Designing and developing a game for learning

Case Nugali

Tampereen ammattikorkeakoulu
Viestinnän koulutusohjelman tutkintotyö
Vuorovaikutteisuuden
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Tiivistelmä

Opinnäytteeni käsittelee oppimisen välineeksi tarkoitetun tietokonepelin suunnittelua ja toteuttamista. Käytän esimerkkinä osittain yhdessä Helsingin yliopiston kehitysmaatutkimuksen opiskelijoiden ainejärjestön, Kehon, kanssa suunnittelemaani sekä Anniina Hautalan, Jussi Järviniemen ja muutaman Kehon jäsenen kanssa demoasteelle toteuttamaani tietokonepeliä, Nugalia.

Nugali on verkossa pelattavaksi suunniteltu peli, jonka tarkoitus on auttaa Kehoa saamaan ihmiset pohtimaan ja syventämään näkemyksiään kehitysmaissa asuvien ihmisten arkielämästä. Heidät saadaan eläytymällä ymmärtämään paremmin ihmisten arkielämään vaikuttavia asioita, siinä olevia ongelmia ja mahdollisuuksia. Nugali on eräänlainen sisarprojekti Kehon järjestämille kehitysmaa-aiheisille eloroolipelitapahtumille, joita he ovat järjestäneet eri kouluissa.

Pelissä eletään kuvitteellisessa kehitysmaassa, Nugalissa, ja käydään läpi ihmisen elinkaari lapsuudesta vanhuuteen. Pelissä on tarkoitus elää mahdollisimman pitkä ja onnistunut elämä.

Pohjustan suunnittelu- ja toteutusprosessin kuvausta käsittelemällä digitaalisten pelien käyttämistä oppimisen välineenä ja pelisuunnittelua oppimiseen tarkoitettujen pelien näkökulmasta. Pelisuunnittelua käsittelevä osio on osittain kirjoitettu EU:n eLearning-ohjelman rahoittamaa SIG-GLUE –projektia varten. Osittain tämän takia myös itse työ on kokonaisuudessaan englanninkielinen.

Nugali ei ehtinyt valmistua demoastetta pidemmälle opinnäytetyön aikataulun puitteissa, mutta projekti ei pääty tähän.

Opinnäytetyöni tarkoituksena on Kehon auttamisen lisäksi antaa yleiskuva digitaalisten pelien laajoista mahdollisuuksista oppimisen apuvälineinä käytettäessä. Lisäksi sen tarkoitus on antaa virikkeitä oppimistarkoituksiin kehitettävien pelien suunnittelua varten.

Aineisto
Kirjallisuus, verkkolähteet, tietokonepelit

Asiasanat
Nugali, pelisuunnittelu, tietokoneavusteinen oppiminen, tietokonepelit, kehitystutkimus

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Muita tietoja

THESIS SUMMARY

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Summary:

My thesis deals with designing and developing a game for learning. I use a demo of Nugali, a game born as a result of a cooperation of a diverse group of people, as a case example.

Nugali is a game meant to be played online. Its purpose is to help Keho, a student guild of the students of development studies at the University of Helsinki, to get people deepen their views on the everyday life of people living in the development countries. Nugali is a kind of sister project for the live role-playing sessions dealing with development issues, which Keho has organized at a few schools.

I ground the description of the design and development process with discussing the use of digital games as tools for learning. I also discuss the game design in general with an emphasis on the learning games. The section on game design is in most part written for the SIG-GLUE –project, which is funded by EC eLearning initiative.

Nugali wasn't completed within the schedule reserved for the thesis. The project continues, however.

The purpose of my thesis is not only to help Keho, but also to give an overview of the vast possibilities of using digital games as tools for learning. Its purpose is also to inspire designing better learning games.

Material
Literature, web sources, computer games

Key words
Nugali, game design, computer assisted learning, computer games, development studies

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1 Introduction

Digital game industry is one of the fastest growing forms of media entertainment and a growing number of people are playing digital games. Playing them is very engaging activity and this is one reason why educators and researchers are getting more and more interested in the possibility to harness their power in learning.

Computer assisted learning is not a new invention. Even games have been used for learning purposes for a long time. However, the educational computer games have got a slightly bad reputation. Many of the games have been badly designed or implemented. Many of them have not succeeded in combining the game and learning content. The games have also been made mostly for children. This notion seems to be changing now.

There are companies developing learning games for more mature audience. There are also government and privately funded projects and initiatives for developing games for adult education and training and for life-long learning. For example in US there is Serious Games Initiative[1] and Games for Health[2] –project. In EU there is for example the EC eLearning[3] initiative, which funded the SIG-GLUE[4] project (Special Interest Group for Game-based Learning in Universities and lifElong Learning). I worked for this project during 2004-2006.

Playing computer games has been one of my hobbies for almost my whole life, but I had never created a computer game of my own before this. In the summer 2005 I had a task to review some books on game design for the SIG-GLUE project. At that time I was also looking for an interesting subject for my thesis. Reading the books inspired me to dream of designing my own computer game one day. Suddenly I got an idea: my thesis project would be a slightly educational game. Now I only had to find a good subject for the game.

In the end of the summer I met some members of the student guild Keho (Kehitysmaatutkimuksen opiskelijat ry) from the University of Helsinki. Keho consists

[1] http://www.seriousgames.org/
[2] http://www.gamesforhealth.org/
[3] http://europa.eu.int/comm/education/programmes/elearning/index_en.html
[4] www.sig-glue.net

mostly of students of development studies. They told me about a role-playing game project they had. They were going to visit some schools and organize role-playing sessions about the development issues there. Then I got an idea. I could make them a computer game, which deals with the similar issues. They could use it as a promotional and educational tool as well. They were excited about the idea and so the wheels started rolling…

My thesis consists of two parts: the demo[5] of the game, Nugali, and this written part. This part has three main sections. In the first section I discuss the idea of learning with digital games in general. The second section is about designing a game from the learning's point of view. Most of it was written for the final report of the SIG-GLUE project during April 2006. The third section discusses the design and development process of Nugali. It also contains a description of the game as it will be like when it's ready.

Basic knowledge of pedagogical theories, digital games and game design helps to understand some of the concepts in this thesis. However, no prior knowledge should be required to understand the thesis itself. I have tried to keep it as comprehensible as possible.

[5] At the time of writing this, the demo can be found from: http://www.tamk.fi/~a2jjouht/peli/. However, the location will change when a server is rented for the game.

2 The usage of digital games for educational purposes

By one definition game is

> an (often, but not always recreational) activity involving one or more players. This can be defined by either a goal that the players try to reach, or some set of rules that determines what the players can or can not do. Games are played primarily for entertainment or enjoyment, but may also serve as exercise or in an educational, simulational or psychological role. (Wikipedia contributors, "Game").

In this work I'm using the term *digital games* to cover all the games played on digital devices: computers, game consoles and mobile devices.

2.1 History – from analog to digital

2.1.1 Playful learning

Play is common in nature. All you need to do is watch young mammals for a while and you'll see they are playing almost all the time. Kittens and puppies have mock fights, chase each other, hunt butterflies and are engaged in other activities that can only be described as play. I've seen a pack of young squirrels running around a tree for about an hour in a way that reminded me of 'peek-a-boo' or 'tag'. This kind of activity could be dismissed as plain fun, but scientists argue that the play is not just that. While playing, the animals are learning and practising important survival skills.

Human children are also playing almost all the time. While playing they are also learning and practising for example sensorimotor, intellectual and social skills. They are all important skills for coping with life.

Johan Huizinga (1984) argues in Homo Ludens that play is fundamental for the whole human culture. The culture has roots in play and play is within the culture.

2.1.2 Learning by gaming

While play as a way of learning is probably as old as the human being, the existing records of games used for educational purposes are much younger, but still date back thousands of years. Chinese strategy game Wei-Hai from 3000 BCE is probably the oldest game, which has been used for military simulations. Wei Chi, also known as Go from around 2200 BCE, Indian Chaturanga and Chinese chess have also been used for

the same purposes. First European examples of games used for military education are from 17th and 18th century AD. (Smith, 1998).

In physical education there are also many kinds of games. Physical education dates back several thousands of years (Dalleck & Kravitz 2002). Polo is among the oldest known ball games. Polo is believed to have been born in around 500 BCE (Wikipedia contributors, "Polo"). Ancient Olympic Games also date back at least to 776 BCE (Gómez-Lobo 1997, 2).

Sylvia Morgan refers to Wittch & Schuller (1973) and writes that in the 1960's simulations such as role-playing became popular in teacher education, the social sciences, and management decision-making. According to Meier et al. (1969), as cited in Faria & Nulsen (1996, 22), the first widely known business game The Top Management Decision Simulation was developed a bit earlier, in 1956 by the American Management Association.

2.1.3 Audiovisual technology in education

First experiments using film for educational purposes were made already in 1890, but not before the WWII was it used in larger scale. The US military needed to train a lot of people quickly and efficiently and instructional films were one of the means to fulfil those needs. (Egenfeldt-Nielsen 2005, 35; Wikipedia contributors, "Instructional technology").

There were unsuccessful attempts using television as educational media until Sesame Street, which was first broadcast in 1969. It was a huge success. Sesame Street is an educational program for children, which is today broadcast worldwide. (Egenfeldt-Nielsen 2005, 36; Wikipedia contributors, "Sesame Street").

2.1.4 Interactive technology in education

Sidney L. Pressey has been accounted for creating the first interactive teaching machine in 1926. In 1950's and 1960's B.F. Skinner constructed his own teaching machines using the principles of a behaviouristic educational theory called operant conditioning[6], which

[6] See for example: http://tip.psychology.org/skinner.html

he had developed. (Lockee & Moore & Burton 2004, 547, 554). Operant conditioning is also applied to animal training (Wikipedia contributors, "Operant conditioning").

2.1.5 Digital games

The first significant[7] computer game, Spacewar, was released by MIT student Steve Russell and his team in 1962. By today's standards it's very simple, but it in a way started the whole video game industry, even though it was not a commercial game itself. (Wikipedia contributors, "History of computer and video games"). The educational use of computer games became widely popular in the early 1970s (Egenfeldt-Nielsen, 2005, 40).

Egenfeldt-Nielsen (2005, 2) identifies three – overlapping and not chronological – generations of educational games:

> The first generation is edutainment that perceives the use of educational computer games as a direct way to change behaviours through repeated action. The second generation puts the spotlight on the relation between computer game and player. Computer games become interesting because they are believed capable of offering a variety of ways to learn with varying degrees of difficulty. The third generation includes the context of computer games and how they facilitate learning environments with peer-collaboration, constructions of knowledge, new teacher role and a changed student role.

Several learning theories have been involved in the evolution (and revolution?) of educational games. Egenfeldt-Nielsen (2005, 113-117) identifies following learning theories behind the three generations of the educational games. The first generation derives mostly from behaviourism[8]. The second generation relies on cognitivism[9] and constructivism[10]. The third generation is backed by socio-cultural learning theories[11], situated learning[12] and constructionism[13].

Since the early phases, the digital games have been used as tools in almost every possible field of education and training. They have been used for example in aviation

[7] The first known graphical computer game, OXO for EDSAC computer, was created by A.S. Douglas in 1952 as part of his PhD at the University of Cambridge. It was a simulation of Tic-Tac-Toe. EDSAC was a unique computer built in at the University of Cambridge. (Wikipedia contributors, "OXO").
[8] See for example: http://en.wikipedia.org/wiki/Behaviourism
[9] See for example: http://en.wikipedia.org/wiki/Cognitivism_(psychology)
[10] See for example: http://en.wikipedia.org/wiki/Constructivism_%28learning_theory%29
[11] See for example: http://www.unm.edu/%7Edevalenz/handouts/sociocult.html
[12] See for example: http://en.wikipedia.org/wiki/Situated_learning

education, business training, health education, leadership training, medical training, military training, physical education, social studies and in teaching chemistry, computer programming, economics, geography, history, languages, mathematics, physics and reading. See appendix 1 for more information and game examples.

2.2 Games, those simple-minded activities?

Prensky (2005) points out, that games can be roughly divided into two categories on the basis of their complexity. In the first category there are so called mini-games. They are games that don't bear any great importance, meaning or are devoid any learning. They are simple and trivial games, games like Pacman, Frogger, Solitaire and most of the games that can be found on the Internet's game sites. They are fun to play for a while and may provide some practice for your mind or reaction speed, but otherwise don't provide any significant learning experiences. Prensky (2005, 2) counts board games like Monopoly and Trivial Pursuit as mini-games as well. Even Chess and Go belong in this category. They are, however, “mini games on steroids”, because they are challenging and hard or impossible to master. Mini-games are not useless, but lack the breadth and depth necessary for being educational. (Prensky 2005, 6).

Pacman (Image 1) is a very famous game and it’s probably familiar to most readers, but here is a short description of it, nevertheless. The player controls a yellow ball, Pacman, which moves in a maze filled with dots. Pacman has to eat all the dots in the maze and at the same time run away from four ghosts that are chasing it. Occasionally Pacman can eat a large pill, which turns the tables for a while: the ghosts become the hunted and Pacman can be the hunter. When all the dots in the maze have been eaten, another maze is introduced. This goes on and on. The player gets score by eating the dots and also by eating the ghosts and some occasional berries when possible.

[13] See for example: http://en.wikipedia.org/wiki/Constructionist_learning

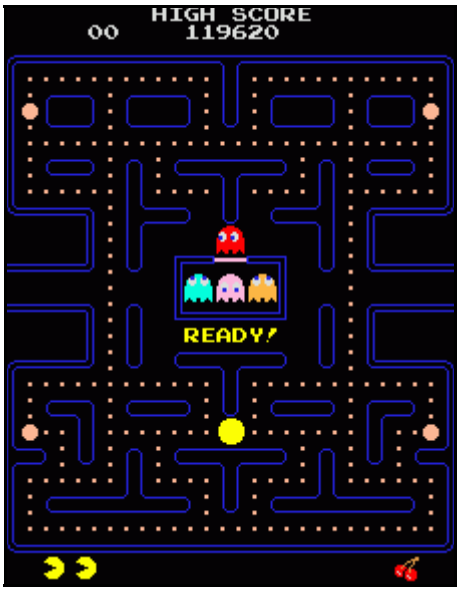

Image 1 Pacman

In the second category there are so called complex games. These games may require even more than an hour to learn the basic skills needed to play the game and tens of hours to master. According to Prensky (2005, 4) these games are among the most non-trivial pastimes ever invented, requiring enormous amounts of effort, skill and learning.

Civilization IV (Image 2) is a game in which the player takes almost godlike role of a leader of a civilization. The game starts in the Stone Age and slowly advances towards the space age a few thousand years later. There are several possible winning conditions in the game, but basically the task of the player is to create a civilization that is a leading superpower in the end of the game. This can be achieved by building cities, gathering resources, building infrastructure, growing the military, spreading the culture and religion, by developing technology through scientific research, handling the economy and by forming alliances with the other nations.

Image 2 Civilization IV

Star Wars: Knights of the Old Republic (Image 3) is a role-playing game taking place in the Star Wars universe. The player is thrown into the middle of a complex story, which gradually unfolds and probably even surprises the player at one point. During the game the player explores the world, meets other characters, fights enemies and solves problems. The player is confronted with dozens of moral dilemmas, which will lead the game character gradually towards the light or the dark side. The alignment of the character affects the way other characters react to the player's character and it also has an effect on the character's abilities. The average time to play the game from start to finish is about 40-50 hours depending on how deeply the player explores the game.

Image 3 Star Wars: Knights of the Old Republic

In both of these games there is a tutorial in the beginning. In Civilization IV it's

optional, in SW: KOTOR it's integrated in the game. The tutorials teach the player the basic skills needed to play the games and last from 30 minutes to an hour, but after that it's up to the player.

2.3 Effects of the digital games

Research in digital games has shown them to have both positive and negative effects on players. Here are my findings:

2.3.1 Positive effects

According to Cole (1996) well designed computer games and Internet activities for home use can have a lasting positive impact on children's academic performance (Rauterberg 2004, 53-54).

Collaborative game playing necessitates the development of social skills, for example in order to decide on, define and agree goals (Rauterberg 2004, 54).

According to Robillard & Bouchard & Fournier & Renaud (2003) using a low-cost commercial computer game VR application with head mounted display applied to phobic and non-phobic persons resulted in a sufficient amount of immersion and presence for the phobic patients to be useful for therapeutic settings (Rauterberg 2004, 55-56).

Green & Daphne (2003) have found out that video games improve visual skills.

Video games have been used successfully in pain management (Griffiths 2005).

There are reports of benefits when using video games as a form of physiotherapy or occupational therapy in many different groups of people (Griffiths 2005).

The games can influence motivation and engagement of the learners in a positive way. Games offer a secure and contextual environment that foster different skill acquisition. Basic skill level starts with eye-hand coordination skills and continues to more complex skills e.g. problem solving skills, communication and collaboration skills, strategic

thinking skills, social skills. (Pivec 2005)

2.3.2 Negative effects

There is a risk of video game addiction (although the prevalence of true addiction, rather than excessive use, is very low) (Griffiths 2005)

There have been numerous case reports of other adverse medical and psychosocial effects (epileptic seizures, auditory hallucinations, enuresis, encopresis, wrist pain, neck pain, elbow pain, tenosynovitis, hand-arm vibration syndrome, repetitive strain injuries, peripheral neuropathy and obesity. (Griffiths 2005). However, adverse effects, when they occur, tend to be relatively minor and temporary, resolving spontaneously with decreased frequency of play. (Griffiths 2005). Also, Olson & Mauer & Heuer have pointed out, that the negative physical effects can be minimized with following simple instructions. They have also argued that games are not responsible for making people overweight.

According to Mitchell & Savill-Smith (2004), Clark (2003) has pointed out several attributes of the games that may have negative impact on learning:

- learning objectives may not be congruent with game objectives
- games can distract from learning as players concentrate on completing, scoring, winning
- games require suspension of belief; it may be difficult to retain learning acquired in that state
- reaching male and female audiences to the same extent may fail
- there is a risk of alienating the learners by ‘hijacking’ what is seen as their world; they may feel patronised.

Also according to Mitchell & Savill-Smith (2004) The **Becta** project (2001, pages 3–4) points out further disadvantages.

Games may:

- be pitched at the wrong level of interest and challenge for the user
- be too easy or too difficult, resulting in decreased motivation
- take a long time to work through, which can cause problems with timetabling and set curricula

- be poorly designed (e.g. there can be problems with a confusing interface, insufficient feedback and illogical rules or constraints)

Also:

- much games software is gender specific and/or peopled with violent and stereotyped characters – as the game provides no opportunity for reflection on this stereotyping and behaviour, it is implicitly condoned

However, most of Clark's and Becta's findings can be turned upside down with a proper and good game design. Also when the games are used in a school setting under teacher's supervision, most of the other problems vanish as well.

3 Game design for educational games

Prensky (2001) has listed several factors that make games engaging:

> Games are a form of **fun.** That gives us ***enjoyment and pleasure.***
> Games are form of **play**. That gives us ***intense and passionate involvement.***
> Games have **rules.** That gives us ***structure.***
> Games have **goals.** That gives us ***motivation.***
> Games are **interactive.** That gives us ***doing.***
> Games have **outcomes and feedback.** That gives us ***learning.***
> Games are **adaptive.** That gives us ***flow.***
> Games have **win states.** That gives us ***ego gratification.***
> Games have **conflict/competition/challenge/opposition.** That gives us ***adrenaline.***
> Games have **problem solving.** That sparks our ***creativity.***
> Games have **interaction**. That gives us ***social groups.***
> Games have **representation and story.** That gives us ***emotion.***

The list is at the same time also one definition of what games are. However, not all games succeed in being engaging. For example badly designed games may still be games by definition, but they won't engage people at least as well as well designed games. I'm going to discuss game design to some extent and use Prensky's list as a foundation for it. I'm going to open his list with my interpretations and some examples. First, however, I'd like to point out an important factor of games.

3.1 "Games are a form of fun"

As Prensky says, fun is one factor of engagement. Most games are fun, but what does it mean? 'Fun' as a term is very vague. One can have fun in so many different ways. Ludologist Jesper Juul (2003) lists on his blog some ways in which players often derive pleasure from games. The list is partly based on Marc LeBlanc's speech in Game Developer's Conference 2000.

> *Clearing*: Many games allow the player to clean up a scattering of interactive elements. There's a simple pleasure players seem to get from "Hoovering" their way across a room full of gold coins or revealing the blacked out sections of the maps in RTS games or RPG's.
>
> *Collection*: The act of accumulating things. (Could be referred to as Consumerism.) Sometimes tied to the desire to complete a set. Examples: Collecting coins in Mario. Collecting Magic cards. Buying things in The Sims.
>
> *Creation*: Bringing something into existence. Building something that feels like it belongs to you. Examples: Constructing and growing a city in SimCity.

Creating and arranging a fish tank in El-fish.

Discovery: Space to explore and gain mastery over. Sometimes conceptual space, like the rules to a new game. Examples: It's fun to range over a new (often blackened-out) map in many strategy games like Warcraft or Sacrifice. You can see players go through phases when playing successive games of Onhe Furcht und Adel–they gain enjoyment over discovering the parameters of the game (and the successful strategies therein), then mastering the game.

Diversion: Pleasure derived from performing routine game system activities–the mechanical act of manipulating the game. Examples: Playing an hour of Windows Solitaire.

Expectation: Waiting with exciting for some perceived reward or entertaining moment. Examples: The thrill of gambling; blindly waiting to see if you've 'won' playing slots. (DX1 featured a similar chest lock picking dynamic–the player spent a lock pick and waited for a few expectant seconds to see what he had won.)

Experience: Allowing the player to engage in a real-world activity that is beyond his practical means. Examples: Killing a person with a pistol. Flying a fighter plane in a flight sim. Driving crash-up derby cars in a mud arena car game. Getting to play against Tiger Woods in a golf match.

Expression: Self discovery/exploration. Identity expression. Examples: Choosing a self-gratifying nickname, character name or call sign in a game like Quake, EverQuest or X-Wing Vs Tie Fighter. Choosing a character race/group in an RPG that is identified with an archetype or demeanour. Deck construction in Magic the Gathering.

Fantasy: Vehicle for imaginative or impossible activity. Examples: Flying on the back of a red dragon. Battling the undead. Piloting a space ship.

Fellowship: Social aspects of gaming. Examples: Working with squad mates in FireTeam to form a plan and attempt to score a goal. Standing around, chatting in the town in Diablo.

Goal-completion: Being given a clear goal and actually recognizing that it has been accomplished. Example: Completing a bridge level in Bridge Builder. Completing a mission in C&C (in which the player is often given very clear goals, like, "Build at least 12 tanks.").

Investment: Spending time on some game element and thus coming to value it. Examples: Slowly building up a 60th level druid in EverQuest.

Media-migration: Players desire to interact with familiar (and often well-liked) fictional elements from other media. The keys to this are familiarity (with the established fiction) and interaction. For instance, during beta-testing of the Aliens vs. Predator game, players demanded the option of carrying and using Hicks' shotgun, even though it was an antiquated, inferior weapon. In Star Trek

games, players get excited at the option of attempting their own solutions to classic problems/encounters posed by the television series. Using a light saber from Star Wars carries its own appeal.

Narrative: Drama that unfolds over time, creates tension, engages us. Examples: Learning of "Tommy and Rebecca's" situation in System Shock 2 and finally seeing them run down the hall toward escape. (Embedded narrative.) The dramatic events that occur in a Quake deathmatch as a result of the players' actions. (Emergent narrative.)

Obstacle: Encountering a challenge and overcoming it. Examples: Making a difficult jump in SSX.

Sensation: Aurally or visually pleasing aesthetics. Examples: The first time the player steps out onto a hill and overlooks the world in Sacrifice, with its amazing art, he is in sheer awe and feels pleasure.

Victory: Putting the beat-down on an opponent. Some people are driven to compete and gain pleasure from winning. Examples: Players love being the top-ranking player in a Quake deathmatch.

I'd like to add *Destroying* to the list. Destroying virtual environments and objects can be very pleasurable and relaxing as well.

As already mentioned, there are many ways to derive pleasure from games. But there are also some factors that have effect on how pleasurable game is. Usability is one. Level of challenge is another. I'll discuss these later.

3.2 "Games have rules"

In digital games the rules define what *can* be done and what *should* be done. It's good to remember that when there are rules, there is always a possibility of cheating. In traditional games the players control each other and make sure the other players don't cheat. There may also be a referee to control the players. In digital games it's the software itself, that should make sure the player's don't cheat.

In recreational games the cheating isn't as bad things as in educational games. If the player is able to skip the educational content and get away with it, the game doesn't fulfil its purpose. In digital games the cheating may be possible due to bugs in the software or simply because of a bad design.

The educational games do have advantages in this sense, though. When used in a class setting, the teacher can control the learning of the students, for example with group discussions or tests. If the game is played with a team, the team members can control each other. The game can also be structured in a way that it’s necessary to learn the educational content before the player can progress in the game. If the game has more freedom, it can also have a feedback system that tells the player which parts of the game have not been solved yet. The game should naturally be thoroughly tested to make sure it doesn’t have any bugs or loopholes that can be abused.

3.3 “Games have goals”

Many games do have goals, but there are also games that don't have clear goals and even games without any predefined goals at all.

Most games have very clear goals. The player is told what one has to do and then s/he tries to thrive in the game. Clear goals do motivate, but they also limit freedom. Limiting freedom may take away some of the fun.

Some role-playing games, like Elder Scrolls III: Morrowind and Elder Scrolls IV: Oblivion, have very open-ended structure. They allow the players move in the world freely, choose whether they want to participate in the main storyline or not, make their own friends and enemies and choose their own adventures and so on. There is no real ending in the game, even if one finishes the main storyline. Massively multiplayer online role-playing games or MMORPGs have this kind of open-ended structure as well. These games do have goals, but the player is allowed to choose which goals s/he wants to pursue.

Some games, for example games in the Sim series (e.g. Sim City, Sims) don't have any predefined goals. On the other hand the designer of the series, Will Wright, calls them as software toys and not games. However, if the player defines one's own goals, then these toys become games. This kind of approach can work well in some educational games, because it lets the teacher define the goals. In some cases it's better to have this kind of open-ended structure, because it allows multiple uses of the game.

There are also short-term and long-term goals in the games. Long-term goals are important in the games, because they make playing the game meaningful. They give the players a clear objective, which they should try to achieve. Without clear long-term goals the player may feel at a loss. An example of long-term goal would be to become the greatest civilization in the world in Civilization IV. In Elder Scrolls IV: Oblivion one of the long-term goals could be to save the world.

Short-term goals are important, because they guide the player on one's path. Without them the player might feel uncertain and lost. There would be no way to tell, if the player is making any progress in the game.

An example of short-term goal in Civilization IV would be to build a settler unit and send it to build a new city somewhere. In Civilization IV the player chooses one's short-term goals oneself, but the game also suggests them with default settings. This option can be turned off, though. In Elder Scrolls IV: Oblivion the short-term goals could be to solve smaller quests along the way through the main quest. Saving the world involves making friends, destroying enemies, information gathering, rescue missions, travelling from place to place and so on.

3.4 "Games are interactive"

Interactivity is one of the most important elements of digital games. Crawford (2002, 5) has made up a nice definition of interaction: "*a cyclic process in which two actors alternately listen, think, and speak*". "Listen", "think" and "speak" should be taken metaphorically when the term is used in the context of digital media. Crawford (2002, 6) emphasizes that interaction is a gradual concept. There is either no interaction at all or there are different degrees of interaction. For example Tic-Tac-Toe has very low degree of interaction: the player marks a square, waits for the opponent's action, marks another square, and waits for the opponent's action and so on. In the other end there are complex simulation games, strategy games and role-playing games, which have a very high degree of interaction. Some games may involve so much interaction that their usability suffers and the player gets confused.

When designing an educational game, one should remember that so called "hard core

gamers" [14] are a minority. Some people have never played a computer game and most people play usually less complex games. To play a game with a high degree of interaction may take a very long to time to learn. In educational setting there may not be enough time for this. Playing the game should be easy to learn so the player can get into the real educational content.

3.5 "Games have outcomes and feedback"

Because of the interactive nature of the digital games, the player usually sees the consequences of one's actions in the game. The games are more or less abstractions of reality and can thus be used to convey complex ideas in a simplistic and easily understandable way. For example Squire (2004) has made a case study using Civilization III as a tool in history education. Even though the game didn't teach the students history, it enabled them to grasp the idea how culture develops.

Reflection is an important part of the learning process. Educational games should enable it. Using educational games in a class room makes it possible to have group discussions about the game. For example in Squire's study the group discussions played an important role in supporting the students' understanding of the underlying concepts of culture development.

If the game is played alone, there should be other ways to enable reflection. An on-line discussion is one way. In-game dialogue is another way. It should be noted, however, that in-game dialogue may be quite limited. Dialogue in games is usually handled with some pre-written selectable sentences and predefined reactions to them. Sometimes there is some primitive language interpreter and artificial intelligence involved. Language interpretation and context sensitive artificial intelligence are still infant technologies and can't enable sensible, believable or rich dialogue. They can merely amuse. There is at least one interesting example of a bit more advanced system, though. It's Façade[15] by Michael Mateas and Andrew Stern. Façade is not exactly a game, but an interactive drama – depends on the definition, though. The technology used in it could be applied to games as well. In Façade the player is thrown in a middle of a family crisis

[14] A hard core gamer is a computer game enthusiast who spends a lot of time playing them. S/he also spends considerable amount of money for keeping the computer in the higher end of the spectrum, because the newest games demand more and more processing power and memory.

in a role of a guest. The player can interact with the other characters by writing sentences and with some simple actions like hugging and kissing. The story goes on in real time and unfolds on the basis of the player's actions – or non-action. The player can write sentences in natural language and the characters sometimes react surprisingly believably to them. The technology isn't perfect, however, and it's relatively easy to get into a nonsensical dialogue with the characters as well.

Games can be built with a feedback system, which can be used during the game and after the game has ended. During the game the player can get feedback on one's performance. After the game the player can get an overall evaluation of one's actions and performance.

3.6 "Games are adaptive"

Prensky (2001) notes that adaptivity *gives us flow*. 'Flow' in this context is a psychological concept by Mihaly Csikszentmihalyi. With it he means a

> …state in which people are so involved in an activity that nothing else seems to matter; the experience is so enjoyable that people will do it even at great cost, for the sheer sake of doing it. (Csikszentmihalyi 1991, 4)

The flow state is also called as 'being in the zone', especially in the sports psychology (Young & Pain 1999). The flow is important both for motivation and for learning. For example Kiili (2005, 37) refers to the research by Skadberg and Kimmel (2004) and points out that flow has a positive impact on learning, among other things.

It has been argued that the flow state can be induced. There are several factors involved: skills, challenge, boredom and anxiety. If the challenge is too easy, it becomes boring. If the challenge is too hard, it causes anxiety. Flow happens when these factors are in balance. It happens somewhere between boredom and anxiety.

Holt (2000, 13) has listed seven factors from the perspective of video games, which contribute to flow:

1) Task is completable by the player
2) Player is able to concentrate on task
3) There are clear goal(s) for the player to accomplish

[15] Façade can be downloaded free from http://www.interactivestory.net/

4) There is immediate feedback for action
5) Deep involvement, resulting in a ‘no-self’ experience
6) Player experiences a sense of control over their own action(s)
7) Self Concern disappears

If the game adapts to the player's skills, the flow is possible to be maintained for a longer time. There are several ways that computer games can adapt to the skills of the player. The first one is a gradual increase of challenge. Because the player's skills increase while playing, the game soon becomes too easy, if the challenge doesn't increase at the same pace with the player's skills. Suitable gradual increase of challenge can be anticipated from an average player performance. However, experienced players may still find the game too easy, because their skills are above the average already in the beginning. On the other hand, less experienced players may still find the game too hard in the beginning and be discouraged.

Another way is to have selectable difficulty levels. The player can choose the beginning level of challenge. If this is combined with the gradually increasing challenges, it works better. However, this system may still not be flexible enough.

Again another way is to have a system, which alters the level of challenge constantly based on the performance of the player. Kiili (2005, 64-65) has suggested an adaptive game flow engine as one solution. The adaptive game flow engine would take care of manipulating the challenge levels according to the player's game play. He points out, however, that there is a risk of abuse in this kind of system. The player could willingly play worse than s/he is capable of and thus get an easier game. When designing an educational game with an adaptive challenge system, this should be taken into account.

Poor usability can cause anxiety and distraction and thus prevent the flow experience. Poor usability ruins the game experience. The usability of the game should be tested profoundly before publishing it. Here are some suggestions to avoid the most obvious problems in the games:

- the game’s user interface and game controls should be easy and quickly memorable
- long games should have a save game option, because it’s frustrating to start again from the beginning after playing long time, if one has to leave the game at

one point

- challenges should be suitable for the player's skills; not too easy and not too hard
- there should be help available when needed
- player should not be forced to passivity by showing intros or cut-scenes that are not bypassable, because the player wants to play and not watch TV (usually)

3.7 "Games have win states"

Again, the win states come on many degrees. First, some games can be beaten. In them, there is a clear ending and when the player gets there, the game has been won. Some games never end, but continue as long as the player is able or willing to play them. Both types of games – usually – have some kind of smaller win states during the game. Some games involve moving from level to level. Solving the level, the player gets to the next level and this continues until the end of the game. Some games have puzzles, which need to be solved before the game continues. Some games have opponents who have to be beaten before one can continue further. All these are examples of those smaller win states.

The player usually gets satisfaction of beating the game or parts of it. The amount of satisfaction depends much on the level of challenge. The more challenging the game has been, the more satisfaction it brings to beat one.

The player can also be rewarded additionally in some way for winning the parts of the game and also the game itself. This way the satisfaction deepens. There are many ways to reward the player and it depends on the type of the game what is a suitable way. The reward could be something visually or aurally pleasurable, increase of the game score or some other kind of bonus, hints, information, a companion... In an educational setting the rewards can naturally be also external, outside-of-the-game rewards.

3.8 "Games have conflict/competition/challenge/opposition"

Crawford (2003, 55-69) has described different dimensions of conflict. There are various types of conflicts: physical, verbal, economic, political. Conflict can be direct or indirect. Intensiveness of conflicts can vary. Some games deal with one type of conflict

only.

Basic shoot'em ups for example deal with a very intense, direct and physical conflict. In an old adventure game classic, Secret of the Monkey Island by Lucasfilm Games, the sword fights were verbal conflicts. The best verbal insult brought the player an upper hand and after several successful insults the fight was won.

There are also games that deal with many kinds of conflicts. Civilization IV deals with physical conflict – war, but also with economic, political, cultural and religious conflicts. In Civilization IV the conflicts can be direct – between military units, but they can also be indirect. Indirect conflicts in Civilization IV mean for example influencing an ally by diplomatic means, and getting it to start a war or cancel diplomatic agreements with another civilization. It can also mean blocking access to important resources from a rival civilization.

Competition in a game can happen between human players or between a human player and an artificial intelligence. It can also be a competition against time. One can also compete with oneself. The competition between players can take place in the game or it can be a competition for the highest score or the fastest time for example.

It should be noted that competition can motivate some people, but it can also discourage other people. This seems to be a gender issue as well:

> Women students also seem to avoid currently available software that encourages highly competitive learning processes than cooperative learning, a style that they themselves prefer (Fasick, 1992). (Rajagopal & Bojin 2003).

Competition can also be cooperative. There are games in which teams compete with each other. Team play can naturally cause pressure as well, so it may not be suitable for all learners either.

Crawford (2003, 41-53) has also identified many different types of recreational challenges. Some of them are applicable to computer games: spatial reasoning, pattern recognition, sequential reasoning, numerical reasoning, resource management, social reasoning and sensorimotor challenges. Sequential reasoning and numerical reasoning, however, are not very suitable challenges in computer games, because the computer

outperforms human being easily in the tasks involved.

Because there are different types of learners, the game should serve their needs. There should be enough variation of the challenges or many ways to solve them.

3.9 "Games have problem solving"

The problems in the games are closely related to the challenges in them and there may be many different types of problems. The more complex the problems are the more creativity is needed to solve them. In educational game the problems should be related to the educational content.

Problem solving is an important factor in learning. When the learner contemplates on a problem and finds a solution for it, learning has usually already happened, unless the solution was found by luck.

3.10 "Games have interaction"

Games may involve or encourage social interaction in many ways. Multi-player games involve competition or collaboration. Some multi-player games, especially MMORPGs, involve more complex social interaction as well. Some examples of social interaction in MMORPGs are chatting, trading, fighting, having virtual sex and teaming up with other players. Some games, like Ultima Online, have created fully working societies with politics, elections and hierarchy (Taxén 2002). Some games, like Everquest, have real economies (Castronova 2001). There is even crime in some games. For example in Sims Online and in Second Life some players have teamed up to become Sim Mafia[16], which acts like a real mafia, only virtually. In some games there have been gangs, which blackmail other players for virtual money (Wikipedia contributors, "Virtual crime").

Single player games sometimes involve competition with others as well, for example in the form of high score tables. They can also involve collaboration, because gamers usually share ideas and hints about games with each other and both multi-player games and single player games have created large fan communities around them.

[16] http://www.thesimmafia.com/

3.11 “Games have representation and story”

Storytelling in games varies both in quality and quantity. Some games, like Tetris, don't involve any storytelling at all. Some games have external stories, for example in a handbook, and many games have internal stories.

In Myst series the story is told mostly through diaries and notes, which the player finds scattered in the game world. The player is not forced to read them, but they contain important hints to the puzzles in the game. Also, if the player really wants to understand what is going on in the game, then the diaries make things more clear.

In some games the story is told through an introduction video, through cut-scenes during the game and in the end-of-game debriefing video. The cut-scenes have been criticized for breaking the immersion. They do this at least for two reasons. The first one is that the player has to watch them passively without possibility to interact before the cut-scene is over. The second one is that they are also often visually different than the game itself.

Half-Life introduced cut-scenes that happened in the game without breaking the action. The player was free to do whatever one wanted and the events unfolded nevertheless. The immersion wasn't broken like in the example above.

Storytelling is also an age-old teaching method. A good story can make an everlasting impact on people's minds, because it touches their hearts also.

Unless the game is purely linear and limits player's freedom, there may be two parallel stories as Rouse (2001, 216-218) has pointed out. There is the game designer's story and there is the player's story. The player chooses one's actions regardless of the game designer's ideas and creates a story of one's own. If the game is well designed, these stories can merge into one.

Here is one example of player created story from a computer role-playing game Elder Scrolls IV: Oblivion:

It was early morning in Skingrad. The streets were silent and the fog covered the houses made of grey stones. If someone had walked past the bakery and looked carefully at the bay in the wall next to it, one might have been able to notice a cloaked figure leaning against the wall. That was me, Shaleeba, an agent with a mission. I had been hired to spy on a woman who might have been a part of a conspiracy against my client.

The streets were still empty when it started raining. Suddenly I saw movement in the end of the street. It was my client... What was he doing here? I tried to hide in the shadows. He didn't seem to notice me. He was just standing there. Then I saw a door opening and a woman coming out the house. She was my target. I followed her with my eyes, then with my feet. She went past my client who was standing next to a wall. Maybe she nodded to him, I'm not sure. I saw her going into the church. I sneaked in and saw her sitting on a bench. I sat on another bench a bit farther away. We stayed there for about an hour. She left and I followed. I noticed the sun had come out of the clouds.

We came to a vineyard. She seemed to be working there. I was beginning to wonder, whether she was any conspirator at all. Some people had warned me about my client being slightly mad... paranoid. I decided to confront the woman and ask her about my client, in a discreet manner. She was wondering why I was asking about him, but finally told me that she found him quite nice, but that there was something strange about his behaviour. Something, which made her worried about his sanity. I decided to report my client she was not part of the conspiracy. I had plenty of time to think about how to tell it. The meeting would be at midnight.

The game provided a setting for this story. The game character had got the spy mission from a person she had met in the game. The game world in this game is quite alive with changing weather and day-night cycle. The characters in the game have their own agendas. They live their lives. It was me, the player, who chose what to do in this setting. It was me who experienced the situation. And that's how the story was created. It was a combination of the game designer's storytelling and my own storytelling.

The player created stories might be used as tools of reflection, which is an important part of the learning process. The teacher could for example ask the students to write their own stories based on their game experiences.

Games can have interesting characters, atmospheric graphics and music and sounds that all can create an emotional experience. They increase the motivation to play the game. They also help in making the game immersive. Immersion can create memorable experiences. Immersion can also help learning (Buchanan & Sheridan 2005).

4 Case: Nugali

4.1 Early sketches

4.1.1 The idea behind the game

As mentioned in the introduction, the game was supposed to inform and educate on the development issues. At first I had some difficulties in deciding what kind of game would be most suitable for the purposes of this project. First of all it had to be fun to play, it had to be somewhat educational, it had to be complex enough so it could be accepted as a thesis project and so I could actually learn something while working with it. I finally ended up with an idea about a simple life simulation game, in which the player could experience at least to some degree what a life in a development country could be like.

When I was looking for some reference games, I found only a few life simulation games. The Sims by Maxis was the most popular one, but I didn't want to even try to make a game like that. I also knew Real Lives 2004 by Educational Simulations[17], which is a game, in which the player character can be born in almost any part of the world and live one's life accordingly. That game has influenced Nugali quite a bit. Another game that has had influence on Nugali is a text-based Alter Ego[18], in which the player character lives one's life from the womb to the grave by getting into situations, which are based on real interviews.

I decided the game would be turn-based and not real-time based, because for my programming skills that was more suitable. At first I also thought the game would be mostly text-based as I wasn't sure, if I could get a graphics designer to work in the project. Now I've got one, but the core of the game remained text-based.

I also had to make a choice between a linear and an open-ended game. Linear game means that the game is quite straightforward from the beginning to the end. The game must be played in a certain order and the freedom of the player is somewhat limited. The game is almost the same every time it is played through. Open-ended game gives the player much more freedom. There are many ways the game can be played through

[17] http://www.educationalsimulations.com/
[18] Alter Ego can be found here: http://www.theblackforge.net/

and the game is never quite the same. A linear game is easier to design, but it usually becomes boring after the first time it's played through. I wanted the game to be playable many times, so I decided to make it as open-ended as possible.

4.1.2 Brainstorming

In August 2005 we had a brainstorming session with some members of Keho. During this session we managed to draw the outlines of the game. There were many elements that didn't end up to the final version of the game and some elements changed during the development. The basic outlines are still quite the same.

Here are the results of the brainstorming:

1. The game takes place in an imaginary development country. The country is in Africa, because the issues in there are simpler to present than the issues in Asia or in Latin America.
2. The goal in the game is to live as long and successful life as possible. In the beginning the game character is 15 years old.
3. Successful life is defined on the basis of successfully completed situations. The situations are text-based and there are several actions the player can choose from. There are no 'right' or 'wrong' actions, but the outcome of the situation will be defined based on the skills of the game character. These situations are the core of the game and they are one way to convey the way of life in some development countries.
4. There are several attributes that will increase or decrease according to a successful or unsuccessful action. These attributes are: social relations, health, knowledge, income security and contentment. When the attributes get high enough they will open bonus attributes: prestige, spirituality, education, material richness and happiness.
5. Game character is either female or male and both options are available in the game. The game character is either poor, rich or in the middle. The game character has family/relatives. The character has four skill sets: social skills, mental skills, physical skills and initiative.
6. There are several ethnic groups in which the game character can belong to. The game happens in a city or in the countryside.

7. There are some environmental factors that may have an effect on the game character's life. Such factors are diseases, crime, macroeconomics, environmental issues and socio-political issues.
8. There are some random special events, like meeting special people or some other special events in life.
9. The game ends when the game character dies.
10. The game score is calculated with the net result of the attribute points and the age at the moment of death.
11. In the end of the game the player is given a short description of the game character's life. The description includes the main events during the life and gives some kind of verbal evaluation of it based on the game score.
12. There is a high-score list for encouraging competition between players as this is one way to increase motivation.
13. The game is mostly text based and has only simple graphics, unless a graphics designer joins the team.
14. The game has no music or sounds, unless a sound designer joins the team.
15. The game should be playable on-line, so it will be possible to play at schools and at homes.
16. The main target group of the game are the students in the secondary school, but it's not limited to them. The game is also targeted to everyone interested in the development issues and also to people interested in life simulation games.

4.1.3 Technical decisions

4.1.3.1 Game platform

I chose Macromedia Flash 8 as the platform for the game as we wanted the game to be playable on-line. Flash was a good choice for this kind of game, because you can easily create visually rich content with it. Because the game is turn-based and there wasn't going to be any complex animations, it wasn't supposed to require much processing power and Flash should have been able to handle all the required calculations without any problems.

Other possible choices would have been for example Java or Macromedia Director. However working with Java, especially if the graphics are involved, is more laborious and challenging than working with Flash. I had only basic skills in Java and it would

have taken me quite a lot of time to learn the skills needed to make a game with it. I have to admit that I also had only basic skills with Flash, but it's easier to learn and thus was more suitable for this project. As the game wasn't going to need a lot of processing power this was also a suitable choice. Java and Director are more efficient than Flash for some tasks, but in this game there wasn't going to be any special requirements in that sense.

To be able to view Macromedia Flash content, the web users are required to install a Flash Player plug-in for their browsers. According to a survey[19] made by NPD's New Media Services Division the penetration of Macromedia Flash Player was 97.7 % of internet connected PCs in December 2005. Java applets and content created with Macromedia Director need their own, much heavier, plug-ins. The penetration of Java was 86.2 % and Macromedia Shockwave Player (Director) had only 55.4 % penetration.

4.1.3.2 Display resolution

Even though the resolution of 800x600 pixels may still have rather high number of users, I decided to choose the resolution of 1024x768 pixels. The reason for this was the graphics. It would have been rather difficult to get all the graphics and text fit on the screen, if the resolution had been lower. On the other hand there are some popular Flash applications in the web that support only the higher resolution. Habbo Hotel[20] is one example. As the game may be played in school settings, this decision may have been wrong, because the schools don't necessarily have hardware that is new enough. However, I decided to take the risk.

4.1.3.3 MySQL, PHP and XML

I'm using both the MySQL database and XML format to store some game data. I use database for storing game score, player accounts and saved game sessions. XML format is used for storing and importing the text-based game situations into the game. I could have used XML or plain text files to store the game score as well, but because I was going to use the database for the saved game sessions anyway, I decided to use it for storing the game score too.

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[19] The results of the survey can be found from:
http://www.macromedia.com/software/player_census/flashplayer/
[20] http://www.habbohotel.com/

4.1.4 Game environment

As the game is supposed to educate people on the Third World issues in general, the idea was first to create an imaginary developing country that would have combined many Third World issues. However as the game would have become too complex, we had to abide by an imaginary African country. I wanted to create a credible environment, so I grabbed several books on African history and politics and also looked into the information in the CIA World Fact Book[21] and Wikipedia[22]. Finally the country was created and named as the Republic of Nugali (Image 4). The information I acquired during this process provided information not only for me, but also for the graphics designer. The information will also be provided for the players, even though it's not necessary to know it to play the game.

Image 4 The Republic of Nugali

4.1.5 Financial issues

At the time of the brainstorming session, people from Keho decided to try to get some funding for the game from the Ministry for Foreign Affairs of Finland. The ministry has a program for supporting NGO's working in the area of development cooperation.
The funding wasn't necessary, but it was thought that it would allow Keho to pay for the possible music and it would also help to get a graphics designer involved in the project.

[21] http://www.cia.gov/cia/publications/factbook/
[22] http://en.wikipedia.org/

It would also allow Keho to rent a server space for the game.

After Keho decided to try to get funding for the project, it seemed to be clear that their involvement in the game depended on whether they would get the funding or not. I had decided to make the game, but as I needed their help in creating the situations, I was quite uncertain whether I was able to make the game the way we had been planning. The funding decision was expected in the end of December.

4.2 Creating the skeleton

4.2.1 Revising the initial plans

During the autumn 2005 I was developing the game idea a bit further. I noticed the game needed some elements, which had not been thought about during the brainstorming session. It also had to be scaled down, because otherwise it would have taken too much time to develop.

4.2.1.1 Scaling down

The number of possible ethnic groups had to be limited to one. The game had to happen also only in one place, because otherwise it would have grown too much. The open-endedness would have allowed the player move from place to place and this would have created a need for much greater number of situations, which was already quite big.

4.2.1.2 Healing

Because the game character could get sick or hurt, there was a need for a way to get healed. I decided to add a healer and a hospital in the game. The healer would offer services cheaper than the hospital, but s/he could only cure some minor diseases and heal wounds. The more serious diseases would have to be cured in the hospital. Both options would consume a certain amount of game time. There would still be some diseases that couldn't be cured at all, like AIDS.

4.2.1.3 Education and jobs

Because the success in the situations would depend on the skills of the game character, there was a need for a way to hone those skills. I decided to add education in the game. By going to school, the game character could increase one's mental skills and knowledge. I also decided to add jobs section in the game. The jobs would bring the

game character money and also hone the skills required in the job. This made it possible to increase all the skills in the game. It shouldn't however be possible to simply select a job, but getting a job should have some requirements depending on the nature of the job. These requirements would include the sex of the game character, certain skills and certain attributes. For example becoming a miner was going require that the game character is male and has certain level of physical skills and health.

4.2.1.4 Marketplace

Because the game character would be able to get money from a job, I wanted to give the player a possibility also to spend it. I thought it would be a good idea to have some bonus items that could be bought from a marketplace. These would be for example chickens, goats and other useful things that would increase certain attributes and thus the game score for a certain period of time.

4.2.1.5 Home

Because the possibility to buy things was created, I wanted also to create a place where these things would be visible. I decided to add a home section in the game. I also thought that there would possibly be some ways to interact with the game character's family and this would happen at home.

4.2.2 Programming begins

During the autumn I spent some time learning game programming with ActionScript, the programming language in the Macromedia Flash environment. I began programming the first demo version of the game in late November 2005. The demo was ready in mid-December. It looked quite crude (Image 5) and it had only some of the basic functions. The situations section was almost ready, the marketplace worked somehow and you could visit home and see the acquired bonus items there. Other parts of the game were not functioning at all yet.

I informed Keho about the demo and began to wait for comments on it. The people had already left for holidays, so I didn't get the first comment until the end of December. It was rather positive so I continued working according to the plan as I received no other feedback.

Image 5 The main user interface of the first demo version, in Finnish only

4.2.3 Graphics and music

Even though the funding was still uncertain, our team grew with two members. Anniina Hautala from the Tampere Polytechnic University of Applied Sciences, Art and Media, decided to work on the game graphics as her thesis project. Jussi Järviniemi from the Pirkanmaa Polytechnic University of Applied Sciences had promised to work on the music and sound effects of the game for the experience's sake. Both had been promised some money, if Keho got the funding, but they were also willing to work for free, if the funding was not got.

I was really happy they decided to work on the game. The graphics and the music don't turn a bad game into a good game, but they certainly have an effect on the atmosphere of the game. Good graphics and music also lure people to play the game. Bad graphics on the other hand may turn people away from the game. I wanted people to at least try the game before turning their backs on it.

I had some kind of visual image in my head what the game could look like, so I tried to convey this idea to Anniina during a meeting in the end of December. However, I didn't want to tie her hands too much with my ideas, so I just told her about the elements that are needed in the game. We came to an agreement of the slightly cartoonish style of the graphics. We also decided the development of the game character would be visible. For example the aging of the character would change one's appearance. Changes in the

attributes would also cause visible changes in the character. I also wanted that the main user interface of the game would be represented as a village and the main elements would be represented as buildings.

I was very happy to see the first sketches Anniina made. Later I became even happier when I saw more final versions of the graphics. The image of the final version of the main user interface (Image 8) is shown on page 44.

With the music I had the same philosophy as with the graphics. I had a basic idea of what the music might sound like, but I wanted to give much freedom to Jussi as well. I just gave some basic instructions to him. As the game happens in Africa, the music had to convey African atmosphere somehow. I also needed two kinds of music clips. The main theme should be quite calm and neutral, so it wouldn't get annoying. Another theme was to be played during wartime. That was to be more aggressive and slightly threatening. The clips had to be quite short, because the game was going to be played on-line and the file size should stay as small as possible. This meant that the music should also be cyclic, so it could continue forever without any distinctive beginning or end.

When I heard the first versions of the clips, I was again very happy. They sounded very good, especially the main theme. Jussi made some slight changes to them, but otherwise the music will remain basically the same in the final version of the game.

4.2.4 Problematic situations

Because I had decided to make the game as open-ended as possible, I needed to create a structure for the situations system that would allow as much freedom to the player as possible, but at the same time the system should stay as consistent as possible. This turned out to be quite problematic.

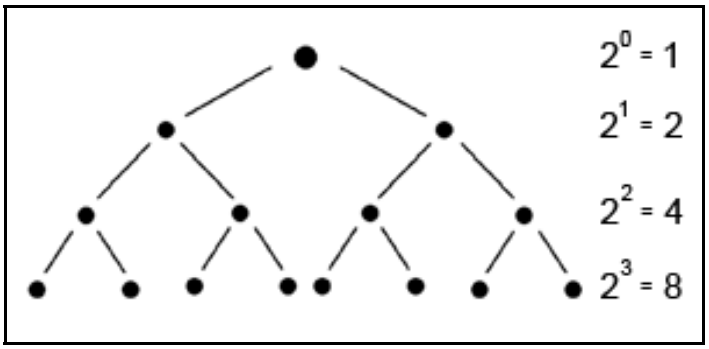

Image 6 Branching tree structure easily creates too many nodes to handle

Open-endedness naturally meant that I couldn't create a list of situations, which would lead from one to another. Branching tree was out of the question, because of the required number of the situations. The number was big, because there had to be enough situations to give an idea about life in the development country. Branching quickly leads to an unbearable number of nodes (Image 6), because the number of nodes grows exponentially. For example only four steps would create a need for $3^4 = 32$ situations.

I decided the situations wouldn't form a unity, but they would be more like fragments of life. However, they still had to be logically twined together with the game character's life. In the first version I bound the situations and the current game year together. Later it became necessary to create three hidden phases of life: the youth, the adulthood and the old age. This is actually quite similar system to Alter Ego. In Nugali the situations work differently, however.

As I didn't want to create black and white situations with a possibility to only make a 'right' and a 'wrong' choice, I created a skill system in the game and bound it and the situations together. Now the player could make the same choice and the result would be either positive or negative. The result would depend on the combination of the skills relevant to the situation and a difficulty factor. The difficulty factor was a necessary element, because otherwise the character with poor skills would almost always fail and a character with perfect skills would almost always succeed. For working well this kind of system requires finely tuned balancing. If the difficulty factor is badly tuned, the situations become either too easy or too difficult. The final balancing can hopefully be found during game testing, but it will happen in some distant future.

The number of situations needed with this system was quite big, but still tolerable, especially, because Keho has about ten active members and dozens of less active members who still might be interested in participating in the project. If the situations had been bound together with the game year and if every year there had been four possible situations, the total number of situations would have been at most 560 with an addition of a few dozen wartime situations. The real number would actually have been less than that. I calculated it like this: 2 * 70 * 4. Two sexes, maximum number of game years, four situations in a year. Because there are common situations for both sexes, the actual number would have been smaller.

I was hoping the situation creation process would be relatively painless. I was quite wrong about that, however. It turned out that creating situations coherently related to the game character's life was quite difficult. For example, if the character didn't have a family, there shouldn't be any situations where the family would be involved. Or, if the character didn't go to school, there shouldn't be any situations where the character is at school. This created a problem. Either those kinds of situations had to be left out totally or some kind of system had to be created to solve it otherwise.

Hard coding[23] the situations in the game would have solved the problem, but this was not a good option, because it would have made editing the game very difficult. The code would also have grown very large. The code could also have been written only after the situations were ready. The time reserved for the project would have run out. The file size would also have grown, but as there was only text involved, the growth would probably not have created a problem in this sense.

The only reasonable options for bringing the situations into the game were using a database or XML files. They both are good techniques in bringing external data into the Flash environment. I am using both techniques in the game now, but for different reasons. I am also using a database to store the created situations, but I finally decided to use XML to bring the data into the game. Later this turned out to be the only working

[23] **To hard code** or **hard coding** (also, **hard-code**/**hard-coding**, **hardcode**/**hardcoding**) refers to the software development practice of embedding output data directly into the source code of a program or other executable object, or fixed formatting of the data, instead of obtaining that data from external sources or generating data or formatting in the program itself with the given input. (Wikipedia contributors, “Hard code”)

solution as the game structure changed. More about the changes in chapter 4.4: “Fundamental changes and the final game structure”.

I created a tool for inserting the situations into the database and a tool for editing them (Image 7). I also created a tool for extracting the situations from the database into XML format. It might be possible to extract the data directly as XML files, but it depends on the server's capabilities. This would enable everyone to create situations directly for the game application, which could use them automatically. There are only some slight changes to be made in the code, if the number of created situations grows larger than it was originally thought.

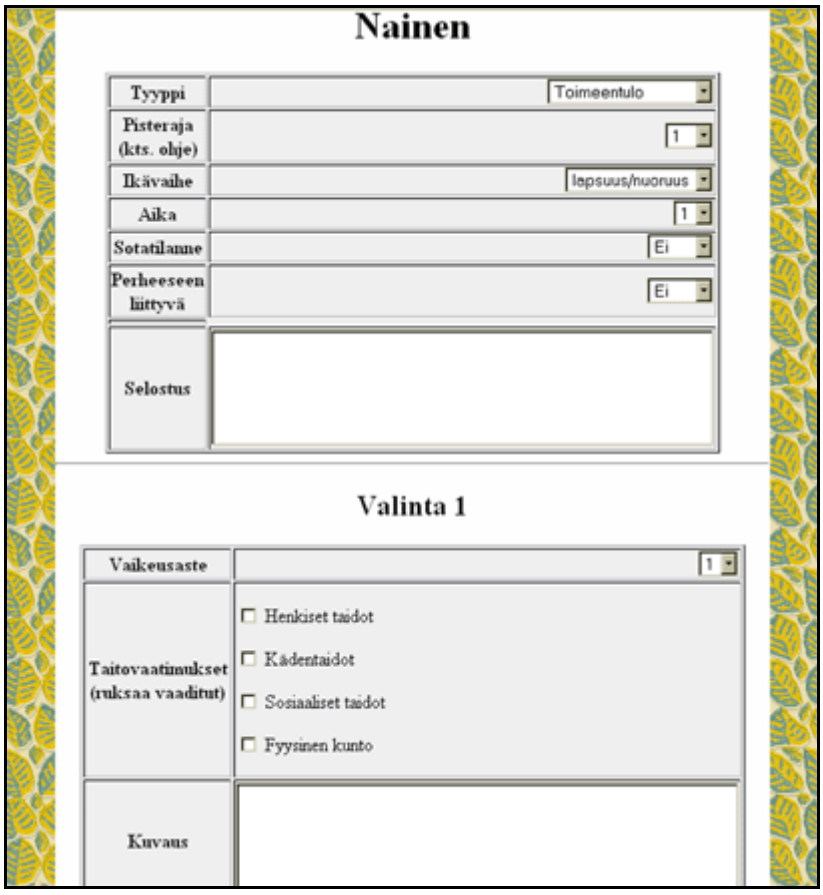

Image 7 Part of the situation inserting/editing form

4.3 Fundamental changes and the final game structure

The funding decision was made a bit later than anticipated, on the second week of January 2006. Keho was granted ca. 70% of the applied funding, which was really good, but it also meant some cuts had to be made in the project. Week after the funding decision we had our first meeting with the members of Keho since the autumn. By that

time I had created the first working versions of the jobs and education sections.

In the meeting it turned out that most of the active members of Keho had not even looked at the game before that day. It also turned out that the implementation of the situations, the jobs section, the education section, the skill system and the way money was presented in the game, were not suitable for their purposes. They had to be redone. That meant I had to rewrite about half of the code, several thousands of lines. The changes also created some programming dilemmas, which took quite a long time to solve.

The attributes mentioned in the brainstorming session are no longer in the game. They were removed for simplicity's sake. Money was also removed. Instead of those, three new elements were introduced: welfare, human relations and income. Human relations and income together formed the welfare. The outcome of the situations was to affect the human relations or income.

This chapter deals with the final version of the game. At the time of writing this, the game is not ready yet. Thus the following is at the same time a description of the current version of the demo and a design plan for developing the game further. The current version is not very playable and most of the elements and functions described are not implemented yet.

4.3.1 Character creation

Before the game begins, the player creates a game character. The creation process is quite simple and quick. First the player chooses the sex of the character. Next action is to select an African name for the character or write a name oneself. After that the character is given randomly shared skill points. The player can also share a certain amount of bonus points to the skills. The skills, or skill sets, are different than in the brainstormed version. There are now *fitness* (in the game it's counted as a skill), social, mental and *manual* skills.

After all is done, the game can begin. The player character has a family, which gets a randomly selected social status and income level. The player character inherits these, so s/he has some income points and human relations points in the beginning of the game.

In the beginning, the game character is 12 years old. We decided to give a bit longer playable childhood for the character than it was thought in the brainstorming session.

Image 8 Character creation: sharing skill points

4.3.2 The main user interface

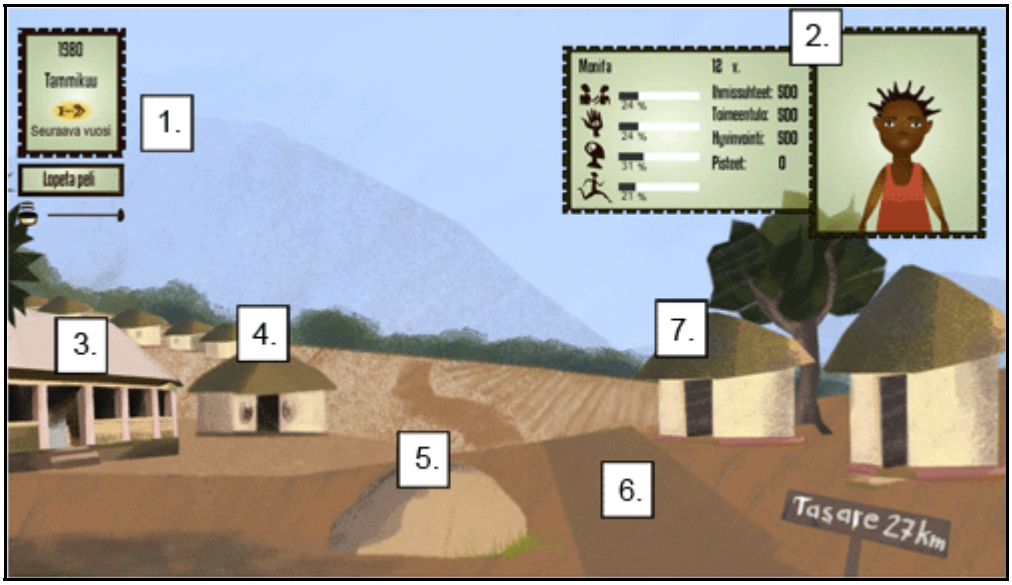

Image 9 The main user interface is depicted as a village

4.3.2.1 Explanation of the image 8

See appendix 3 for images of the different sections.

1. End turn, quit game, adjust sound level (or turn it off/on)

This is a collection of elements that can be used to end the game turn (move to next year), to quit game or adjust sound level. The placement of all these elements may change in the final version of the game. There will also be a save game option in the game and an element for that will be added somewhere.

The larger element tells the current year and month. The arrow with the orange background is a button to move to next year. The background is orange, if there is still time left. If there is no time left, the background turns green. In the beginning of the game there is probably only 10 months of available game time in a year, because there is no well in the village. The water has to be carried from somewhere outside of the village and it consumes time. Later in the game a well may be built in the village. After that the available game time increases to full year.

2. Character information

The character information sheet becomes visible when the mouse pointer is taken on the picture of the player character. The sheet shows following information: name, age, skill levels, human relations points, income points, welfare points and game score.

Fitness can decrease temporarily due to injury or sickness. If that happens, both the original and current value will be visible. In the final version of the game, the other skills may also decrease on annual basis, if they are not used.

The welfare points are the average value of the human relations points and income points. Game score will be calculated with the welfare points and the age of the character.

The image of the character changes according to the age, income points and welfare points. The image also shows whether the character is going to school or is in the military. The colour of the background of the image changes, if the character is sick.

3. Education

The school building represents education.

4. Healer/Clinic

The hut in the picture belongs to the healer. If a clinic is built in the village, it will replace this hut.

5. Human relations

This element is depicted as a rock in the beginning of the game. If the well is built in the village, it will replace the rock.

6. Marketplace

The road takes to the marketplace.

7. Home

This is the childhood home. It is possible that the hut next to it will become the home of an adult player character in the final version of the game.

4.3.3 Education

At school the character can get educated. Becoming a pupil isn't easy, though. First, there is an income requirement to cover the costs of school uniform, books and writing tools. Second, a child needs a permission from one's parents to go to school. The permission can be got from home by having a successful dialogue with the parents.

4.3.4 Healer/Clinic

If the character gets hurt or sick, it's possible to get healed or cured with the help of a healer or a doctor. The healer can only heal wounds and maybe cure some minor diseases. The healer's services are quite cheap. If there's a serious illness, the healer can't help. If there's no clinic in the village, the character can get to nearest hospital, but it costs a lot. If there's a clinic in the village, the doctor can help. It stills costs more than the healer's help, but less than going to the hospital.

Healing involves resting. This means it consumes available game time. The amount of consumed time depends on the severity of injury or sickness.

4.3.5 Human relations

This section has two different activities available.

Situations related to human relations

See “Situations” for information about this.

Possibility to get married

Getting married and having children increase human relations points. They may also decrease, if the spouse leaves the player character or if a child dies.

There will be three candidates of the opposite sex of the character. If the player character is female, there will be three men who will try to propose marriage to the player character. A dialogue options will be available and the player can try to find out more about these characters. If the player character is male, he can propose marriage to the women. There will also be a dialogue option, but this time the player has to convince the selected character that he is the ‘right one’.

Homosexuality was discussed as an idea, but Keho decided to avoid it in the game, because the issues related with it are too difficult in many African societies.

4.3.6 Marketplace

The marketplace has three different activities available.

Income related situations

See “Situations” for information about this.

Buying & Selling

It will be possible to buy at least chickens, goats, certain tools and seed from the market trader. It will also be possible to sell chickens, goats and farming products to the same character. Because there is no money anymore in the game, the income points will be used as the currency.

Jobs

There are several jobs in the game. Some of them are temporary, some are long-term jobs. To get a job, certain requirements must be met. The jobs can be got from a head-hunter, who can usually be found from the market place. It's also possible to get a job by acquiring certain commodities and using them to produce tradable items.

Job	**Requirements (x)**	**Skills provided**	**Income acquired (x)**
Accountant	Mental skills	Mental skills	x
Administrative chief	High social status, bribes	Social skills	x
Butcher	Manual skills and fitness	Manual skills and fitness	x
Cattle owner	Goats	None?	Depends on the number of goats
Charcoal burner	Manual skills and fitness	Manual skills and fitness	x
Chicken raiser	Chickens	None?	Depends on the number of chickens
Worker in a development project	Social and manual skills	Social and manual skills	x
Farm worker	Manual skills and fitness	Manual skills and fitness	x
Farmer	Piece of land, farming tools, family, seed	Manual skills and fitness	x
Healer	Social and mental skills	Social skills	x
Hunter	Manual and mental skills	Manual and mental skills	x
Inn worker	Social and manual skills	Social, manual and mental skills	x
Nurse / midwife	Clinic in the village, social, mental and	Social and manual skills	x

	manual skills		
Shepherd	Fitness	Fitness	x
Smith / metal collector	Manual skills	Manual skills and fitness	x
Textile worker	Tools, manual skills	Manual skills	x
Tool renter	Tools	None?	x

(x) The required skill levels have to be in balance with the other factors in the game. They can be properly determined and adjusted only after there are enough situations written for the game. This applies also to the income acquired from the jobs.

4.3.7 Home

At home the player has several options available:

Farming

Farming provides a certain level of income in the form of food and it may also provide surplus products, which can be sold at the marketplace. The level of income and number of surplus products depends on the skills and on the nature. If there is drought, farming suffers badly. Farming consumes game time.

This option is not available, unless the player character has *a piece of land, farming tools, seed* and enough *work force, i.e. family members*.

Interacting with the family members

The family is represented as a family portrait. Depicting all the different family members graphically would have been too laborious task, because the family is meant to be a dynamically changing element. There may be a different number of family members each time the game is played. Children may be born and they may die.

The child and an adult with an own family have slightly different functions available. The child can ask for a permission to go to school.

If the adult character has a family, the player sees the status of the family members

(healthy-sick, happy-unhappy). The health and happiness of the family members are related to the income and human relations points of the player character.

Using the textile worker's tools

If the player has acquired the tools, they can be used at home. Working with them consumes game time and produces textile products on the basis of the required skills. The products can be sold at the marketplace.

Checking the status of goats and chickens

If the player has bought goats or chickens from the marketplace, they will be shown in this section. One animal will represent all the animals of the same species, but the player will be shown the real number of the animals in a status screen. The animals have a varying life span. Each animal provides some income.

4.3.8 Situations

When the player decides to get into a situation, s/he will be offered three situations, which all take a certain amount of time, from one to several months. The time consumed by the situation doesn't necessarily mean the situation takes so long time, but that the situation happens *during* that time. There is also an entry qualification for the situations. They require a certain amount of either income points or human relations points.

The content of the situations will be unknown at this moment for the element of surprise. There is also an option to run away. If the player chooses one of the situations, s/he will get a description of it. S/he will also be offered 1-4 choices of action, which have unique difficulty levels and skill requirements. When the player chooses one of these actions, the success will be determined based on the skills and the difficulty level.

If the action is successful, the characters skills will increase and depending on the type of the situation, the human relations points or the income points will increase as well. If the action is unsuccessful, the human relations points or the income points will decrease and if the situation involves physical injury, the fitness of the character will decrease.

There are gender related situations and common situations. This means the content of the situations may be different depending on the sex of the character. During the wartime the situations will be related to war.

The situations are also related to the phase of life. There are three hidden phases of life: childhood/youth, adulthood and old age. These phases are not visible to the player, but they are used in extracting the proper situations. The phases are not related directly to age, but to the progress in the game. For example the transition between youth and adulthood happens when the character has accomplished certain tasks and is not dependent on the parents anymore.

Some problems arouse with the life phases. For example the situations need to be recycled, if all the situations related to the current phase of life are used up. There were some other issues as well, but discussing the technical details would be too complicated here.

See appendix 2 for an example of a situation.

4.3.9 Special events

There are some special events, which will occur occasionally and randomly. There can be only one special event in a year. The following descriptions are still preliminary and there may be changes in the final version of the game.

General special events

- The development cooperation worker visits the village. There will be a dialogue with the worker and the player. Depending on how the dialogue resolves the development project will bring a well into village. The well increases the available time the player has yearly, because the water doesn’t have to be carried from elsewhere anymore.

- The game character receives a piece of land for farming and can become a farmer, if s/he has enough work force (family) and necessary tools.

- A person in a need of help confronts the player character. There may be several similar events with some differences in the content. They may involve some ethical dilemmas. The actions in these events affect the human relations.

- There is a development project in the village and the player character gets some tools from it. Renting them to others increases income.

- A large part (a certain percentage) of the fortune is robbed.

- A parent dies. This may decrease the income, because the funeral is expensive.

Special events during wartime

- "Dilemma of the Prisoner of War". The game character and his group have arrested some enemy fighters. The other members want to torture the fighters. There will be an ethical dilemma whether to join them or not.

- The tortured prisoner may confront the player character later in the game and behave according to the player's actions during the war.

- The soldiers tax the village.

4.3.10 Death

Eventually life ends. When this happens, the player gets a summary of the character's life. The contents of the summary will be determined later, but it will at least tell the cause of death and the age of the character at the moment of death. If the game score is high enough, the character's name (or the player's account name) will be inserted into the high score table.

4.3.11 Diseases

There will be at least the following diseases in the game:

- yellow fever
- typhoid fever
- bilharzia

- hepatitis A
- HIV/AIDS

Other diseases will be caught on random basis, but HIV will be transmitted by one of the candidates of marriage. The dialogue with the candidate will reveal clues of the candidate's HIV positivity. HIV takes 5-10 years to develop into AIDS in the game. After that, the player character dies quite soon.

The diseases decrease the fitness until they are cured. If the fitness gets too low, the character dies.

4.3.12 Natural events

There are two rainy seasons in Nugali. Sometimes Nugali may suffer from drought. When this happens, the farming will suffer. It will be determined later, whether drought has other effects as well. There may be some other natural disasters too, but this will also be determined later.

Rainy season is represented with an animated rain and cloudy sky. This consumes surprising amount of processing power, which lower-end computers don't seem to be able to handle. This has been by far the only processing power related problem. It will be seen whether a solution can be found to make the animation lighter. This might be necessary, if the game is supposed to have as wide audience as possible.

4.3.13 Internal politics

There are at least three different political states in Nugali: peace time, political turmoil and civil war.

The peace time is the most common state in Nugali.

During the political turmoil the prices at the marketplace are higher than normally. The school may be closed. Some of the jobs may not be available.

During the civil war, which happens very rarely, the situations change to war situations. The prices at the marketplace are higher than normally. The school is closed. Some of

the jobs may not be available. If the player character is male, he may be recruited by either side of the combatants. There will also be some special events during the wartime.

4.3.14 Saving the game

It will be possible to save the game. Technically this means saving certain variables into the database. This requires that the player has created an account (login name and password) for the game to identify the data. The option will be available in the final version of the game.

5 Conclusions

Designing an educational game is challenging. Developing it is time consuming.

I was hoping to get the game ready by the beginning of May 2006, but it seems I was too optimistic about it. The game is still a demo and it will take a few weeks more to get it ready for testing. The testing process will take some time more and only after that the game will get its final touches and be published. Hopefully this will happen before the end of the summer 2006.

There are some clear reasons why the game wasn't completed as quickly as I had hoped. First of all there is much more graphics in the game than was originally planned. Assembling the graphics with ActionScript code in Macromedia Flash is more laborious and time consuming than I had predicted. This time has been taken away from the time reserved for actual game programming and dialogue writing.

There was a demand for very big changes in the game structure and especially in the code in the middle of the project. This was totally unpredicted and a part to blame is the non-existing project management.

Creating the situations hasn't advanced as fast as I had hoped. On the 16th of April 2006, there were only 22 situations for the female character and 9 situations for the male character created. The non-existing project management is again one reason for this. Naturally the members of Keho have their own studies, jobs and life as well. I have had no time to spend for this part of the project myself, because programming and assembling the game, as well as writing this written part of the thesis has taken almost all the time I have had. After the game is ready otherwise, I will begin working with this part as well.

There were some unexpected programming dilemmas, which took some time to get solved. These challenges were, however, also the most educational parts of the project.

Some of the changes, which were made in the middle of the project, may have been a mistake. They were implemented in a hurry without time to contemplate on the real

consequences of them. They made the game structure easier to understand and handle from the player's point of view. This is a good thing. However, at the same time they made the situation creation process slightly more complicated. They also made the situations a bit shallower than they were before the changes.

Despite all the problems, the project has been very interesting. I have also learned very much during the project. I have learned about designing a game, I have learned about programming, I have learned about Macromedia Flash, I have learned about educational games and I have learned about development issues. The project will continue and I will probably still learn much more. It has also been interesting to work with a diverse group of people from different faculties.

Whether the game will be successful in entertaining and educating or not, is at the moment impossible to say. Hopefully the game testing will give some idea about that. The game may be too limited and it may suffer from a western bias. On the other hand the purpose of the game is not to tell how things really are in the development countries. It may, however, function as a discussion igniter. This could be the educational value of it. If it succeeds in being an engaging game and at the same time helps to provoke discussion about the Third World issues, then the project has been successful.

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Images

Image 1. Pacman, Midway. Retrieved April 18, 2006 from http://tips.retrogames.com/gamepage/pacman.html

Image 2. Civilization IV. Firaxis/2K Games. Juho Jouhtimäki.

Image 3. Star Wars: Knights of the Old Republic. BioWare/LucasArts. Retrieved April 18, 2006 from http://www.lucasarts.com/products/swkotor/G_gallery.html

Image 4. The Republic of Nugali. Jouhtimäki, Juho 2006.

Image 5. Nugali, first demo version. Jouhtimäki, Juho 2006.

Image 6. Branching tree structure. Jouhtimäki, Juho 2006.

Image 7. Situation inserting/editing form. Jouhtimäki, Juho 2006.

Image 8. Nugali, character creation: sharing skill points. Jouhtimäki, Juho 2006.

Image 9. Nugali, main user interface. Jouhtimäki, Juho 2006.

Image 10. Nugali, education. Jouhtimäki, Juho 2006.

Image 11. Nugali, the healer’s hut. Jouhtimäki, Juho 2006.

Image 12. Nugali, human relations. Jouhtimäki, Juho 2006.

Image 13. Nugali, marketplace. Jouhtimäki, Juho 2006.

Image 14. Nugali, home. Jouhtimäki, Juho 2006.

Appendix 1 Examples of games and projects

Examples of games used for learning and education

Aviation education

Microsoft Flight Simulator

Business education

Virtual U

Leadership training

Virtual leader

Medical training

Life & Death 1 and 2

Military training

Full Spectrum Warrior, Operation Flashpoint

Physical education

Dance Dance Revolution

Programming

Robocode

Social studies

Civilization III, Sim City series, Real Lives 2004

Projects and initiatives involved with learning games

Department of Defense Game Developers' Community:

http://www.dodgamecommunity.com/

The site's purpose is to bring together people developing games within the U.S. military,

and provide them with useful resources and a way to contact each other.

Games for Health: http://www.gamesforhealth.org

The Serious Games Initiative founded Games for Health to develop a community and best practices platform for the numerous games being built for health care applications. To date the project has brought together researchers, medical professionals, and game developers to share information about the impact games and game technologies can have on health care and policy.

Games Parents Teachers: http://www.gamesparentsteachers.com/

A Parent-teacher toolkit

Serious Games Europe: http://www.seriousgameseurope.com/

Serious Games Europe brings professionals looking to use games for more than just entertainment together with games developers, technical experts and, as importantly, *other* professionals who are using games seriously.

Serious Games Initiative: (http://www.seriousgames.org)

The Serious Games Initiative is focused on uses for games in exploring management and leadership challenges facing the public sector. Part of its overall charter is to help forge productive links between the electronic game industry and projects involving the use of games in education, training, health, and public policy.

SIG-GLUE: http://www.sig-glue.net/

Special Interest Group for Game-based Learning for Universities and lifElong Learning was a two-year project funded by EC eLearning initiative. It aimed at creating an European network of educational institutes, researchers and game producers who are interested in using games in education, promoting more and better use of educational games, monitoring the quality and establishing a quality stamp for game-based learning

resources and organizing both national and international events on educational games.

Social Impact Games: http://www.socialimpactgames.com/

The goal of this site is to catalogue the growing number of video and computer games whose primary purpose is something other than to entertain. These are also known as "serious games."

The Learning and Skills Network: http://www.lsneducation.org.uk/

The Learning and Skills Network (LSN) is an independent not-for-profit organisation committed to making a difference to education and training.

Water Cooler Games: http://www.watercoolergames.org/

A forum for the uses of videogames in advertising, politics, education, and other everyday activities, outside the sphere of entertainment.

Appendix 2 Example of a situation

This situation was created when it was thought there are going to be more ethnic groups and locations in the game. This situation was meant for a nomadic tribe. It was also written when the game character still had different attributes in which the outcome of the situation affected. However, the structure of the situations has remained the same, so this example is still valid in that sense. Success in the situation would increase the skills involved and also the income or human relations points. Failure would decrease the income or human relations points.

Description:
You are herding goats on the desert. The sun is setting and there is still a way to go to the main camp. From a distance, you hear hyenas laughing. The goats are vital to your community and you are responsible of their safety now.

Choice 1: You get ready to defend the goats and yourself with the herding staff while walking calmly towards the camp.

Requirements: mental & manual skills

Success: You manage to keep the hyenas away and get safely to the camp.

Failure: The hyenas attack, you hit around with the staff in panic, but one of the hyenas manages to bite you. Finally you get victorious, but after the hyenas have run away, you notice they have taken some goats with them.

* * *

Choice 2: You gather some wood, set a fire and get ready to camp and watch the goats for the night

Requirements: mental skills & fitness

Success: You stay awake watching the goats. The hyenas are not able to catch any goats.

Failure: Despite your efforts, you fall asleep. When you wake up, you notice some goats have disappeared.

* * *

Choice 3: You try to hurry to the main camp with the goats.

Requirements: mental & manual skills

Success: You manage to get safely to the camp with the goats before sunset

Failure: When you get to the camp, you notice some of the goats have left behind.

*** * ***

Choice 4: You leave the goats and run to the main camp to get some help.

Requirements: social skills & fitness

Success: At the last moment you arrive with some men to where you left the goats. Together you escort them to the main camp.

Failure: When you get back to the goats, the scene is horrible. Half-eaten goats are lying on the desert. After a long search you manage to find only a couple goats alive.

Appendix 3 Images of the game sections

These images are incomplete. They lack the elements that will be in the final version of the game. They may also have some graphical errors and some elements may be in wrong places. They will be corrected in the final version of the game. The graphics are by Anniina Hautala.

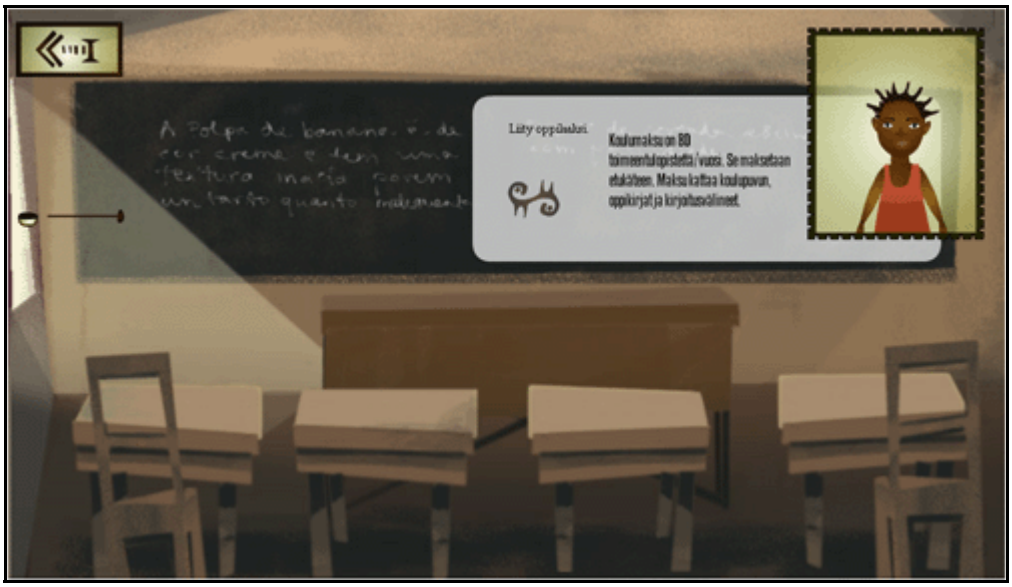

Image 10 At school

Image 11 The healer's hut

Image 12 Human relations

Image 13 Marketplace

Image 14 Home