to be passive respect to the game: if the user does not involve itself, the game does not work. In this way, the learning experience begins with a real situation, but without the risks of the real consequences of a real training, being: interesting, surprising and even fun. Finally, it is a good fusion between an emotional experience and knowledge acquisition.

IV. SERIOUS GAME CHARACTERISTICS

Serious game has both entertaining game and training software characteristics. A serious game is aware of the consequences (the learning process), real data and the accuracy of the results, in a similar way as training software, besides of the contextualization and the player activity, as in entertainment games.

A serious game emphasises:

- User experience (self lead) and high interactivity
- Player requirements: knowledge, capacities, skills, venturing
- Software requirements: precision and data and images processing capability
- Visualization requirements: efficient management of content and development of an attractive and friendly interface
- Simulation using real data: situation predictability
- Specific object: results are important

The table 1 presents a comparison between entertainment games, serious games and training software.

TABLE I. COMPARISON BETWEEN ENTERTAINMENT GAMES, SERIOUS GAMES AND TRAINING SOFTWARE

	ENTERTAINMENT GAME	TRAINING SOFTWARE	SERIOUS GAME
Goal	Nothing further the pleasure, fun and entertainment	Learning , skills and knowledge aquisitions	Player training
User requirements	venturing and skills	Knowledge and capabilities	Knowledge, capabilities, venturing and skills
Interactivity	High (could be difficult) more challenging implies a better experience	Low: more easy is better.	High level of player interactivity
Visualization requirements	Efficient management of content, development and an attractive interface	Friendly interface	Efficient management of content and development of an attractive and friendly interface.
Software requirements	Fast processing of dynamic data and images	Evaluation from comparisons with real data	Precision: comparisons with real data simulation. High data and images processing capability
Methodology	Surprise and interest	Clear and predectible	Surprise, interest and clarity

V.   A SERIOUS GAME: COMCITY

COMCITY [2],[5], could be considered a serious game, because it has been conceived as an educational game; it is supported in real environments and has a mix between reality and entertainment. In COMCITY, game engines capabilities are fully exploited in order to obtain a dynamic environment, with a rich experience, and, at the same time, introduce the student to complex concepts related with wireless planning.

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Figure 1.   Avatars of propagation models in COMCITY

At the same time, the game absorbs the complexity of the mathematical propagation models like avatar or characters in the game (Figure 1), related with the mathematical behavior of such models. Besides, it is supported in real maps, obtained from Digital Terrain Models from real cities that usually represents a challenge for radio planning. All these features are linked with several missions, oriented to improve the abilities of the player.

Moreover, the game is supported by a real planning tool [1], the results are similar to those obtained from a commercial planning tool (Figure 3), like those used by mobile operators. Towers, antennas (Figure 2) and other elements are modeled with high realism. In this way the concept of a serious game is fully applied to this tool.
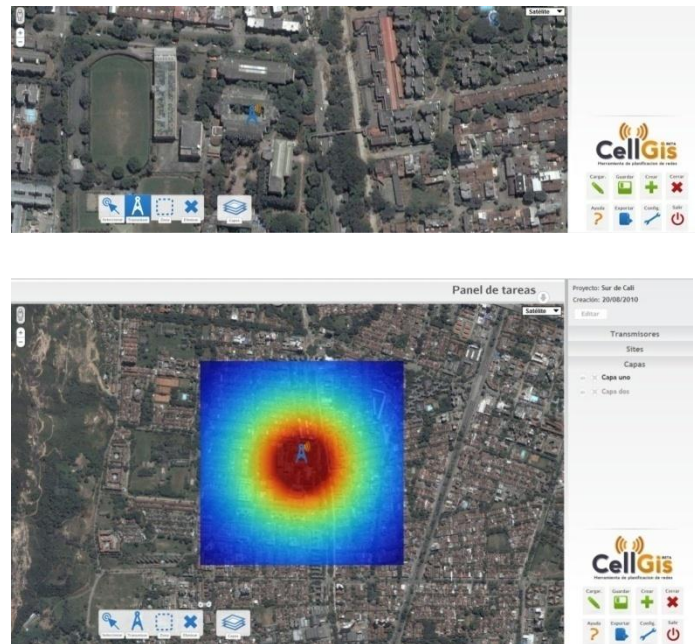

Figure 2.   An example of 3D models of antennas
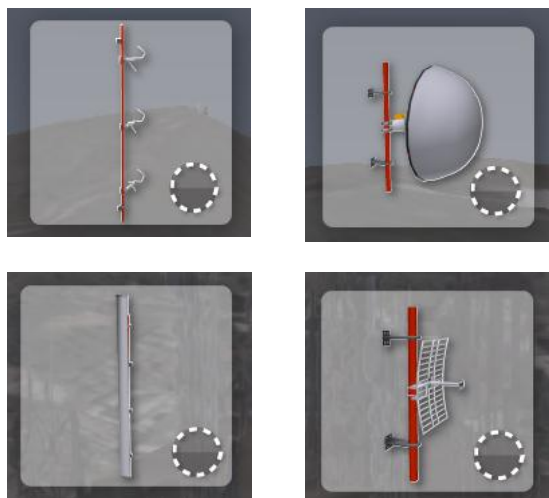

Figure 3.   Results from CellGIS Planning Tool

VI.   SERIOUS GAMES AS TRAINING SUPPORT: TEST

From the experience obtained with the development of COMCITY [5], we begin the development of a training system for radio technicians that develop activities in the field, as installations or technical surveys on radio stations. This work requires some specific skills, and then the system has some specific requirements. This system was called TEST (TESAmerica Software Training), from the name of the company that will use it.

TEST is a series of "virtual learning objects" running on a learning platform that combines serious games with training software. The goal of the system is to train people for a specific job and evaluating the most qualified people for the field job. TEST is in part an application of COMCITY for specialized training.

In order to complain with TEST requirements, we modify some aspects in COMCITY, specifically some missions and scenarios with problems oriented to some typical task that the trainees will perform in their field jobs. In these missions, the trainee must solve problems related with radio technologies (Wimax, UMTS, etc), antenna type (panel, monopole, dipole, etc) and frequency bands.

For example, in the antenna identification mission the player must solve eight cases (Figure 4), including: telecommunications support to the army, coverage of a transmission of cycling tour and restore communication for the public transport service. The player navigates between cases and by selecting the most suitable antenna for each case, taking into account: environmental conditions, radio technology needed and available frequency band (Figure 5).

Figure 4.   Cases for antenna identification mission

In this serious game, we try to reproduce real situations that the apprentice will face in their real activities, preparing them to recognize potentially dangerous situations. Each activity that the player executes is associated with typical activities performed in real situations in remote areas where the trainee will work in a future, if the training is successful.

In this way, the player (trainee) makes associations between real objects that will find in a real situation, but through simulated situations in a 3D environment.

VII.   CONCLUSIONS

Serious games are an excellent tool to acquire new knowledge and an approach to real skills, applicable directly in job environment.

Figure 5.   Capture of a mission for antenna identification

TEST has become is an excellent experience for the creation of mechanisms for training and evaluation of candidates. Expected that the candidates are to carry out the training process and meet the assessment objectives have an excellent performance in field.

The maturity of development tools influence the use of 3D games and allows designers, developers and educators to find a common place to obtain important results in knowledge generation.

The simulation of real situations gives us an efficient and inexpensive way to training by experience.

The experience in the creation of serious games in COMCITY and TEST, allowed transform the complex concepts of an area of knowledge and make them available to students in ways simple and striking, in a multimedia environment that involves different learning styles. It is expected that the outcome of this process have a positive impact on the acquisition of new knowledge by students.

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