The Serious Game SimPort: Overcoming Technical Hurdles in Educational Gaming

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Abstract

SimPort is a multiplayer serious game in which the aim is to develop a new seaport area in 30 years of simulated time. It is played in a network of computers, each with its own role and set of tasks. The game has been played for over two years now, but some issues still remain. Playing SimPort should be about the content and not a challenge on getting to know the computer game. This paper describes the issues faced during the development of SimPort with respect to videogame illiteracy. It goes on to discuss the different approaches used to solve various aspects for multiple target groups. These solutions result in a smoother gaming experience, and should allow for better learning in future courses.

Keywords

SimPort, Videogame Literacy, Tutorial, Gaming

1 Introduction

The presence of serious computer games in modern teaching environments is increasing. This means that more people with little computer gaming experience are being confronted with this medium. Serious computer games can have a beneficial effect on the learning experience, but this depends on whether the learner in question is able to fully use the game. Therefore, it is important that steps are taken to overcome the lack of gaming experience. This paper will give an overview of the state of the serious computer gaming art (2) and difficulties commonly associated with computers and gaming (3). The authors developed a serious computer game named SimPort (4), which will be used as a basis for the rest of the paper. It will show its effectiveness, but also demonstrate how the lack of gaming experience significantly affects that same effectiveness. Several solutions are discussed for overcoming this problem (5).

2 Serious Gaming

Many different definitions of serious games are used within the serious games community. Bergeron, for example, has the following definition of a serious games: An interactive computer application, with or without a significant hardware component, which has a challenging goal; is fun to play and/or engaging; incorporates some concepts of scoring; and imparts to the user a skill, knowledge, or attitude that can be applied in the real world [Bergeron, 2006 p.xvii]. Michael and Chen [Michael and Chen, 2006] comes to the following definition: "Serious games are games that use the artistic medium of games to deliver a message, teach a lesson or provide an experience (p.23)" According to the Serious Gaming Initiative (SGI) serious gaming entails using "games in education, training, health,

and public policy." Some definitions [Wikipedia, 2004] say that serious games are similar to educational games, because they usually target a higher age group than primary and secondary education. While most serious games are custom made for the genre, such as Darfur is Dying, Food Force, September 12th [Wikipedia, 2004], there a few entertainment games that have also been used for educational purposes, for example SimCity and Civilisation [SGI, 2002]. For the scope of this paper we will adhere to Bergeron's definition.

According to Ben Sawyer [Ben Sawyer, 2005] "the diversity of content (of serious games) is growing and the quality of organizations, developers, and companies participating is also ratcheting up." At this point in time there is a growing need for development of serious games. This is not only apparent in the traditional educational institutions, but even more so in the corporate world. [Te Velde et al., 2007]. For this reason the likelihood of being faced with one of these games in internal commercial course or other educational situations is growing.

3   Computer Literacy

"To fully participate in a high-tech and global society, people should cultivate new forms of computer literacy in ways that go beyond standard technical notions." [Richard Kahn & Douglas Kellner, 2005]. We have observed several challenges when participants play SimPort. The largest cause for these challenges lies in a lack of computer- and computer gaming experience. The current state of computer- and videogame literacy is an essential topic in this case (3.1). After this has been defined we will look at what the consequences of the current state are (3.2).

3.1   Computer- and Videogame Literacy

The computer has placed itself in our life in such a manner that it is nigh impossible to function without the most basic knowledge of how it works. This might seem overly dramatic, but remember that a computer is present in most things we use now a day. According to the U.S. Census Bureau in 2003, 61.8 percent of the households own a computer [U.S. Census Bureau, 2003]. Looking at the demographic groups this number is comparable between the U.S. and the Netherlands [CBS, 2002].

 "Computer Literate: having sufficient knowledge and skill to be able to use computers; familiar with the operation of computers." [The Online English Dictionary]. Some computer literacy definitions narrow it down, saying that computer literacy does not necessarily mean that the user understands how a computer works, but instead has managed to learn how to use it by rote [Wikipedia, 2005]. This type of user can function well within their known computer environments, but lack the understanding needed to adapt to changes. While most studies include these users into the group of so-called 'computer literates', this classification is not necessarily valid.

A specific computer literacy is video game literacy. "According to the United States Entertainment Software Association (ESA), 60% of all Americans age six and older, or about 145 million people, play computer and video games" [ESA, 2005]. In our opinion videogame literacy is the ability to play computer games and understand the basic concepts of gaming, in such way that the player can learn other videogames with less effort.

Over the last years we have played the game SimPort with a diverse group of players, ranging from (international) students from different faculties, to port executives over the age of 50. These groups each face different issues while playing the game, such as cultural backgrounds within international teams. One of the most noticeable problems we observed during the game sessions is the difficulty that older players have in grasping the computer interaction. One possible reason is the videogame illiteracy of this group. From the ESA survey we learn that only 19 percent of Americans over the age of 50 have played, or play,

computer games [ESA, 2005]. When games are used for professional purposes like training, health and public policy these older players will also be part of the gamers. Therefore it is important to realise that some players will experience more difficulty due to lack of gaming experience.

3.2   The Consequences

The effectiveness of computer based serious games is dependent on the computer skills that the learner has in using the game. Many children grow up with at least one computer and computer games; the game generation as Prensky [Prensky, 2001] call them. The current generations of managers are mostly digital immigrants. This means that, as a designer, one may never assume that the learner is an experienced gamer or even understands basic gaming concepts. Ways must be found to lift an inexperienced learner to the level of the standard gamer. If this is successful, the learner can benefit from the serious game; otherwise, the only learning that will likely occur is the learning of how to use the computer game. While the latter will have to be present in every scenario, the art lies in decreasing its percentage within the total effort needed.

Different groups experience different computer based hurdles when playing games. This is mostly related to difference in computer and video game literacy. Other hurdles, like those posed by physical handicaps and language differences, while just as important, fall outside the scope of this paper. For this section we will differentiate between common hurdles and those hurdles that are thrown up due to lack of gaming experience.

The common hurdles can be classified by the general questions "What?" and "How?". Every new game a player faces has its own goals and methods of reaching them. This means that every player will need to learn the steps that are necessary to perform the actions that are specific to that game. Without the proper guidance, a player will spend the first minutes, or worse, hours, finding where everything is in the interface and what they should be doing. This last point is the first hurdle that needs addressing. The first thing a player needs to know in a game is what its goal is. This need not be the actual end-goal, just something that a player can work towards. This should answer the question "What am I supposed to be doing?"

The next step is the "How am I supposed to be doing this?" question, or teaching the player how to work with the interface. The player will need to be taught the meaning of most icons and the flow through the game. The specific goal for this phase is to make allow the player to play the game without having to think about how to do. Some solutions that are prevalent in the game industry is using tutorials or by implementing an assistant to help gamers through their first steps [Gee, 2003].

The developer needs to consider more aspects when dealing with inexperienced users. This extra level of necessary information needs to be transferred to allow this group of users to participate. Once again a subdivision is possible, this time between the computer- and the video game illiterate. Video game illiterate need to be taught basic gaming issues; like high scores and other typical game elements. Though this knowledge might seem intuitive, non-gamers who have never seen these things need to grasp them to be able to play a game, instead of working through a simulation without enjoying themselves.

The computer illiterate person will need to be guided even more. They will face problems when needing to interact with the computer using the basic interaction methods like mice and keyboards. When developing ways to instruct this group the developer must take care to explain information on a very basic level, or risk losing this group of players.

4   The Game SimPort

The serious game SimPort is an extensive management game that was developed over the last two years. In this section we will give a short overview of the game's history (4.1) and present the results of playing the current game (4.2).

4.1   History of SimPort

SimPort has a significant history leading up to its current state. It is based on the flash game SimMV2, which was a combined effort between the Delft University of Technology (DUT) and the Port of Rotterdam. The serious goals of the game were to emphasize strategizing, project management and teamwork and learn about the complexity of the design and building of the seaport extension called Second Maasvlakte (MV2) in the Port of Rotterdam in The Netherlands [Tygron, 2007].

While professionals were the initial target audience, the general objectives also make the game useful for engineering and management students at the DUT.

In the game the task for the players is described as follows:

"Make appropriate planning and implementation decisions, individually and collectively, that will lead to a satisfactory design and exploitation of the Second Maasvlakte over a 30-year period." In this time span five or six players, divided in three roles, have to create the terrains in the port, assign customers to them and effectively create a profitable international seaport.

The game SimMV2 was finished in the summer of 2005 and was received very well. The game sessions were always very active, and enjoyable, though certain technical choices limited the growing potential that the game concept demonstrated. The game was developed as a web-based game, using mostly Flash and Java Enterprise. As the game was played, increasingly more features were requested. This conflicted with the already growing system load and network overhead. The need for a new version became clear.

In late 2006 this resulted in a new version of the game, named SimPort. This version was developed with a larger range of possibilities in mind. Not only was it a more solid and interesting version of SimMV2, it also held the possibility to easily manage different content. This means that the development time of future, similar games will be shorter.

The SimPort core is a Java-based game framework developed by Tygron Serious Gaming, allowing it to run on any system that supports Java 5.0 and OpenGL. These platforms were chosen due to their open nature, large community support and their platform independence. The target groups for serious games were expected to be more likely to use a wider range of platforms than the normal gaming crowd.

4.2   SimPort Live

SimPort has been used in many real-life situations. "Preliminary findings suggest that the game is of high quality, that players enjoy it and find it educational and instructive" [Bekebrede, and Mayer, 2006] was the initial evaluation. This is not only true for the initial target group port experts, but also for other learning situations like higher education.

Observations during the game and the results from questionnaires indicate that the students generally greatly enjoyed the game. The game's degree of immersion was fairly good. It is not uncommon for players to have to be urged to stop for a lunch break, and then find that they have come back early to resume playing. The active presence of two contacts from the Port of Rotterdam in one of the student sessions also seemed to engage the students even more and improve their performance. It triggered interesting discussions and interactions between the professionals and the students, which clearly demonstrated the value of the game for education and training. [Bekebrede and Mayer, 2006]

Each time the game is played a score is calculated to decide how effective the team was in building the new port. This performance score is based on the earnings and the client satisfaction. Both professionals and students have played the game, so one might think that professionals are more likely to have a high score, since these people are more involved in port decision-making.

Target group/audience	Score
Students	140.0
Professionals	157.4
Professionals (Young only)	132.8

Table 1 - Average Score of the teams per target group, Each time the score is compared with the scores of the other session and the best team on a certain criteria recieves 1 point the second best 2 etc. The total score is based on the total points on each criteria. That means the lower the score, the better it is.

When we look at the high score list in Table 1, we see students score slightly better on average, when compared to professionals. This can be resolved to several difficulties that professionals face. For example, professionals know more details on how a port is built. They tend to create extra problems that are not actually present in the game, since a game is always a simpler version of reality. Thinking about these extra problems takes more effort and therefore they tend to run into time shortage.

Another, more persistent, problem professionals face is their lack of familiarity with computers and especially computers games. Students are more used to working with computers and might therefore be quicker in understanding the game in more depth. Getting to know the game and its interface in less time creates a big advantage over competing teams. There are several reasons to suggest this is true. First it is reflected in the team-scoring list. Port teams filled with younger people tend to gain better scores, while teams based on older employees are more likely to have a low score. Also it can be seen in observations made during the game play. Older people usually have extended in depth knowledge of port decision-making but have trouble getting this knowledge into the computer. Questionnaires [Mayer, Bekebrede and Schuylenburg, 2007] filled in by the teams after playing the game also show a higher score on need for extra instructions for this particular group.

5 Technical Hurdles

SimPort is a serious game simulating the development of a new port. It is not, however, a challenge about computer game understanding. To give each team a fair challenge to win the game based on the content, it is important that they understand the game before it starts. This problem becomes more complicated since SimPort is usually played in an afternoon spanning workshop. Furthermore, professionals have busy lives and therefore have limited learning time in advance. To resolve this the game should be very intuitive and have a short learning curve, allowing the players to get to know the fairly complex game in the shortest possible amount of time. In the first sessions, we sent a manual about the game to the players a week in advance. The players could prepare themselves with this document, but we noticed that this manual was not sufficient due to a lack of time and experience. Further, the session starts with a talk about the objectives and some tips for playing, but this presentation also leads to many questions.

To solve these challenges three options are combined in SimPort; User interface design (5.1), game support (5.2) and an extended Tutorial (5.3).

5.1　User interface design

The user interface should be simple and intuitive! This is part of every good computer program development, but always creates difficulties. Many of today's programs are overcrowded with too many options, which the normal user seldom uses. In SimPort this problem is even more challenging since the players usually have only about one hour of instructions before playing the actual game. The simulation model behind SimPort is very complex and takes many variables into account, putting more strain on the learning time. The simulation model is kept inside the framework on the server. The players interact with it through the user interface by means of certain variables.

Deciding which variables to edit and which to make visible is part of creating a good user interface. In SimPort multiple roles represent sections of the port authority, all with their own set of tasks. These roles all have their own special tab in the user interface. Examples of roles are planning buildings or negotiating contracts. Within the team players can now specialize in one role of the game and communicate by means of a team's general director. Still, within each role there are a lot of variables to consider, of which some are more important then others. This is a process of trial and error where the game is constantly being reshaped after playing it with new teams. Certain things are left out and others are introduced. SimPort, for example, makes use of a lot of lists with multiple columns. These columns are always a selection of about three variables out of many more.

Besides limiting the amount of visible variables, the buttons representing the commands in the game are fairly large and limited in amount. To give players extra information a tool tip was added to every button.

Figure 1: The SimPort Interface

Limiting the amount of visible variables means that the team does not have total control over the situation. This is however also the truth for real life port development at the Port of Rotterdam. Where building a new port extension is very complex and it is difficult for a large organisation to control all details.

5.2　Game support

The game interaction is done exclusively through the computer. However much of the team decision-making is done outside the computer. The teams spend a lot of time discussing options on how to build the port. In reality, building a port is also a lot of teamwork within different sections of the port authority. These sections are represented in the game by three networked computers logged into a server.

To support this decision-making, SimPort has several options. First there is a lot of paper-based documentation. Much of this information can also be found in the computer but most

people prefer reading of paper. There are also magnetic boards where players visualise the various ways through which to build the different terrains. Doing this outside the computer makes it possible for the team to stand around one table and stimulates discussions.
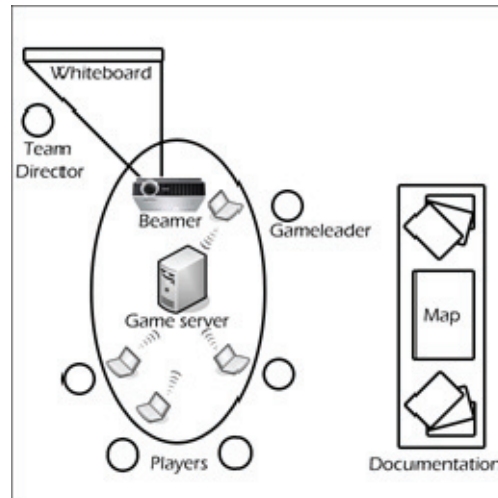

Figure 2: SimPort session seen from above.

Secondly a beamer projects the current state of the port onto a large whiteboard. This projection should be seen as a current view outside the window of the port authority's building onto the new port. Using markers the team director can easily appoint certain areas to customers and show it to the entire team. This has the added benefit of allowing other competing teams in the same room to view the team's progress.

Finally one important role rests in the hands of the game leaders. Every team playing SimPort has one game leader that can control the game from his or her computer. The leader can load/save games and set game speed, but also influence the economy or customer reactions. This way it is possible to sometimes help the team when they are in trouble or make the game more challenging when all goes well. The game leader should therefore understand the game thoroughly to best support the players.

Next to this guiding task, the game leader is there for questions. A lot can be explained inside the computer or documentation but there will always be questions about certain unforeseen things. The game leader can answer these but also raise awareness for things the team might have forgotten to think about. A good game leader can therefore create the best game experience.

5.3   The tutorial

SimPort needed to overcome the initial playing challenges. This became especially evident in evaluations with the players. These showed a common need for a start-up round. To this end we developed an interactive tutorial. This tutorial is set up to be useful for all levels of experience. An inexperienced gamer is led through the different steps in the form of foci, which point the gamer to the area that he should interact with. These foci do not appear immediately. This is to give the users the chance to find the correct interaction themselves. The benefit here is that it does not dumb down the experience, thus not frustrating the more experienced users. A lot of explaining is done during the tutorial. To transfer this knowledge the tutorial uses two modalities: visual support in the form of text and images and spoken text supports each step of the tutorial. Teachers can edit every step in the tutorial freely, giving them the possibility to create custom tailored tutorials. The advantage of being able to freely change the tutorial is that subjects can be highlighted or expanded to conform to the course subject matter. Over the last year SimPort has proved its relevance in several different courses at the DUT. By adapting the pre-game lecture, the game was used effectively. The flexibility of the tutorial can support or supplant this pre-game lecture.

This solution can be deployed in two ways. The first way is to allow users to take the time to play the game at home and move through the tutorial without time constraints. The second way is to reserve time for the tutorial before the actual game session. In this case, due to the limited playing time, the players will need to complete the tutorial within a maximum amount of time. This introduces new difficulties. An advantage of the first method, especially in corporate settings, is avoiding the potential for losing face.

Instead of integrating the tutorial within the program, it was designed as an extra layer around the already existing game. This allows for quick adaptation of the tutorial without running the risk of influencing the core game. The tutorial is set up to listen to the game events that were already present. By defining which events should be reacted to, the tutorial can be guided in any necessary direction. The tutorial should not be a passive learning experience, as this would be too stark a contrast to the very active aspect of the rest of the game.

6   Conclusion

When playing serious computer games the developers need to face the problems surrounding video game illiteracy. This is especially true for corporate setting where most people are digital immigrants. For the game SimPort these challenges of overcoming the technical hurdles have resulted in an efficient user interface and extensive game support. These solutions have seen multiple iterations in the two years since the game was first played. Every new interaction has been tested internally and with the target audience. Through evaluating the session the developers have the opportunity to further improve the game by adding or improving functionally, and by deleting it. Player questionnaires show that this makes the game easier to control today then at the start of the project. The tutorial is nearing completion and will be used extensively over the coming year. This should bridge the gap between the video game literate and those who are not. Thus giving everyone a fair and enjoyable chance to tackle the challenges posed by the content.

References

Bekebrede, G. and Mayer, I., 2006, 'Build your seaport in a game and learn about complex systems', J. Design Research, Vol. 5, No. 2, pp.273–298.

Bergeron, B.P. (2006). Developing Serious Games. Hingman, Charles River Media, p. xvii.

Gee, J.P., 2003, What video games have to teach us about learning and literacy, Palgrave Macmillan, pp.114-117.

Kahn, Richard and Kellner, Douglas (2005), Reconstructing Technoliteracy: a multiple literacies approach.

Centraal Bureau voor de Statistiek, 2002, Sociale ongelijkheid achter het scherm

Entertainment Software Association (ESA), 2005, 2005 Essential Facts & Game Player Data

U.S. Census Bureau, 2003, Computer and Internet Use in the United States: 2003.

Mayer, I.S., Bekebrede, G. and Schuylenburg, M., 2007, SIM Maasvlakte 2 – create your own future! Een spelsimulatie over het ontwerpen en bouwen van de Tweede Maasvlakte (2007-2037).

Michael, D. and S. Chen (2006). Serious Games: Games that Educate, Train, and Inform. Boston, Thomson Course Technology PTR.

Online English Dictionary, The, http://www.oed.com.

Prensky, M, 2001, Digital game-based learning, McGraw-Hill, pp.35-65.

Sawyer, Ben, 2005, The State of Serious Games, http://www.gamasutra.com/features/20051024/sawyer_01.shtml.

Serious Gaming Initiative (SGI), 2002, http://www.seriousgames.org/.

Tygron Serious Gaming, 2007, Simport Game, http://www.simport.eu/

Velde, R. ter, Brennenraedts, R., Kaashoek, B., Seger, J. 2007, Serious Games Crosssectorale Technologie- en marktverkenning.

Wikipedia, Computer Literacy, 2004, Serious Game, 2005