

# **Serious Games**

**Learning skills by means of computer games**

**A.J. Voortman**  
**Bachelor Computer Sciences**  
**Vrije Universiteit Amsterdam**  
**Student id: 1333402**  
**voortman.bram@gmail.com**

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## **Abstract**

Serious Games is a research project in search for games which are developed to have a positive influence on our society. These games are not made for entertainment alone, but to learn people specific (social) skills in combination of playing a game. The research will include evaluation of different games currently on the market or in development. This evaluation will look at how the games influence the society, what platform the game uses and what the developers (expect to) have as result. Concerning the development of serious games this research also includes a survey of specific game engines developed for serious games and the trends concerning serious games.

## **Keywords**

Serious Games, Game Engine, Trends, Education

## **Introduction**

Computer games are very popular. Today you can choose between millions of games with lots of hours of fun. Through the years computer games have evolved from text based games to fully-fledged 3d environment games with surround sound. The diversity of the games has also changed. In this research we will discuss a specific category of games, the 'Serious Games'. A serious game is a game with more than just the element of fun. The term serious game can be implied as: 'computer and video games that are intended to not only entertain users, but have additional purposes such as education and training'.

This research is a survey of the current games available, what platform they use and what their expected social impact is. As there is a large amount of serious games this research will focus on games that create awareness for problems, improve psychological health, teach to cope with health problems, teach social skills, overcome fears, and even physical training. Concerning the development of serious games this research involves the analyses of current trends. Also a summary of game engines specifically developed for serious games will be presented.

# 1 What are Serious Games

In this Section the term serious games will be explained. In short we will describe the elements of a computer game. Then we will look at what makes a serious game, followed by the category of serious games described in this paper.

## 1.1 *Computer Games*

When looking in the dictionary a game is defined as: ‘an activity which is relaxing with defined rules and elements like imagination, competition, dexterity, insight and chance’ Out of experience many games also have an element of time, where you have to complete objectives in a certain timeframe. There is another definition of a game as: “any contest (play) among adversaries (players) operating under constraints (rules) for an objective (winning, victory or pay-off)”, Smith (2002). He points out that the objective is part of the game, in a game there has to be a goal to be achieved.

When looking at these definitions they are general elements of any game, not specific to a computer game. A computer game is a game played on a computer, console or other computer like system. The definitions given about a game also apply to computer games. Concerning computers there is another distinction, between games and simulations. When looking at the previously stated definition a game needs to have a goal, which is not always present in a simulation.

Prensky also makes a distinction between simulations and games. From his opinion simulations focus on a thing or process and try to copy the reality, the purpose of a simulation is practice. Games focus on user experience, including fantasy and the purpose of games is entertainment. Another distinction between games and simulations is the sort of goals you have to achieve. A simulation has no strict goal you have to achieve, they are more like personal goals, Prensky (2001). In a game the goals are more specific, you have to complete objectives to finish the game or a level. However a simulation and a game can be combined, meaning that both elements are present in a game.

## 1.2 *Serious Games*

Now that we have defined what a computer game is, we will look into serious games. While searching the internet there is not one definition of serious games, although there are elements described of a serious game. In a serious game the element of fun is combined with a serious message or an education scheme for changing behavior or learning new competences. The game makes use of the element of fun to make the process of learning more enjoyable, comparable to the educational techniques used to motivate students during classes.

Serious games are not to be confused with advert games. Advert games are games developed by corporations, to promote their company or product. By implementing a message, which is positive about their company or their product, people will learn this message while playing. It is a scheme of advertisement where the message is hidden in a game. The focus is not on teaching, but on convincing people to agree with their message.

Another type of games is persuasive games which can be applied with serious games and advert games. Persuasive games are designed to change attitudes or behaviours by making desired outcomes easier to achieve, Khaled (2006, p 1). The persuasive element can have a negative impact, for instance convince people with a false message in the form of a game. A serious game meant to make people aware of a social problem, could contain a worldview of the creator, which might not be true. Though the persuasive element can also be used to activate people in for instance physical activity.

In the category of serious games are numerous sorts of games, most serious games learn skills like languages and profession skills. These games are very popular, in this research however we will discuss another kind of serious games. Games that create awareness for problems, improve psychological health, teach to cope with health problems, teach social skills, overcome fears, and even physical training. Most of the games presented in this paper are developed for 'lay people' and not for professionals.

## **2 Why use a computer game**

In this Section we are going to look at the advantages of using a game for educational purposes. The advantages are categorized in five elements, which are important stimulators for education.

### **2.1 *Interactive***

Games are environments specifically designed for players to experience interactively through play, Stapleton (2004). The player decides what to do and has control over what happens on the screen. The interactivity created by the game can be a part of the learning process. Most teachers use techniques to make their classes more interactive, as result that the students pay more attention. When a teacher has the attention the material discussed will get more ground, as the interaction makes the student more focused on the material.

It is commonly known, when learning a person has to be motivated, which is not always the case. There has to be a connection with the ideas and material, Prensky (2002). A game could make this connection, by making the subject visible. You can create real life situation in which the study material must be applied, this in turn will make the subject more visible. This will make the learning process less abstract and more practical.

### **2.2 *Addition element of fun***

The element of fun is an important part of the serious games. Without this part it would not be a real game, for a game is usually played for fun. The element of fun creates an extra motivation for people to learn. If one is enjoying the material he has to learn, it will be easier start learning and continue the process, Prensky (2002). Also if a game is fun, people will spend a lot of their available time playing the game. This will increase the effectiveness of the learning process. This is another way to motivate the player to start learning.

### **2.3** *Widely deployable*

A computer game is mainly software, with possibly some extra hardware beside the personal computer to operate the game. Software is a product, which is widely deployable with the current technologies like the Internet and portable storage devices. As the Internet is available almost everywhere in the world, the software can be distributed all over the world.

This means that if a serious game does not need any special hardware, the game can easily be used all over the world. Especially for games that are meant to make people aware of problems, or educating society, the prospect of widely deployment of the game is important. The more people who are reached, the more chance the message will have effect.

### **2.4** *Autonomy*

A game presents a learner centered approach to learning, instead of a teacher centered approach, Stapleton (2004). When using a game for the process of learning the player can learn at his own time and speed. The player is not bound to specific time of classes but can play whenever time provides. Making it easy to start the game, knowing you won't have to continue for two terms. You will have full control on when you start or when you want to do something else. Even when the games can only be played at an institute, the player has full control on what happens on the screen and how fast he will progress through the game.

### **2.5** *Safe environment*

When playing a computer game, there is no risks of what is inflicted in the game, too pursue you in real life. This of course with the exception of computer inflicted diseases like RSI. The safe environment gives people the opportunity to experiment with different approaches. Simulators are based on the existence of this safe environment, this way people are allowed to make mistakes. Like when learning to fly, you start at a simulator, where you can learn the basics without jeopardizing your own or someone else his life. This element of a game is especially useful when used for psychological help, as the threats and worries are not really present in the game, Coyle (2004).

## **3** *Trends in serious games*

### **3.1** *Casual games or hardcore games*

A common trend within video games is that there is more focus on casual games. Casual games are games that do not require the player to have intimate knowledge of the game or to spend a lot of time on playing the game. The whole idea of video games started out with casual games, like pong. The controls were simple and everyone without knowledge of the game could play it.

As the market for games grew and new techniques emerged, there arose new type of gamers, the hardcore gamers. They spend a lot of time playing a game and required higher graphics and higher difficulty of gameplay. This resulted in the hardcore games, games that take a lot of time to play and also more knowledge on how to play. The focus is on using more realistic environments and graphics to make the game more challenging.

Within casual games there are two main categories. First there are the downloadable casual games, which are usually 2d environments where the action takes place on the screen. The other category is the casual games with a mimetic interface, which consist mainly of 3d environments where the action takes place in the user space and continues on the screen. An example is the Nintendo Wii, where you make the movement in front of the screen like throwing a bowling ball, and the rest of the action resumes on the virtual environment, Juul (2010).

When looking at serious games, today you see a lot of development on de mimetic interface, especially concerning health games. To improve physical health there has to be physical movement. For example, the Nintendo Wii has his own game called Wii Fit<sup>1</sup> which is focused on training exercises at home. By use of an interface the balance board, which measures weight and the place where the force is placed, the game can give feedback on how well the exercises were performed.

Downloadable casual games are also popular for serious games, as it has wide promotion and usability over the internet. The games are easy to play and you are not obliged to play for a long time, which support the autonomy of the player and makes the game accessible for more people. Concerning games that make people aware of circumstances, it is important to reach a wide public.

Concerning hardcore games, this type is also applicable for serious games. When considering professional training with difficult scenarios, it is important that the player spends more time on the game and on acquiring knowledge. As the scenarios would be more difficult the game will consist of more possible actions that can be performed. For instance when using a game to train a surgeon, it is important that the game is realistic. Or considering a flight simulator, where the player has to get as close to reality as possible, which cannot be implemented as a casual game.

### **3.2 *Social Networks***

Serious games already make use of social networks by starting their own community. An example is Virtuagym, which uses a community as motivation for people to play the game. When you can play a game together with friends, you will have a social interaction while playing. Most video games today have a great focus on the multiplayer aspect, because this will endorse the continuation of a game,

A new market for serious games could be making use of existing social networks like Facebook. Technically it would be possible to implement a serious game with Facebook, using the facebook API 3D games are also an option<sup>2</sup>. By making use of an existing social network, you can easily acquire your own community, without the need for people to create yet another personal account.

### **3.3 *A game is not enough***

A common misunderstanding with all games aimed at learning, is that housing the learning material inside a game is enough to be educational. This however does not guarantee that the player will actually learn from the game. The player in this case might be entertained, but it does not guarantee that any new skills or knowledge is gained. There has to be some testing options to evaluate that the player actually learned something, Chen (2005).

To ensure that a game will be educational a game can be based on an educational principal or theory, which of course has been proven to work. Which theory you choose depends on the aim of the game. By making use of an existing and proven theory, the teaching experience of the game will be enhanced. Another advantage of using a theory is that most theories are structured and contain various models. As a

game consist of programming structures, the structure of the game can be combined with the structure of the theory used for teaching, Coyle (2004).

Though using a scientifically proven theory is a good indication of educational success, I personally think it is not a complete prove. The game might be making use of a proven theory, but it is not guaranteed the game will meet its purpose. To prove the success of the game, you have to show that the game is effective within the target group of the game. There has to be scientific reading with the explanation of the chosen theory and some testing to see if the game indeed is engaging and educational. By researching the effectiveness of a game by for instance, clinical trials, also non-proven theories can be used in a game.

Eventually it is as important that the game is engaging as well as educational, because the game should be the element that will make the player enjoy the process of learning. A good way of testing the games, would be using a representative selection of your target group evaluate the game. Afterwards they can write down their experience and take a test to see if the players have gained the skills and knowledge the game is intended to teach.

## 4 Game engines used for serious games

### 4.1 *Engines developed specifically for serious games*

Serious game engines need to deliver more than a normal game engine. At a minimum it needs to track player behavior, assess their ability, capture and report on those metrics and make them available. In some serious games where player behavior must be analyzed closely, instant replay may also be essential.<sup>3</sup>

Depending on the product and market segment, an engine may interact with real world data from GPS systems, instrumentation, weapons, vehicle simulators, as well as other players and non-player characters. And for certain US government or education applications, it has to conform to SCORM<sup>4</sup> standard of communication between different platforms.

#### 4.1.1 **Mōsbē**

Mōsbē<sup>5</sup> is an engine created by Breakaway, known from games like Civilization. As they started to get more assignments for military purposes, they discovered there was a special need for serious games, which required a specific engine. For instance there was a need to adjust the gameplay on the fly, to meet changing doctrine and mission variables. As a result the engine can be useful for military, first responders and healthcare markets.

Mōsbē supports 2D and 3D views and supports multiplayer from one to 16 players over a LAN. The engine comes with an inventory of objects that can be modified to simulate real-time logistics, supply management, the 4C's (command, control, computers and communications) and ISR (intelligence, surveillance and recon) situations. The package includes a world builder, scenario editor and asset libraries.

Scenarios constructed in the engine can be rewound or replayed, and can even be moved back to live player control during replay to try for a different outcome or to drill down on critical moments in the scenario. All scenario data is logged to a file that can be exported via XML for analysis. External data can be imported into the scenario to customize aspects of the simulation based on theoretical or classified data. Mōsbē makes use of the language C++ and is only available for Windows client/server platform.

As the engine is for real-time simulation and complex scenarios, it can be considered to be useful for hardcore games. It is necessary that the person has intimate knowledge of the simulation and as it considers a complex scenario, it costs a lot of time to play.

#### 4.1.2 **Sandstone**

Sandstone<sup>6</sup> is created by Muzzylane to overcome many of the hurdles that serious game projects face. An example of use is Making History II, a serious game for history education. The focus of the engine is on the online use of games, for which the user only needs a browser. Also there are little limitations concerning the communication and implementation of other internet platforms like Flash. This creates a lot of possibilities for a game to be promoted and used by many people.

Sandstone supports 2D environments as well as 3D environments. And games can be created and played without compiling, making it much easier to test and revise. Also the player will get the latest version of the game without installing updates. To play the game you need a Java plug-in with the browser and the Sandstone Player.

Sandstone uses Java as a shim between the browser and the C++ code, which creates more possibilities for 3D games on the web.

The games can be assigned and managed from a website, or any Learning Management System. Progress made in the game can be tracked and assessed from any web-connected computer, since all data is stored online. Which is a necessity for only learning games to keep track of the learning progress. Considering an online curriculum, In-game progress can determine what material a student is given next.

The engine supports the use with social networks and has great multiplayer options. Any game can be a multiplayer game without additional development work. Players can invite friends to a multiplayer game by simply sending a link. This is also possibly via facebook by just posting the link. Within sandstorm games can be built with JavaScript, C++ and XML and is available for Windows.

#### **4.1.3**

#### **NICE**

NICE<sup>7</sup> (Numedeon Interactive Community Engine) is an engine developed at CalTech in the 1980's as a general-purpose engine for modeling and simulations. The initiative spun off as a private company called Numedeon. The focus of this engine is on online gaming under the category of MMOG's. The engine does not require any downloads or software, games can be played just by use of the browser and Java plug-in. An example of use of the engine is for Whyville.com, an online community for children.

Before the creation of NICE there were 5 criteria which had to be met, and the first one was there should be no barrier to use. So it had to work on any computer with a 56kb modem and a browser, without special plug-ins or software. Second, the avatars had to be fully customizable by users, and most of the users are children. Third, social interaction was key and so were community management tools. Fourth, it had to be a safe, kid-friendly environment that was fully COPA compliant. And fifth, it had to be educationally dynamic, physics-based and not tied to a rigid decision tree.

Eventually NICE is also used as an online conference area, more focused on adults, where you can participate in a virtual world. You can go to a library to consult articles and go to a conference room which you booked to give a presentation. The people present at the conference room can follow the presentation and give comments.

NICE makes use of Java and supports only a 2D graphical environment. It has a full suite of tools for in-world communication and interaction. These tools include: customizable avatars, bubble chat, transcription, bulletin board, calendar, event scheduling tools, moderator tools, conferencing tools, document sharing, collaborative editing, shared desktop, and language filters and community safety tools. Games are scripted with the use of Java.

#### **4.1.4**

#### **OLIVE**

OLIVE<sup>8</sup> (On-Line Interactive Virtual Environment) provides distance collaboration and training functionality through a virtual environment. The platform is a suite of tools and interfaces that allow non-programmers to rapidly create application specific content and scenarios.

All key components for starting up a private virtual world are provided out-of-the-box, including hundreds of customizable avatars with associated animations and fully-integrated VoIP-based spatial audio. The engine supports 2D and 3D view and supports the import of 3D object from many modeling tools.

The Software Development Kit provided with OLIVE enables extension and customization to meet specific requirements. OLIVE is an open, distributed client-server platform for building private, realistic virtual worlds. The architecture supports up to thousands of concurrent users. The SDK provides an API, licensable 3D content, and 3rd party system integrations and tools to create and edit 3D content and scenarios. Also the Artificial Intelligence can be imported through an API, which allows third party applications. As a special feature the engine has a physiology model plug-in for medical use, which calculates the conditions, behaviors and responses of patient avatar.

The open nature of the OLIVE Platform allows customers to create powerful multi-resolution and multi-fidelity federated simulation environments. Forterra's Paged Terrain Format (PTF) supports large area and multi-resolution terrain data in a WGS-84 compliant, geospatially-referenced format.

Forterra Studios supports OLIVE customers through all phases of development, from requirements gathering, to implementation, to operational support of large-scale solutions. Forterra Studios also builds and operates custom environments for customers interested in turnkey solutions. Programming of the games is done in C++ and XML.

## **4.2** *Common game engines*

### **4.2.1** **Unity 3d**

Unity 3D<sup>9</sup> is an engine which provides all the basic needs for a game and comes in a free version and an extended version. As the basic functionality of the engine is free, it is really attractive to use for serious games as it will save some money on the budget. There will however be a watermark or splash screen of unity for a short while in the game and not all functionalities are present. When there is need for more functionalities you could also get the extended version, without the watermark of splash screen.

The engine provides a lot of possibilities and can be extended by the programmer to meet his wishes. Unity 3D comes with its own editor, with drag and drop possibilities, pause and replay options to change the environment. It supports importation of 3D object form almost all 3D applications and all audio files supported by QuickTime can be imported.

The engine has built in physics, which are used in games like unreal tournament 2007 and ghost recon 3. This is an advanced physics engine which will meet the wishes of the programmers. Programming is done in JavaScript, C#, and a dialect of Python called Boo. Communication is possible with .net libraries and support databases, regular expressions, XML, file access and networking. It also supports web based applications, which allows you to publish your game online.

The engine supports platforms like the Nintendo Wii and Iphone, and is available for Windows and Mac.

### **4.2.2** **Flash and HTML 5**

Flash is a platform which supports low graphic games, most games created are in 2D. The platform is not a real game engine, but provides the basic needs to create a simple game. It supports bidirectional streaming of audio and video and can manipulate vector and raster graphics. Each game created in Flash can be played online in the web browser with a Flash Player plug-in, which creates a consistent platform on every computer. Programming is done in a language called ActionScript currently at version 3 which is an object oriented programming language to create an reuse complex code.

As Flash has a long history there are multiple plug-ins you can use for the creation of games easier.

Currently HTML 5 is in development which could be a great competition of Flash. HTML 5 will eventually support open video and audio, which will not need a license. This means you will not be in need to install a plug-in to play audio or video streams. HTML 5 will also support vector graphics. HTML 5 is not yet fully in use and will be expected to fully evolve in a couple of years. The programming of games can be done in JavaScript, which is fully supported by the platform.

## 4.3 *Summary of game engines*

### **Mosbe**

Advantages: Supports high graphics, has a great replay option with return to live play option, good for creation of real-time complex scenarios

Disadvantage: Not usable on the web, focussed on LAN

### **Sandstone**

Advantages: Play games without compiling, share progress with friends by using simply a link, web based playing of the game, good multiplayer options for games

Disadvantage: Not for really high graphics or complex scenarios

### **NICE**

Advantages: Really easy to use with lots of content managing tools, massive multiplayer options, no need for plug-ins can be played just in the browser

Disadvantage: Only 2D support, created for simple games

### **OLIVE**

Advantages: Supports high graphics, built in physiology engine, main elements for virtual world provided out-of-the-box, API created for import of many 3 party applications

Disadvantage: In need of third party applications for Physics Engine, not usable for online games

### **Unity 3D**

Advantages: High graphics, built in physics, free basic functionalities, many extension possibilities

Disadvantages: Not created specifically for serious games, not for web based games

### **Flash**

Advantage: Great for web based applications, widely used by other people, many plug-ins

Disadvantage: Needs a lot of programming for serious games you need to create the whole game engine or buy one, not useable for complex scenarios

### **HTML 5**

Advantage: No need for plug in to play in web browser, uses open video and audio formats

Disadvantage: Not created for games, needs a lot of programming to provide basic engine, probably really useful in couple of years

## 5 The games

### 5.1 *Make people aware*

#### 5.1.1 World Hunger – Food Force

Link: <http://www.food-force.com/>

Platform: Windows / Macintosh

Age: All

Target: Raise awareness about goals of organization

##### **Description**

Food Force is a game developed by the United Nations World Food Programme (WFP). In the game the player works for the WFP and has to complete six different missions. The missions take place in Niger and are equal to the activities the WFP performs on regular basis. For instance, the player has to drop food from a plane with the best accuracy and safety for the receivers, move a convoy through a dangerous area and create the best food packages with the few nutritious substances available.

##### **Gameplay**

At the beginning of each mission the goal will be explained to the player, the difficulties are pointed out and the player will have to complete the task. As a reward the player gets points awarded for fast and accurate play and good decision-making. Each mission ends with a short video explaining how the aid agency would have dealt with the problem you solved. This way you will become aware of the difficult problems an organization like the WFP encounters and how they deal them. You will also realize the importance of the activities WFP performs.

##### **Evaluation**

The game has some nice 3d-effects and the controls are pretty much intuitive, which together creates a nice gameplay. By making effort to let the game look good, and navigation feel easy, I assume people are more motivated to play the game.

#### 5.1.2 Carabella Goes to College

Link: <http://www.privacyactivism.org/>

Platform: Macromedia Flash

Age: Students

Goal: Raise awareness of privacy issues and providing personal information

##### **Description**

Carabella Goes to College is a simple flash game, created by Privacy Activism, whose goal is to protect privacy. In the game you have to guide Carabella, a girl who is finished with high school and starts at a college. To get started with her new live she has to enroll for a college and open a bank account and other related activities. The object of the game is to provide as little of private information possible, while applying for different necessities.

##### **Gameplay**

The game has a fixed set of activities that have to be performed. For making the right choices the player will get points awarded. If the player makes a wrong decisions and private information is possibly unsafe, points will be subtracted. After every activity, which can consist of multiple actions, a summary is given of the collected points. The game will show the reasoning behind the awarded points and give advice on how to keep your private information safe.

### **Evaluation**

The game is as previously stated a simple flash game and can only be played online. The possibilities are not that extensive and the gameplay is a little awkward. When you have to fill in a form you do not get a lot of options; the simplicity of the game does not make it very appealing. Also the given advises, sometimes seem a little paranoid, but on the other hand it will most definitely keep your private information safe.

### **5.1.3 Life Simulation – Real Lives**

Link: <http://www.educationalsimulations.com/products.html>

Platform: Windows

Age: All

Target: raise awareness of life situations in other countries

### **Description**

Real Lives is a simulation game, created by Educational Simulations; a software company focused on educating people about our world. In the game you are born on the earth as a male or female character. Your character its gender and circumstances are based on real live statistics. This means that you have a very good chance of being born in China or India, and a high chance of being born poor. When starting you're your character, you will get information about the chance of being born in the situation in which your character is born.

### **Gameplay**

In the game the player will get numerous statistics about the country where the character is living. The player will get information about the family circumstances and has to manage their finances. When age progresses different events occur, for instance a relative gets married or dies, or the character himself. While playing you will learn how someone has to manage through live, who is living in different circumstances than you.

### **Evaluation**

The game itself has not much graphics and mainly consists of pictures and tables with statistics. It gives a notice of what is going on in this world, but is not a real game, more like a simulation. There is no goal to achieve or points to earn; this makes it less attractive to play. By using mainly tables and figures it is hard to start the game and really enjoy playing it. It takes a lot of fantasy to make this game real for you.

### **5.1.4 Escape from Woomera**

Link: <http://www.selectparks.net/archive/escapefromwoomera/>

Platform: Half-Life

Age: 18+

Goal: Make people aware of the life of captured refugees

### **Description**

Escape from Woomera is a 3d action/adventure game where you crawl into the life of a refugee. The software is actually a modification on Half-Life and requires a registered version of Half-Life. The story is about a refugee locked away in Woomera and is based on true stories from refugees and media archives. Playing the game makes people aware of what went on in Woomera and what could be happening in other detention centers. By making people aware of the problem, the creators hope to stimulate people to take action.

### **Gameplay**

In the game you are in a detention centre in Australia called Woomera, which exists in reality. You have escaped from your country by boat and are locked away according to UN laws. Those who captured you are acting illegally, but you are the one being treated as a criminal. First you will have to try for asking asylum, during which you will get acquainted with the bureaucracy of it all. When applying for asylum fails, there is no other chance and you have to find a way to escape within a specific timeframe.

### **Evaluation**

Inside the detention centre you will have to explore your situation and meet other refugees to hear their stories and gather information. By researching the environment you can solve the puzzle and escape from Woomera, you will get acquainted with the troubles that took place in a specific detention center. The ending of the game depends on the choices made by the player, which should encourage people to play the game more than once.

## **5.1.5**

### **<Eye Witness>**

Link: <http://www.mic.polyu.edu.hk/nanjing/index.asp>

Platform: Windows

Age: 18+

Goal: Make aware of what happened during the Nanjing Massacre

### **Description**

<Eye Witness> is an Interactive Situation Simulation Software (ISSS), created by students as a Master project. It is a high resolution 3d game in the form of a first person shooting game, except the only weapon you carry is a camera. In this game you will experience the Nanjing Massacre in person, with no censure. The Japanese soldiers killed refugees in various brutal ways; for example, cutting of heads, stabbing, running people over with tanks, shooting, lopping and bombing.

### **Gameplay**

The goal of this game is to make good pictures of the things that happen around you during the massacre. The quality of the photographs is important because they will be used for convicting people of war crimes. The score of the photos are based on 5 characteristics: Viewing Direction, Object Distance, Golden Time, Sharpness and Focus.

### **Evaluation**

By using a game you can really become part of the massacre and see the horror, which goes further than the books according to the developers. The game makes you aware of the Nanjing history in order that this will not be forgotten and repeated. It is a bit of horrifying game, with a lot of cruelty, but makes its point. The game is free of charge and not recommended for children to play.

### 5.1.6

#### Virtual U

Link: <http://www.virtual-u.org/>

Platform: Windows

Target: Students, Professors, University Staff

Goal: Make aware of the difficulties of running a university and how they can be dealt with

#### Description

Virtual U is a simulation created by Enlight Software, which looks like Sim City with a university campus as model. When playing this game you will take up the role of president of a university or a college. You have to run the university by controlling the cash flow and define rules and regulations. During the progression, you have to monitor the developments of your university and act accordingly.

#### Evaluation

While playing this game, the player becomes aware of the political choices that a president of a college has to make. The goal is to make people aware of the trade offs there have to be made, while positioned at the head of a university. By letting the payer encounter complex problems, the creators want to create more respect for the decisions made by management.

### 5.1.7

#### Darfur is Dying

Link: <http://www.darfurisdying.com/>

Platform: Macromedia Flash

Age: All

Goal: Make people aware of the bizarre circumstances in camps in Darfur

#### Description

Darfur is Dying is a narrative-based simulation of a refugee camp in Sudan. It is created to make awareness of the situation in Darfur in hope that people will give financial support.

#### Gameplay

You start by choosing a character of a family and have to survive. To survive even children have to perform life-threatening tasks, like fetching water miles away. You have to dodge arm trucks, get food and medical care. The aim of the games is to make people aware of the troubles that are present in Darfur, and how they affect the inhabitants, who have to survive instead of live.

#### Evaluation

The game gives a glimpse of what people are going through in Darfur. The interface is simplistic, and the navigation is not that intuitive. If you play the game you will experience the problems in Darfur, but you will have to take some time to understand the game, as it consist of multiple actions, which are not always explained.

## 5.2 *Psychological health*

### 5.2.1 **Personal Investigator**

Link: <http://medialabeurope.org/mindgames/publications/publicationsPersonalInvestigatorCHI2004Presented.pdf>

Platform: Windows

Age: Teens

Goal: To be an intermediate between psychologist and teenager, create a safe environment, in which the teenager can talk about his problems

#### **Description**

Personal Investigator is a therapeutic 3D game for teenagers. The game acts as a intermediate between the therapist and the teenager and implements the Brief Solution Focused Therapy (BSFT), which is a goal-oriented therapy. Also this is one of the few games with documented research on the effects, which gives more value to estimated effectiveness of the game.

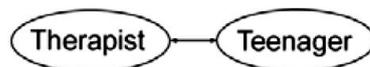
#### **Gameplay**

In the game teenagers play the role of a detective and move around a Detective Academy. As they journey through the academy they meet several characters and must carry out series of tasks. Rewards are given as each task is achieved and if the teenager succeeds at all the tasks he or she is able to graduate from the academy and become a Master Detective.

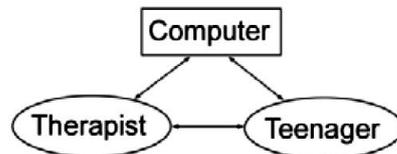
#### **Evaluation**

Because BSFT is a goal-oriented therapy it is easy to implement in a game, which is also goal-oriented. In the game players must achieve minor goals (e.g. fight a beast, vault a wall) to achieve the major goals (e.g. finish the game). The games interact with the player in a way that problems can be communicated to the therapist. The game acts as an intermediate between the therapist and teenager, Coyle (2004). The game makes effective use of the safe environment a game creates.

Traditional model: Direct communication



New model: Computer aided communication



**Model Personal Investigator**

## 5.2.2

### The Journey to Wild Divine

Link: <http://www.wild-divine.nl/>

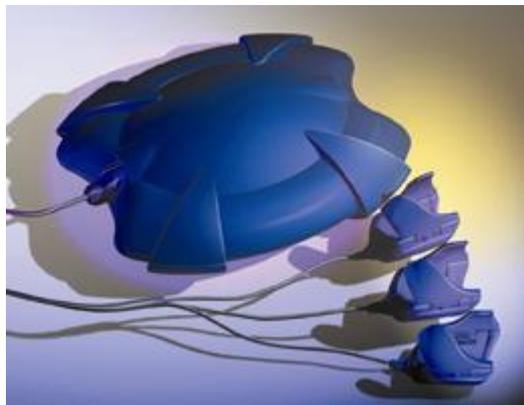
Platform: Windows and Macintosh

Age: All

Goal: Learning relaxation techniques by controlling your biometrics

#### Description

The Journey to Wild Divine is a collection of games developed by the Wild Divine Project. The games are unique in the way the interface works to play the games. With the game you have to get a new kind of controller, which you can plug in to an usb-port. The controller consists of three finger sensors. The sensors measure measures skin conductance level and heart rate variability, which is monitored and translated in the biofeedback hardware platform called the light stone.



**biofeedback hardware platform**

#### Gameplay

Biofeedback is scientifically proven to have a powerful, positive effect on your emotional and physical well being by teaching you to alter your brain activity, blood pressure, muscle tension, heart rate and other critical bodily functions. By increasing, decreasing or synchronizing body rhythms, through various levels of breathing, relaxation, and meditation techniques you control the game. In the game you get explanation of the various techniques you have to use to play the game. Eventually you will learn different meditation techniques, which you can use in your normal life. By playing the game you learn how you can reduce stress, which in turn is good for your health

#### Evaluation

The game environment is very calm, which stimulates the relaxation. The levels consist mainly of fixed backgrounds where you are guided to and have to learn another technique to move further. When moving to another level you are guided through a 3d environment with relaxing element like temples and sunrises. By providing the controller with different games the player can learn more and will also have lots of ours of playtime. In the games there is no scoring, you manage yourself through different levels where the reward is the unlocking of a new level.

Evaluation

### 5.2.3

#### **Earthquake in Zipland**

Link: <http://www.ziplandinteractive.com/>

Platform: Windows

Age: 9-12

Goal: learn children to cope with the divorce of parents

##### **Description**

Earthquake in Zipland is a game developed by Zipland Interactive for children with divorced parents. The game is made in cooperation with two psychologists who have years experience with divorce therapy.

##### **Gameplay**

The game is about a little moose that lives on an island. The islands where once two islands that zipped together. After a period of time the island splits again. The little moose is upset en does not understand why it happen. In the game the moose goes to different parts of the island and talks to different figures. In his room there is a diary where the little moose describes his emotions, for the player there is the option to start his own diary, which is encrypted by a password.

The game is provided with a parent's guide. The parent(s) can open a dialog with the child when playing the game. By using the guide the parents get advise how they can talk about certain aspects of the game. Earthquake in Zipland can enable parents to:

- To talk about painful issues, of which the child is usually reluctant to express
- To broaden the knowledge and understanding of the impact of a separation on their child(ren)
- To play alongside their child and (nonverbally) address personal family issues
- To deal with the issues of separation and divorce in an indirect way

##### **Evaluation**

The game has a 3d environment where you navigate through by clicking on object, there is no free movement. The character will have to collect different items. There are different characters in the game to which you can talk. The player can choose what he/she wants to say; the player even has the choice to act unreasonable and mad.

## 5.3

### ***Health Education***

#### 5.3.1

##### **Ben's game**

Link: [www.makewish.org/ben](http://www.makewish.org/ben)

Platform: Windows en Mac

Age: Children

Goal: Let children with cancer express their feelings against their disease and learn them about the symptoms

##### **Description**

Ben's Game is a game developed by an employee from Lucas Arts in cooperation with make-a-wish foundation and a boy Ben. Ben is a boy who suffers from leukemia and had a wish to make a game for kids with cancer. The object of de game is that de player gets the feeling he or she can fight against cancer and provide some information about the symptoms.

### **Gameplay**

The game is a platform game where you play as a boy or girl (you can design your own character) who is in a body fighting against cancer cells and the symptoms that come with them. The goal is to collect seven shields, each protecting against a symptom related to cancer and the therapy that goes with it. To obtain the shield you have to complete a level by killing all the cancer cells and the monster protecting the shield. Each monster is designed in a way they have similarity with the symptoms.

### **Evaluation**

In the game children with cancer can express their emotions, which in turn relieves little pain. The game is designed in cooperation with Ben who brought his own experience with his disease in the game.

## **5.3.2**

### **Remission**

Link: <http://www.re-mission.net/>

Platform: Windows

Age: children/adolescents

Goal: Learn about cancer and its symptoms and the use of medicine

### **Description**

Remission is a game developed by HopeLabs made for children/adolescents with cancer. The game has the same idea as Ben's game except the game makes use of a full 3d environment. Another difference is that Remission is more focused on providing information about cancer and the different medicine. This element makes the game more educative for the person who is playing.

### **Gameplay**

The game consists of 20 missions where you fight against the different types of cancer cells. Each mission has a goal, you have to monitor someone that he takes his antibiotics in time help someone relax who is nervous for an MRI scan. All these actions take place inside of the body. You play a nanobot inside a person's body fighting against cancer. By using painkillers and antibiotics you can fight against cancer.

### **Evaluation**

The game does more than just let the player express his or her emotions. It gives the player notice what goes on in the body when using antibiotics and painkillers, and stimulates good use of medication. The use of a full 3d environment makes the playing very enjoyable.

## **5.3.3**

### **Bronkie the Bronchiasaurus**

Link: <http://www.prairiepublic.org/features/healthworks/asthma/bronkie.htm>

Platform: Super Nintendo

Age: Children

Goal: Learn to cope with asthma

### **Description**

Bronkie the Bronchiasaurus is an old game designed for children with asthma, created by Raya Systems. In the game you play a dinosaur that has asthma. You have to play the levels and make sure the dinosaur keeps his breath. Players make decisions about their health throughout the game and see how the decisions affect Bronkie.

### **Gameplay**

The game is a 2 dimensional game created for the Super Nintendo. To complete the game you have to go through different levels, where you have to avoid dust and cigarette smoke. The goal is to collect pieces of a machine that fix the machine to clean the air.

### **Evaluation**

The game helps people to learn important asthma management skills and gain the confidence to manage asthma effectively in their own lives. Skills that are learned are the following skills:

- taking daily medication
- using an inhaler and spacer
- avoiding asthma triggers
- monitoring peak flow
- responding to changes in peak flow
- using a sick day plan appropriately
- reviewing the asthma record (create a record of personal triggers for asthma)
- basics of asthma management

A great disadvantage is that the game is relatively old, they are created in 1994 for the Super Nintendo; which is no longer in production.

### **5.3.4**

#### **Heart Sense**

Link: <http://www2.amia.org/pubs/symposia/D200787.PDF> (article)  
<http://www.acasa.upenn.edu/heartsense/about.htm> (game)

Platform: Macromedia Shockwave

Age: All

Goal: train (non-medical) people how determine when a heart attack occurs and how to act properly

#### **Description**

Heart Sense is a game developed by the university of Pennsylvania for lay people to provide information about heart attacks and the symptoms proceeding. When having heart attacks it is important to get help as soon as possible, by teaching lay people to recognize a heart attack, lives can be saved.

#### **Gameplay**

The game is a Macromedia Shockwave game where you play the character Jack who recently lost his mother because of a heart attack. Jack starts in the hospital where he is offered to become a doctor. When the doctor offering him the job, gets kidnapped he finds a clue leading to one of his patients. Jack now will go with a to two of the doctors patients who show symptoms of heart attacks. Jack will have to make the right choices to prevent further complications.

#### **Evaluation**

The game is very simple, as you can only choose the character needs to say. While playing you become aware of the different symptoms of heart attacks and the actions, which you have to take. Thus providing the player with useful information of discovering heart attacks and how to react in such a situation.

### 5.3.5

#### **Glucoboy**

Link: <http://www.diabetesincontrol.com/issue173/np.shtml>

Platform: Gameboy

Age: Children

Goal: Teach children to check their sugar level and take medicine

#### **Description**

Glucoboy is a game for the gameboy advance®. The game is placed on a cartridge containing a glucometer, which makes it possible to check your sugar level. When you plug the cartridge into a gameboy, you can play a game. The glucoboy contains a number of games, which are just for fun and have no educational value. However the player can earn a new game, not by completing a game, but by checking his sugar level on time and keeping the level between healthy borders. This way the game is a stimulus for a child to learn to cope with his disease.

#### **Evaluation**

Especially for a child it is difficult to learn to be responsible with medication. By rewarding the behavior of the child, he will be motivated to cope with his disease. In return at an early stage the child will become familiar with using his medicine, which is useful for the rest of his live.

### 5.3.6

#### **Nano Swarm and Escape from Diab**

Link: <http://www.archimageonline.com>

Platform: Windows

Age: Children

Goal: Teach about healthy nutrition and use medicine concerning diabetes

#### **Description**

‘Nano Swarm: Invasion from Inner Space’ and ‘Escape from Diab’ are adventure games for children with diabetes, which stimulate healthy eating and exercise. The games blend sci-fi action and adventure with evidence-based behavior modification theories. The theories used behind the games are not present on the website or related websites.

#### **Evaluation**

The games have two aspects what it wants the player to learn:

- To recognize the role that diet and physical activity play in the development of obesity
- To adopt healthy diet and exercise behaviours (specifically, increasing the intake of fruit and vegetables and increasing physical activity)

Momentarily the games is in development the estimated release date was somewhere in 2008, which is currently expired. There is not much published about the game, a few short trailers are present. What the games will look like is unknown, the only thing is that both games will be 3d adventure games.

## 5.4 *Learn Skills*

### 5.4.1 **Team-up**

Link: <http://www.girlsinc.org/gc/page.php?id=6.2>

Platform: Mobile Java/Windows

Age: All

Goal: Learn to work together and make use of the different skills people possess

#### **Description**

Team-up is a game developed by an American nonprofit youth organization dedicated to inspiring all girls to be strong, smart, and bold. The object of the game is to learn the importance of cooperation.

#### **Gameplay**

Team-up is a puzzle solving game where you have to move collect items in a on a small platform. The platform consists of various obstacles, which have to be overcome in order to collect all items. To solve the puzzles you need the skill of different girls. The skills of the different girls are jumping, moving boxes and throwing another girl. By making use of the different skills the player will learn the importance of cooperation.

#### **Evaluation**

The game is challenging because you have to try to solve to puzzles in as less moves as possible. The gameplay is simple; there are no high graphical requirements. A disadvantage of the serious game is that is developed for girls and the characters are all girls, this makes it less attractive for males to play.

### 5.4.2 **Ditto's Keep Safe Adventure**

Link: <http://www.ditto.com.au>

Platform: Windows

Age: Children

Goal: To assist parents in educating their children in how to remain safe

#### **Description**

Ditto's Keep Safe Adventure teaches children to recognize potentially dangerous situations, giving them advice on how to deal with these situations by speaking out and staying safe.

#### **Evaluation**

There is not much known about the game on Internet, besides the goals of the game. The only information left is that the game consists of four different games all provided on the same CD. You have the feelings game, private parts game, yucky feelings game, and Saying No Game.

### 5.4.3

#### Web Wise Kids

Link: <http://www.webwisekids.org/>

Platform: Web based, Windows and Mac

Age: Teens

Goal: Learn teens to be safe on the Internet and other electronic communicational methods, to protect them against scams and such

#### Description

Web Wise Kids is an initiative that created five different games, each coping with a different safety issue of electronic communication like the Internet. Mostly the games consist of a lot of interactive video's, which communicate the message and can be influenced by the choices the player makes. The games are focussed on the teens of today, which have full access to the Internet and cell phone. With modern communication there are more threats and problems on how to use them responsibly. These games will provide information on how to be responsible, by letting the players experience stories, where it went wrong.

#### Gameplay

The first game, It's Your Call, is focused on responsible use of your cell phone and can only be played online. The game is modeled as an interactive movie, the player has to make decisions for a girl based on a question, after which a film will be played with the consequences. Eventually you will know what is accepted to do with your cell phone and what you should not do.

The second Game, Missing, is focused on Internet seduction and is made for Windows and Macintosh. The game gives a glimpse in the life of Zack, a boy with a troubled year, with not many friends and parents that get a divorce. He escapes to a life on his computer modeling games and finds an older man on the internet who is willing to help him. Eventually Zack goes off to work for this man and turns out missing. The player will fill up the role of a detective and has to find out what happened to Zack. During the process the player becomes aware of privacy, Internet seduction and what not to do when problems occur.

The third Game, Mirror Image, is focused on cyber stalking, modeling scams and spyware and is made for Windows and Macintosh. The game is about a girl who finds a modeling agency who is willing to make pictures of her, which will make her look older. After this contact, there is a stalker who follows her around and seems to know exactly where she will be. The photos taken are used as pornographic material, and her computer is infected with hacking software. The player takes up the role as detective and had to find the predator and arrest him. During the games the player will become aware of the techniques used to stalk people over by means of the Internet.

The fourth game, Airdogs, is focused on piracy and illegal downloads and is made for Windows and Macintosh. The game is about a boy Luke, who needs some extra money and begins to counterfeit software. Eventually he gets bullied and gets framed for more crimes on the Internet. As result of the game the player becomes aware of the consequences of online crimes.

The fifth game, Wired With Wisdom, focuses on safety tips on the internet, to protect you privacy. This game can only be played online and has not much information about the gameplay. However while playing, you will get tips on how to responsibly work with email, social networks, chat rooms, instant messaging and such.

## 5.5 *Physical therapy*

### 5.5.1 **On The Move**

Link: <http://www.businessnorth.com/onthemove.asp?RID=652>

Platform: Adjusted system

Age: All

Goal: Enhance physical therapy

#### **Description**

On The Move is an institute that provides games are focused on the mimetic interface and not on the gameplay itself. The games are a stimulus for people to rehabilitate certain muscle functions. As physical therapy can be quite a drag, performing the same exercises every day, some people need an extra motivation. By making the exercise more goal oriented, by letting the exercises control a game, it is more enjoyable to perform the activities.

#### **Gameplay**

Comparable with normal physiotherapy the games are played under supervision to make sure the movements performed are correct. Also the games require additional hardware. This makes the games less accessible, as the person has to go to a specific location to play the games. Though as an advantage of using the computer to exercise, you can also measure the strength which is performed during the therapy. This gives an indication of progression and possibly regression. This gives a good indication of the effectiveness of the therapy.

### 5.5.2 **SilverFit**

Link: <http://www.silverfit.nl/>

Platform: Adjusted system

Age: Elderly

Goal: Enhance physical therapy

#### **Description**

SilverFit is a standalone system combined with a 3D motion camera. The camera registers the movements made by the player and converts them to actions on the screen. Compared with the Nintendo Wii, the focus of SilverFit is on geriatric revalidation. As the target group consist of elderly it is important that the control of the games is easy.

#### **Gameplay**

SilverFit consists of 7 different games, which will probably be expanded to provide more movement options. The games each provide its own movements to be made to play:

Puzzling, while sitting bend total body from left to right and then stand up. The movements control the pieces of the puzzle, which also provides cognitive an visual training.

The mol, Balance exercise by extending one leg whilst standing on one leg. Extending your leg scares a mol away which is the goal of the game

Catch grapes, walk from left to right. In the game grapes are dropped from a tree which you have to collect and evade other falling pieces.

Walking, walk movements without moving in. In the game you are walking through a park and have to evade obstructions

Arm stretching, stretch your arm(s) in different directions. In the game you have to move daily object like in the kitchen or supermarket.

Flower Picking, walk back and forward, to the side and possibly bend over. In the game you have to pick flowers from a garden.

Memory, stretch arms from left to right, up and down. In the game you play memory which also has a cognitive component

### **Evaluation**

SilverFit consist of simple games, with a simple user interface. This makes the system perfect for geriatric revalidation. As discussed with casual games, this is a good example of a mimetic casual game. However it does look a lot like the Nintendo Wii, yet the interface and type of games makes it for better use with elderly.

## **5.5.3**

### **Virtuagym**

Link: <http://www.virtuagym.com>

Platform: Webbased, Iphone

Age: All

Goal: Motivate people for physical exercise and instruct on exercises

### **Discription**

Virtuagym is an online game/community, where you can follow your own physical exercises. The main target is to get people moving, by providing an exercise plan and in the future multiplayer options to compete with others. In the game you can keep track of your physical progress and access new exercises for weight loss or muscle gain.

### **Gameplay**

To play the game you have to follow the exercises, which are explained by your virtual personal trainer. By recording your progress with exercises and for instance weight and body outline, you will get an overview of your total progress. You can choose your own goal of the exercises and virtuagym will create a plan for you. For the multiplayer option the idea is to use your heartbeat for the challenges, which will consist of raising your heartbeat by exercise and pauze intervals to see how your heartbeat responds.

### **Evaluation**

Virtuagym is focussed on stimuli for exercises by means of a community. You do not train on your own, but with friends or other people in the community. By adding a multiplayer option the player will be motivated to train for competitions. As the game is still developing, the real influence cannot be measured at this time. As the game is free and does not require additional software it is really accessible.

## **5.6**

### ***Overcome Fears***

Link: <http://www.vrphobia.com>

Platform: Adjusted system

Age: All

Goal: Help people cope with phobias

### **Description**

The Virtual Reality Medical Center<sup>50</sup> is an institute that helps people overcome fears by the use of virtual environments. For instance if someone has a fear of flying, the realistic environment provides stimuli related to their fear, for instance turbulence.

### **Gameplay**

With the help of a psychologist the person can talk about their fear in a specific circumstance. The simulation can progress with different situations, like turbulence in an airplane. For the simulation existing games are used which really cuts down the expenses, as there are only small adjustments to the games to use them.

### **Evaluation**

The institute makes good use of the safe environment provided by a video game. By nearing reality, people will be confronted with their fears, without real exposure. This makes it possible for a therapist to effectively help a patient overcome their fear. As the games do need supervision of a therapist the games can only be played at the institute. Following a list of fears the institute provides treatment for:

School phobia, social phobia, Attention Deficit Hyperactivity Disorder, fear of needles and blood, panic disorder, fear of flying, fear of driving, fear of public speaking, fear of heights, fear of thunderstorms, flying anticipatory anxiety, fear of closed spaces and fear of open places

## **6**

### **Discussion**

Concerning this paper there are a few notes to be made. First of all the games presented in this paper are not all the games present, only the ones found during my search on the internet. During my search I used Google with search terms like 'Serious Games', 'Educational Games', 'Game based learning', 'Advantage of Serious Games', etc. The site [www.socialimpactgames.com](http://www.socialimpactgames.com) is also a main source of the games discussed in this paper.

As presented within the Section 'problem with serious games', there is a shortage on scientific reading concerning serious games. This may result in unproven statements, copied from the creator of the game. As far as possible this is pointed out in the description of the games. As this is only a literature research it was not possible to acquire additional information of the games from the creators. This might be done for further research, evaluation of the effectiveness of serious games, or possible standard which can be provided for the development of serious games.

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