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The Implementation of Architectural Solutions in the Virtual World of Second Life

Master thesis

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Autorideklaratsioon

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1 Introduction

The society is rapidly changing (Arbab, 2006) and to survive or differ from others, organizations and companies need to come up with new and innovative solutions to promote and introduce their products or services to the wider audience. Mainly those solutions are all connected with Internet (Niazi, 2008): blogs, personal homepages, newsletters, social networks, virtual worlds and etc. To twist one old statement it can be said that if the man is not in the social network he does not exist (Evans, D. 2008). Things that need to be public and outstanding must be on the Internet.

On June 23, 2003 was launched an online virtual world called Second Life (SL), the world's leading 3D virtual world environment. The growth of its premium members from 5000 at the beginning of 2005 (Linden, 2006) to more than 20 million registered users per year 2011 (Tay, 2011) has lead many companies and organizations from different fields of life into this virtual world: health and medicine, education, history, art, science, technology, astronomy, media, retail, architecture and etc. Each of them has different goals what to achieve in this environment: making profit, contribute to online collaboration, marketing ideas, products, services, making education more accessible and many others.

One of those enthusiasts is the architect, who sees those tremendous opportunities that this online world can offer. For example model their schemes, import them to 3D world and presenting them to the users in a way it has not been possible before or use some in-world building opportunities.

From the previous the problem of the thesis grows out: which architectural solutions and how should be implemented in virtual world Second Life? To find the solution to the problem an action research method was used.

The following four research questions were formulated to guide the study:

- How companies have implemented their products in virtual world frameworks like Second Life and others?
- What different solutions exist today for designing architectural instructional online materials?

- What principles should be based on the preparation of architectural online instructional materials?
- What kind of expectations users have for architectural online instructional materials?

For answering those questions, following goals should be completed.

The first goal of this study is to create process for building possibilities in Second Life environment. The aim is to publish possibilities how to add value to architecture companies and organizations who would like to promote their products in some virtual worlds.

The second goal of this study is to analyze already existing solutions and best practices. The aim of it is to find out best solutions and learn from others mistakes.

The third goal of the study is to test the instructional materials created by the author of the thesis on the possible future user. The purpose of this is to find out if the materials are precise and what was the participant's reaction while using them.

The thesis is divided into six parts. In the first part a shot introduction is made and goals and research questions of the thesis are described. Also short overview of different chapters of thesis is given. In the second part the literature overview about virtual worlds, Second Life, best practices, architectural solutions in Second Life is given. In the third part the overview of online instructional materials is given. In the fourth part of the thesis the methodology used in this thesis, overview of selected sample and data analysis are described. In the fifth part of the thesis the results and discussion are explained and in the last chapter the conclusion is made.

This thesis includes the instructional materials made in LeMill by the author in appendix 1.

2 Virtual worlds and its possibilities

In Internet history there have been many stages - from linking web pages with hyperlinks as Web 1.0 to interactive 3D content that is visible to the users through a web browser as Web 3D (see Figure 1). According to Gary Hayes (2006) evolution of the web can be defined as:

- Web 1.0 – one way only web
- Web 2.0 – two-way shared web
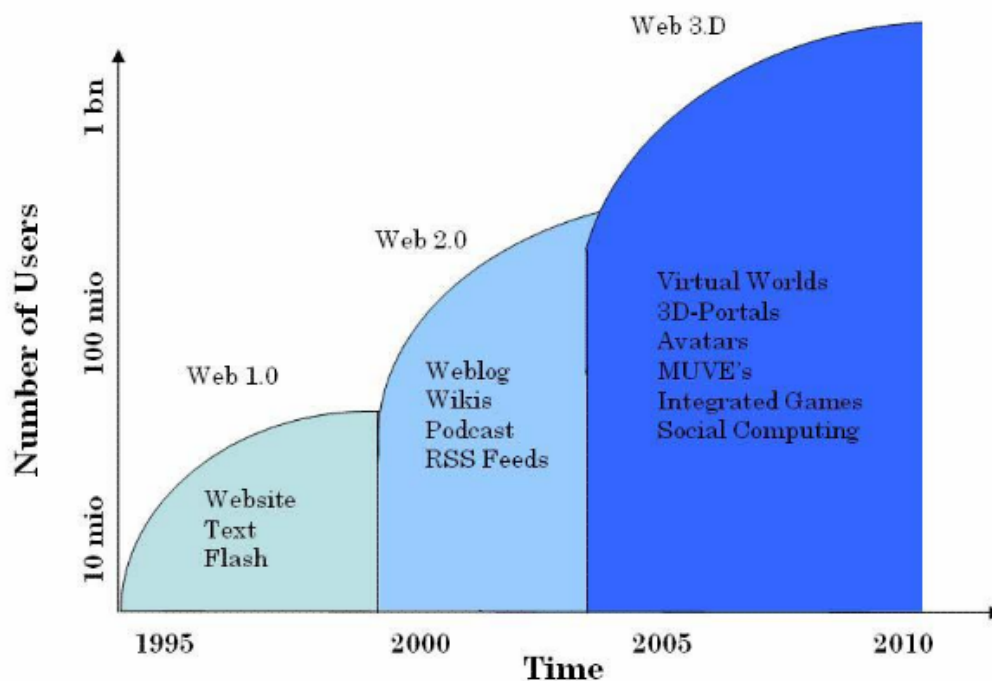- Web 3.0 – the real time collaborative web

Figure 2.1. Evolution of the web (Hayes, 2006).

Figure 2.1 illustrates that now our society is focusing on 3D virtual worlds, avatars and integrated games that are in the top of its use comparing to previous years. A virtual world is the genre of web-based community where users can create their own objects, content or world and interact with one another (Bishop, 2009). According to Bell (2008) there is no agreed formal definition of virtual world, but based on different informal definitions, he proposes that virtual world is a synchronous, persistent network of people, represented as avatars, facilitated by networked computers. The essence of virtual world is to be a home for its users who can manipulate and interact with objects and other users by clicking or moving the

mouse or use arrow-keys or letters in the keyboard. In the other words the user is a remotely controlled character. As Bell (2008) says, without users a virtual world would be an empty data warehouse.

The term virtual world has today become synonymous with interactive 3D environments, where users are graphically visible to others as avatars. An avatar is digital persona that can be created and customized by the user and which can have textual, two-dimensional or three dimensional forms (Rennie, 2010). A textual avatar can be username in chat rooms, a two-dimensional avatar can be an icon in online communities, social networks or blogs and a three-dimensional avatar can be any kind of character from real or fantasy world.

The computer presents the virtual world to the user and the user therefore may experience telepresence to a certain degree (Biocca & Levy, 1995). Worlds presented this way are very similar with real-life by simulating rules based on real world like gravity, topography, locomotion, real-time actions and communication.

Virtual worlds can be divided into categories based on their purposes (Artesia Whitepaper, 2008).

Social virtual worlds - spaces where primary activity is communication between the users on the basis of own chosen subject (Kaneva, There);

Casual gaming virtual worlds – require their users to behave according to the rules in the context of massively multiplayer online role-playing game (WeeWorld);

Role-playing virtual worlds - focus on a certain story supported by certain characters. For example Aces High where the flight simulation is the heart of the game and where the battles rages 24 hours a day with participant from all around the world;

Virtual worlds for creating content - users can create and customize avatar, create scriptable objects, communicate by text, speech or by gesture, build or create interactive content (Second Life, 2011);

Educational virtual worlds - include learning activities like Winglington and Wenks for children;

Interest focused virtual worlds - focus on certain interest like Stardoll where people keen to in fashion can dress up celebrities with latest trends;

Branded virtual worlds – focus on a certain brand like Lego Universe where users can build and battle using Lego brand virtual products (BarbieGirls, Lego Universe);

Mirror worlds – the term invented by the Yale University computer scientist David Gelernter 'to denote geographically accurate, utilitarian software models of real human environments and their workings' (Roush, 2007). Mirror worlds are real world in digital world, connected to real models. For example Google Earth and Microsoft Virtual Earth;

Virtual worlds platforms – software frameworks that allow users to create their own virtual worlds by offering set of open libraries, protocols, open specifications and open source code implementations such as OpenSIM, Sirikata and RealXtend.

Virtual worlds can be with the different focuses, but there are features they all have in common, like Bell (2008) have proposed based on different theoretical foundations: The space of virtual worlds is shared, which means that multiple users can interact and participate at the same place at the same time. User interface is graphical which means that the space is visually depicted and its style may range from 2D imagery to 3D environments. Everything that happens in this environment happens in real time; in the moment the user is giving input into the system. One of the features is interactivity. Users can develop, change, build or submit customized content into virtual world in real time. Users also do not need to worry about content getting lost, because virtual worlds are persistent, it exists even after user log out. Virtual worlds also offer and encourages the generation of social groups like clubs, teams, neighborhoods, etc.
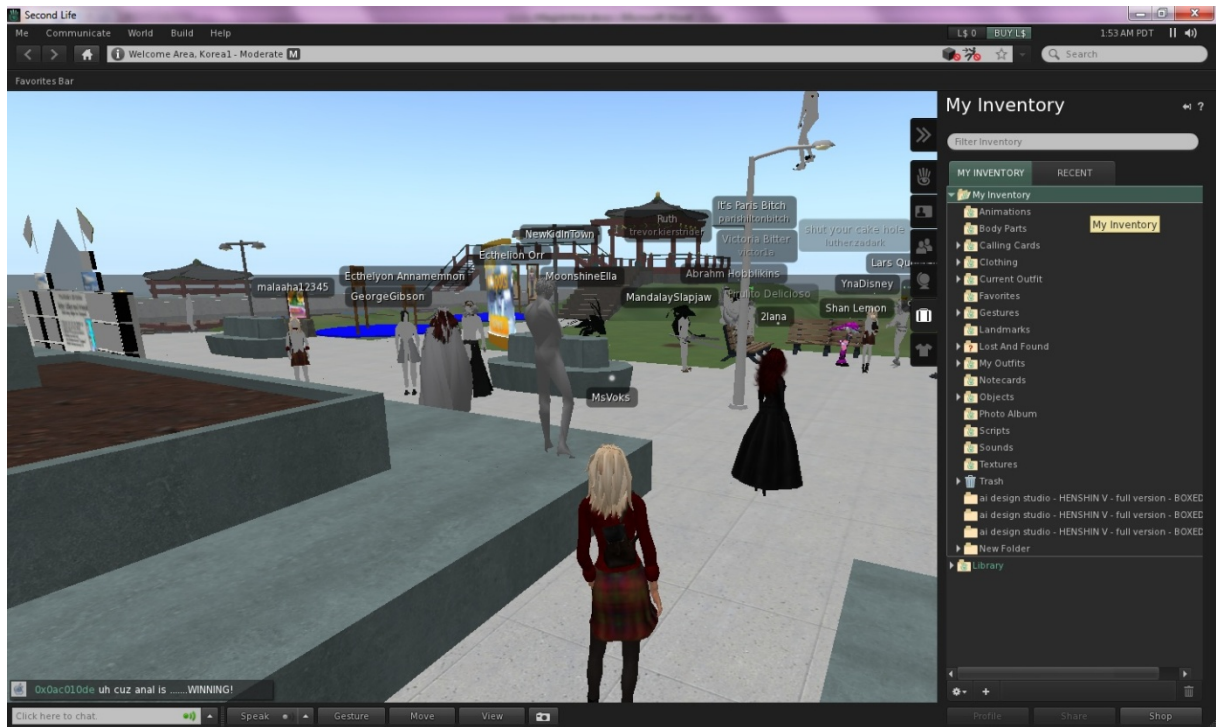
2.1 Second Life

One of the most popular and apparently with the biggest membership (Voyager, 2010) online 3D virtual world is Second Life, which was launched in June 23 in 2003. Linden Lab, a

privately held American Internet company whose mission is to 'create a revolutionary new form of shared online experiences developed it.

According to the Philip Rosedale, the founder of Linden Lab, Second Life is 'a parallel, immersive world which simulates an alternate universe, which thousands of people inhabit simultaneously for communication, play, and work, at various levels and variations of role-playing with their avatars' (Carr & Pond, 2007).

Second Life is similar like real world because of its realistic system. Like many other virtual worlds, Second Life has its own virtual currency Linden Dollar. This is an in-world token currency that can be purchased for real money and can be used to shop or buy products or services inside the virtual world environment or convert it back to real life currency in real world.

Its users – avatars, who are often called also as residents, creates Second Life essence and activities. To start communicating and being part of this world user should become a member. First, the avatar should be picked from the default selection which can also be changed later. After the appearance selection the name of avatar should be inserted and a confirmation note should occur to confirm that the chosen name is available, thereat a dropdown with the choices of last name should come out as well. It cannot be inserted by the user, SL offers possible alternatives itself. After all the choices made and Second Life Grid (picture 2.1.1) installation, the client program for in-world platform which offers the tools for educators, nonprofits, businesses and entrepreneurs to develop a virtual presence (Macedonia, 2007), user can sign in and start discovering the world.

Picture 2.1.1. Second Life Grid.

At first the user is directed to Orientation Island that is designed to familiarize the user with its interface and where a short introduction of basic knowledge is made. The user will be thereafter explained how to move, fly, teleport and where are the basic tools needed to operate in Second Life. After that the virtual world is in the hands of the user.

This virtual world is not popular only among regular people, but also among companies and organizations who find this environment very good to experiment with their business and use it for different kind of purposes.

2.1.1 Communication

Communication is a basic functionality in virtual worlds. In Second Life there are 4 main forms of communication: chat, instant messaging, gestures and voice. According to Perez (Perez, 2008) chatting is the public form of communication that can be seen within 20 meters by anyone who is in this area. Second type of communication is instant messaging (IM) which means that only the person to whom the text is written can see it. Instant messaging can be started with someone who is near to the user. Third possibility to communicate is to use one

of inventory types gestures – mime effects like clapping, laughing, waving with the hand and etc. to alive the conversation. Gestures consist of four elements: animation, sound, chat and wait (like pause) and are created by programming these elements altogether with script (Linden, 2011). Forth type of communication is voice chat. The voice chat function should be enabled and all the necessary settings configured to start voice chatting which can be activated by pressing the 'Talk' button.

In the tabel 2.1.1.1 the list of communication features used in many virtual worlds is described, which all can be compared to other technologies that people are more familiar with (Ryan, 2008).

Tabel.2.1.1.1. A comparison for the communication features of virtual worlds (Ryan, 2008).

Communication Features	
Virtual Worlds have	**Which is similar to**
Real time text chatting – private	Instant messaging
Real time text chatting – group	Chat room
Delayed time text chatting	Email
Real time voice	VoIP / telephone & conference calling
Real time video stream w/audio	Video Calling
Searchable network tools	Social software / Web 2.0
Note card messaging	RSS / newsfeed
Ability to create content	Forum, wiki, blogs
Record activities for later access	Podcasting

Uploading documents	File sharing

From this table it can be read that communication in virtual worlds is very similar with every-day interactions in the Internet. The following comparisons are made in point of Second Life.

2.1.2 Entertainment

Entertainment in Second Life is one of the most popular ways to spent time. According to the Market Truths research study 80% of avatar time is spent on entertainment activities, which means that over 16 hours per week (Zimmer, 2007). Entertainment includes different kind of activities like shopping, clubbing, traveling, dancing, playing games and listening to music and so on. In Second Life it is possible to visit different places all around the world. There is a location-based linking system with special teleporting links to get access to these places (Linden, 2011). These links are called SLURL – Second Life Uniform Resource Locator which are like addresses in this virtual world. It is possible to visit many different places: historical places (Eidenbach, 2009), schools, hotels, natural parks, etc. Visiting different places in *Second* Life can be compared with real time travelling. Even an unofficial tourist guide is made for Second Life users by Paul Carr and Graham Pond in 2007 where they provide the tour 'of the virtually endless wonders offered by this exciting new world (Carr & Pond, 2007)'.

As all the products made in Second Life are owned by their creator and are sellable to others for Linden dollars, it has started a real business. In August 2006 20 best-selling designers sold items for approximately $140 500. Linden spokeswoman Catherine stated that the knowledge that people like to own things came quite quickly. It is not only dressing or being beautiful, it is part of 'individualizing the appearance of player's online persona' (Lavallee, 2006).

2.1.3 Education

Education – the foundation of good life. Every day something new will be heard, seen and learned. Things and phenomenon that life has to offer will be experienced. Learning is the natural part of life and is rather a creative process. Acquiring new knowledge and skills will last life time and therefore it is reasonable to make it as pleasant as possible. Very many educational institutions (SimTech, 2011) have moved into Second Life to reach new students and offer opportunity to learn new things. For example Harvard Law School who offers extension courses through the virtual world (Townsend-Gard & Arnold, 2009), the University of Denver whose professors are creating an online course which includes labs in Second Life (Schulte, 2008) or Ann Myers Medical Center whose interns organized the first medical simulation where a real medical case was elaborated (Mesko, 2007). These are only few examples. It is possible to do a lot more: learn different languages, new cultures, visit libraries, do distance learning or conduct an entire research (Townsend-Gard & Arnold, 2009). But what makes learning in Second Life different? In every form of distance learning there can be global audience and people can study in their home environment.

2.1.4 Business model of Second Life

According to Linden Lab there are very many different areas of businesses set up in the Second Life. Registered users and companies can take advantage of its business, experiential and entertainment opportunities where the only limit is user's imagination.

Before entering into the economy of virtual world businesses and organizations should ask what are the benefits to get part of this environment. Bill Nissim (2007) wrote an article about business models in Second Life and therefore defined what business model is and developed four categories to capture the business rationale:

1. Press coverage
2. New brand channel
3. Consumer feedback
4. Brand engagement

In each category he mentioned examples of companies who belonged to specific category and defined a business model with three values: value proposition, targeted segments and customer relationship. After considering all these categories with those three values he concluded that outcome of his assessment 'yielded a sampling of business models "in play" and the anticipated payoff from venturing into this digital realm (Nissim, 2007).'

Second Life's currency, Linden Dollar, is the very important part of this virtual world's business model. It can be used in every transaction as in real life to pay for goods and services. According to Jefferies Linden Dollar showed 20% increase in the second quarter of the year 2009 while United States economy shrank by 1%. So while real-world currencies are on the slide, Linden Dollar showed its strength (Jefferies, 2009).

Like in real-world, Second Life in-world economy is also observed by several controls to prevent cash accumulation which may cause inflation. It is done to balance the situation in-world, because some entrepreneurs hold big balance in their virtual account, meanwhile others have small amounts. There are also strategies for pricing and promotion, like uploading costs, posting advertisements, which eliminates currency from circulation. That gives room for new Linden Dollars available for purchase (Jefferies, 2009).

2.2 Architecture in Second Life

Among all previously mentioned opportunities architects have some very good reasons why to use virtual worlds while doing their work. Specially Second Life, not any other virtual world. Reason is that only Second Life offers in-world building and opportunity to import 3D models into SL (Daden Limited, 2011).

Schools of architecture also start to see the value of the virtual worlds - 'do urban planning, create a space and see how people interact with it, and run scripts to track where people go (Rendon, 2007). Only the imagination is the limit.

Architects have found that Second Life can be used different ways, not only for visualizations, but in different stages of creating the project (Daden Limited, 2011).

- **Planning model** – Second Life can be used in very early stage of the project, for example when a virtual city model is done in walkable level (like a carpet on the floor), architects can already see the 'hidden' opportunities and impact of the new project. It can be even a time-slider which allows to see how the place will change in the future or how it had looked like in the past.

- **Consultation model** – the best example is methodology called 'planning for real', which means that people can look the planned project virtually, make comments what could be changed into post-it notes and architects can consider the suggestions.

- **Project model** – virtual world offers opportunity to clone the project which could be used by the team to have the meetings in problematic areas. This way it is possible to better approach the problem and its solutions.

- **Social model** – residents of Second Life can have a feeling how the rooms and the building itself start to influence while living or working in it. This way the problematic issues will come up early in the process and can be avoid in real life.

- **Disabilities model** – It is possible to explore the building through the disabled person eyes to assure that building is accessible for them from every side.

- **Services model** - Even when the building is ready in real life, the virtual building could be used to design wiring or piping system or even creating evacuation plan.

- **Environmental model** – it is not possible to predict the behavior of the environmental performance, but it is possible to create certain behaviors through which it is possible to see the effect of the change (like switching air conditioning on or switching some equipment off).

- **Security model** – To the owner of the building and for its users, security is really important. A virtual world can be a key part of 'design with intent' (Lockton, 2004). If the building contains private parts, these could be accessible only with special permissions to specific users.

- **Navigation model** – it is possible to build navigation systems for buildings by using animated arrows to show the fastest way out. If users see the route, it is possible that this will be used it in real life as well.

- **Simulation model** – virtual world can be used to visualize the output of simulation or model.

- **Training model** – when the real life building is ready, virtual building can be used for training the employees (evacuating, customer service or in privacy issues).

- **Live services delivery model** – when the building is ready in real life, virtual building could be used to support its users, like virtual meetings, virtual library booking system or help to stream live news.
- **Building re-design model** – when a real life building needs re-designing, virtual world is the place for looking the bottlenecks of the building.
- **Whole life model** – 3D model in virtual world can support the real-life building in its life time, in above mentioned areas.

When using virtual world like Second Life in all above mentioned stages of the project, it can be assured that less mistakes are made.

To compare real life traditional architecture visualization tools with opportunities in Second Life, then it can be said that this virtual world has a lot to offer. Main differences that can be brought out (Daden Limited, 2011) are that user is impersonated in virtual world as avatar and has better overview of the building rather than having just camera view. User can interact with the building and go behind every possible corner. If users do not like something changes can be done before the actual building is built. And also is very important that the environment of virtual world renders in real-time and is therefore more dynamic than just a pure visualization tool.

To bring out some advantages (Daden Limited, 2011) why to use virtual worlds like *Second Life* in architecture field then the first would the fact that changes can be done in real time and will take effect after the change is done. Virtual worlds have also power to support multiple users at the same time in the same space and therefore users can collaborate and experience new building together. All the activities can be done interactively, like connecting computers with real computer applications. There is also possible to clone buildings to start making some changes into it to search better ideas. When building is finished in real life then this virtual building could be used for many activities: virtual meetings, conferences, collaboration, trainings and etc. In virtual world user can choose the configuration liked the most, have an opportunity to annotate the space and give instant feedback to the architect. And architects have opportunity to trace the users while they are interacting with the building. It is possible to collect data to see what user liked and what was ignored. Architects and users can visualize the building in a new and effective way and peel the buildings to see structural components.

Beside the big amount of advantages there are also some disadvantages (Daden Limited, 2011). To start using some virtual world and get the best usability out of it user needs to have quite powerful computer, otherwise in-world activities can be slow and therefore create discontents. Also user needs to download the client application, because virtual worlds are not accessible in-browser, but it is being worked on.

Some people feel that avatars are hardly controlled and therefore do not want to use virtual worlds. And a number of architects think that virtual world is not for consulting user in means of architecture, because it is not as pure as in real life.

2.1.5 Building opportunities in Second Life

Second Life offers many possibilities to build – in-world building tools and third partner applications for importing built files.

Second Life in-world built-in editor enables to create various objects, which are all made of prims (long term primitive). Prim is the building box in this virtual world. All objects are made of them except ground, trees and avatars. There are various types of prims like cube, sphere, cylinder, ring, prism and tube which can have different texture, size and visibility. Prims are possible to create to places where user has permissions to do it – avatars own land, public sandbox or somebody else's land with permissions to build (Curtis, 2010).

Primitives, avatars and objects can be given a behavior to make them more interactive. By using special Linden Scripting Language (LSL) for making the scripts, avatars can laugh, dance, clap, wave and make many other movies. Objects can blink and make noise when touched (Grobe, 2006).

Depends from the land size there are a certain amount of prims that are allowed to use and it need to be checked before starting to build. If the maximum number of prims is reached then some of them need to be deleted or taken into avatar's inventory.

If the user is building in the sandbox, one need to remember, that these places are cleared out after a certain time fixed by the landowner. Usually it is 1-3 hours, which means that user

needs to save the work periodically otherwise avatar may lost the work done. Second Life offers all the necessary tools to build in-world without any help from 'outside'.

Another possibility to build in Second Life is related with third-partner applications, which enables to create 3D drawings. There are many opportunities like using Sketchlife (New World Notes, 2009), realExtend for OpenSIM (ArchVirtual, 2008) and many others.

Sketchlife is a tool which helps to build in Second Life faster than in in-world environment. It does not support all the tools that Second Life has, but those in-world tools can be used later when a Sektchlife file is imported. Two of the most important parts of Sketchlife are the SketchUp extension and Sketchlife Importer. The Sketchup extension is 'a Ruby script which uses the API provided by SketchUp to add several tools on a toolbar' and the importer builds the object into Second Life (Sketchlife, 2009). Although it speeds up the building process in in-world, it has some disadvantages. Skecthlife has a cost per primitive, but building in-world is free (if the avatar uses free stuff and sandbox) and the user needs to download new applications into the computer and learn to use the tool and go through the importing process.

 Ai Design Studio is offering services to virtual worlds like consulting old and new users, creating new scripts to make an environment more active, designing and organizing trainings, but their main area is the development of Second Life. Many new tools and methods are developed by them and one of those tools is Henshin System which offers an opportunity to import solutions made in AutoCAD into the virtual world of Second Life. As outlined above there are many tools in building in-world that make builder's lives easier, however architects need to do three time more work to build in SL: first the 3D drawing of the building is created with AutoCAD, then necessary calculations need to be done do fill this building with prims in Second Life and then start building it in in-world block by block. To get rid of this extra work, Henshin System product was created which generators build the imported building itself.

Henshin V, the latest version of this product consists of a generator, a HUD and a packager. The Henshin Tools (former SLTools) is 'an application that analyzes any AutoCAD design, allows visual defining of the used primitives and even the textures to apply to the prims of each layer (ArchVirtual, 2007)'. This tool connects with AutoCAD and gets the drawing information. After all the necessary data is generated and exportation carried out, it is possible

to change the utilities of Second Life: the use of layers, the visibility of primitives, and the repositioning. The building is composed by a generator which contains notecards where is all the information from AutoCAD and the HUD (builder package) which controls the building itself.

The system is composed by a generator, which contains the notecards exported from AutoCAD, and the HUD to control the building. All the necessary information needed to import a 3D model into Second Life is in the guides and manuals in Henshin homepage in PDF format.

Features of Henshin V product:

- Layer functionality – each layer can be handled separately, be with different textures or made invisible
- Opportunity to re-position, rotate or delete the entire building
- Opportunity to delete only some layers
- Opportunity to use various texture in different faces
- Opportunity to use all kind of primitives (prism, tube, ring, box, cylinder, sphere, objects)
- Opportunity to manage several projects with one generator
- Opportunity to work in groups – several HUDs from different owners can be controlled by one generator
- Henshin considers the physics and light

Another application that can be used to import 3D Max and Maya files into virtual worlds is Visibuild. It is used to import 3D Max, Maya and Sketchup files into OpenSIM environment (New World Notes, 2009) which is an open source multi-user 3D application server. It is used to 'create a virtual environment that can be accessed through a variety of clients' and to 'simulate virtual environments similar to Second Life' (OpenSimulator, 2011).

Although there are many good aspects to use Henshin or Visibuild products, there are some reasons why users may not want to use them. Users usually do not have so high requirements while building in virtual world and processes of importing 3D models can be confusing and the user depends on the quality of a third partner. If an error occurs, then it is not possible to

finish the import process and users do not have the building. In case of Visibuild, the author finds it not to be as popular as Second Life (Opensim, 2010) and therefore do not use it material creation process.

2.3 Best practices in Second Life

Many companies and organizations have opened their agencies in Second Life. Some of them have done it just for fun, while others have been using Second Life for introducing or promoting their products and services or enhancing their marketing. There have also been those who have been using Second Life for other reasons instead. Aloft Hotel has been one of the first success stories.

Starwood Hotels & Resorts Worldwide, Inc has probably been the first real-world hospitality company who used virtual world Second Life for their new hotel building project – Aloft Hotel. More than over a year before the hotel was built in real-life, it was possible to walk through its corridors, see the bedrooms, colors of walls, ceilings and floors and sit in the hotel lobby - all that in the counterpart of the hotel in Second Life (Senyak, 2006).

Electric Artists and Electric Sheep Company, two marketing services companies built the digital model, marketed it in Second Life and set up the Weblog (Aloft, 2007) for future customers and other people who were interested to give an overview of the process and aim how to create a property in Second Life. Model of the building was based on the real-life prototype which was under construction at the same time. By building the hotel in the virtual world it was possible to value user opinions about the hotel by observing their movements through the space and to collect new ideas from the customers about the design. This feedback was used in the real-life.

Brian McGuinness, senior vice president of Starwood's Specialty brands, said that they are saving money with both prototypes - the physical and the virtual. If they find out that significant number of people do not like certain features in virtual prototype, they do not need to build it in real life (Reena Jana, 2006). Now they have this knowledge before building it and time to analyze the necessity of the change. The work Starwood employees and their clients are doing in virtual world is the same they would do in real life: modeling buildings,

asking for feedback, managing with reputation, considering health and safety and make money.

But making money has not been easy. Starwood discovered that avatars do not need to sleep and therefore the hotel did not make sense in long-term (McConnon & Jana, 2006). After a year in Second Life, Starwood Hotels & Resorts Worldwide decided to leave from virtual world by donating its land to the nonprofit social-networking group TakingITGlobal. According to Brian McGuinness, vice president of Aloft 'it was difficult to attract people to the virtual hotel to help build the real-world brand' (Semuels, 2007). But still they accomplished good experience from Second Life – user's suggestions to improve their hotel design like more natural colors and music at the shower, creating online presence and getting new experiences.

The second best practice is from an international real estate franchise Coldwell Banker founded in 1906 in San Fransisco by Colbert Coldwell. The need for the company came up after devastating earthquake and fire to help rebuild people's homes, the city and that unscrupulous people could not take advantage of the real estate consumers in this situation (Setzer, 2007). Later with the growth of the company Arthur Banker joined the company and they officially named it to Coldwell Banker. For now they have offices in six continents and in more than 45 countries and they have helped millions of families with their dreams to own a home (Coldwell Banker, 2011).

For the same reasons the company was first founded, Coldwell Banker now wants to go to Second Life to bring some clarity into the virtual real estate business. In 2007 they started with the campaign to sell real estate in Second Life and therefore opened their first virtual sales offices in a region called Ranchero (Setzer, 2007). In these offices there are two real employees as avatars with whom it is possible to communicate and ask questions about different transactions in virtual world and also about transactions in real life. As these transactions are confusing in Second Life, a trusted brand is a solid choice.

 Coldwell Banker bought an extensive part of land in the so-called mainland and divided it into 520 smaller pieces for individual houses, half of them for selling and other half for renting (Kirkpatrick, 2007). Users were able to purchase this land and build their own homes, stores or event sites. The price of the land varies based on the size, style and location. If an

avatar is interested in one of the properties an appointment with the sales associate avatar should be made, after what it is possible to make the tour in the neighborhood. Users should also realize that the land owned in Second Life does not have any connection with real life (Lastowka, 2007).

With these steps Goldwell Banker took home selling to a totally new level. Charlie Young, the company's senior vice president for marketing said that Coldwell is not in Second Life for profit. Any profit will be reinvested into real estate in Second Life. Coldwell's real goal is to sell land in real life and to reach new potential customers in Second Life (Roney, 2007).

In case of Coldwell positive arguments can be pointed out why to use Second Life for business. Coldwell itself can have a good learning experience while connecting with the next generation of homebuyers, provide a service and therefore sell land in real life, solve a 'land baron issue' in Second Life, where nobody owns a too big part of the land and have a corporate presence in a virtual world which everybody talks about. (Setzer, 2007)

To summarize it can be said that many companies have made right decisions when joining the virtual world Second Life. Two positive experiments support that statement that architectural solutions can be successfully implemented.

3 Online instructional materials

People who use Second Life or any other virtual world or social network, may feel a lack of knowledge in the beginning while being new in environment. It is common for using the system for the first few times. To enhance knowledge about the system users start to experiment on their own or look for some online instructions. It is really important to use correct technological instruments and instructions otherwise it may happen that the high technology solution will not be used because of the lack of knowledge or because the complicated instructions would take too much time and effort. It is important to understand the learners and their environment (Morrison, Ross, Kalman & Kemp, 2009).

Internet is full of all kind of online materials: instructions, video-based trainings, 'how-to' sections, courses, programs and many other. One of the possibilities is to use web-based instructions.

A web-based instruction (WBI) is a "hypermedia-based instructional program which utilizes the attributes and resources of the World Wide Web to create a meaningful learning environment where learning is fostered and supported" (Khan, 1997). WBI's can be in many different formats and refer to many other terms like Web-based learning (WBL), Web-based training (WBT), Internet-based training (IBT), online learning (OL) and e-Learning. It is delivered to the user via the computer with Internet access which 'makes it capable of instant updating, distribution, and sharing of information (Rosenberg, 2001)'.

For the purpose of this thesis, WBI is synonymous with online instruction and expresses the delivery of new knowledge to anybody who looks for it by the support of media and technology, which is according to Tavangarian, Leypold, Nölting & Röser (2004) e-learning.

The main 5 types of e-learning are the following (Horton & Horton, 2007):

- Learner-led e-learning
- Facilitated e-learning
- Instructor-led e-learning
- Embedded e-learning
- Telementoring and e-coaching

In this thesis only learner-led e-learning is used, therefore other types of e-learning are just for information. When user is studying online instructions then it is called learner-led e-learning. In this case user has opportunity to get an effective self-learning experience. Learning content may consist of web pages, multimedia presentations and other materials available from the Internet. Materials can be used via web browser. In learner-led e-learning all the materials must be covered, because student to not have opportunity to ask extra questions if something is not understood. Learner is totally independent (Horton & Horton, 2007).

Online materials can be presented on many different ways. Instructions can be placed on the webpage (related resources can be added as links), can be packed together or be downloadable from the Internet and can be presented as audio files or as a video, which are accessible from the Internet.

There are lots of different tools and environments that support developing and designing the online instructional materials.

Lectora is a software package which includes e-learning environment for the preparation of teaching materials used by individuals or group of people to create interactive content and place it to the Internet or save it as a separate CD-ROM application. Lectora is integrated with many e-learning environments like WebCT, Blackboard, Frontera, Moodle and others by supporting various types of media such as text, images, audio, video and even technologies like Shockwave, Flash, HTML, Java and JavaScript [see läks kaduma, otsin]. Materials created with Lectora look like a book, which includes titles, chapters, sections and pages. User has a very good overview of the structure of the work, knowing exactly how many sections there are under each chapter and how many pages there are under each section. Lectora supports many different media types. If some content is already created in some of the Lectora supported media types, then it can be easily imported to the Lectora learning materials.

eXe is the program used to 'assist teachers and academics in the publishing of a web content without the need to become proficient in HTML or XML markup (eXe, 2010).' It is Open Source authoring application that is freely available to everybody. Materials created in eXe can be easily exported as a packages of IMS Content Package, SCORM 1.2, or IMS Common Cartridge (eXe, 2010). These packages can be imported into different learning environments

like WebCT or Moodle or used it as a simple webpage without a learning environment. eXe enables to add 19 tools into a content package, like a picture gallery, flash video, reading pane, Wikipedia article and many others.

LeMill is an international online community that 'allows teachers to find, create and share web-based learning materials (Põldoja, 2011). Since the service launch LeMill has been available for anyone 'interested in codeveloping learning resources' and is free of charge (Leinonen & Toikkanen, 2011). LeMillI has four sections: content, methods, tools and community. In the content section new materials, slideshows and exercises can be created using webpage version, uploading media files (picture, audio or video files) or adding links to other sources. In the methods section there are learning methods described, games, ideas of the project and many other method related things. Links to other web environments, which can be used in the learning process or in the preparation of learning materials, are in the tools section. In the community section users can create different focus groups based on common interest (LeMill, 2011). The main advantages LeMill has over others are that a) it has web-based learning materials b) it is an authoring tool where people can create content together and change and adapt other user content c) it has Creative Common licenses, which means that content is free and open (Toikkanen, 2011).

3.1 Principles of the preparation of instructional materials

Before starting to create instructional materials some questions need to be asked (Morrison, Ross, Kalman & Kemp, 2009):

- What is the problem we are asked to solve?
- Will instructions solve the problem, or is there another approach?
- What is the purpose of the planned instructions?
- Is an instructional intervention the best solution?

According to Keeton, there are the following principles that should be followed to create online instructional materials (2004):

- Set clear learning goals and paths to goal.

- Use deliberate practice and provide prompt constructive feedback.

- Balance challenge and support to the individuals' readiness.

- Broaden the learners' experience base.

- Elicit active and critical reflection by learners on their growing experience base.

- Link inquiries to genuine problems of high interest to the learners.

- Develop students' effectiveness as learners.

- Contribute to an institutional environment encouraging inquiry.

To develop those online instructional materials 6 e-learning phases can be used (Voksepp, 2007). First phase is the planning phase where all the preparation of materials will be done by asking several questions: who is the target group, what kind of methods to use, how to build up the course, how learners have access to the materials, what is the expected result, what are learners prior knowledge, what kind of technologies should be used and etc. Expected final results and purposes of the instructional materials should be formulated.

Second phase is the design phase, also known as realization phase, where the structure of the teaching materials, teaching methods, exercises and tests preparation plans and evaluation plan should be placed. In case of online instructions only structure of teaching materials and teaching methods should be placed. To transfer materials, the following options can be used: video, audio, text or graphic.

To ensure that created instructions are understandable and correct, they should be tested. Third phase is the testing phase. There are many different methods used to test materials and the participant should be picked according to the audience. If the material is meant for students then participants should be very concrete group of people (like an entire class from one school), if the material is meant for experts, then participants should be a group of experts who can be in the student and the mentor role. The testing phase includes a technical testing, substantive testing and corrections. All the links, videos and pictures must open without errors and content must meet the purposes of the materials. After the review corrections will be made.

Fourth phase is training phase which ensures that the material also includes instructions how to orientate in the materials. The structure should be understandable to the user.

Fifth phase is the evaluation phase where depending on the material 3 different evaluation methods can be used: test or exam (main emphasis is on facts), implementation (in case of instruction) or practical work (If materials consist of practical advice).

Sixth phase is the feedback phase, where users' opinion about the material should be asked.

4 Methodology

This chapter provides an overview of the research design for conducting the study. Also the data collection and sampling will be discussed.

4.1 Research design

In this study, action research was used. Ferrance (2000) have said that action research is a 'reflective process that allows for inquiry and discussion as components of the "research". Action research can be used in real life situations and is 'learning by doing', where the person who conducts the research will get new practical and theoretical knowledge for the future.

Action research is often used to find solutions to everyday problems at work, at school, or at any other institution or organization; to improve instructional materials to make them better to understand and increase student achievement. By following the steps of action research it will help to 'assists educators in assessing needs, documenting the steps of inquiry, analyzing data, and making informed decisions that can lead to desired outcomes' (Ferrance, 2000) but also involves people to improve their knowledge, techniques and strategies to impact the learners.

It is based on the following assumptions: first teachers and principals work best on the problems what they have identified, secondly they will become more efficient when examining their own work and finding ways to improve, thirdly teachers and principals help each other cy collaboration and fourthly it is good for their professional development (Watts, H. 1985).

Action research 'creates new knowledge based on enquiries conducted within specific and often practical contexts' and is lasting learning process, in which learners and educators share their knowledge to those who can benefit from it (Koshy, 2005).

The process of research action (Kemmis, S. & McTaggart, R. 1990) contains of cycles and all cycles include four steps (figure 4.1):

1. Planning a change

2. Acting the process and its consequences

3. Observing the process and consequences of the change

4. Reflecting the process and consequences of the change

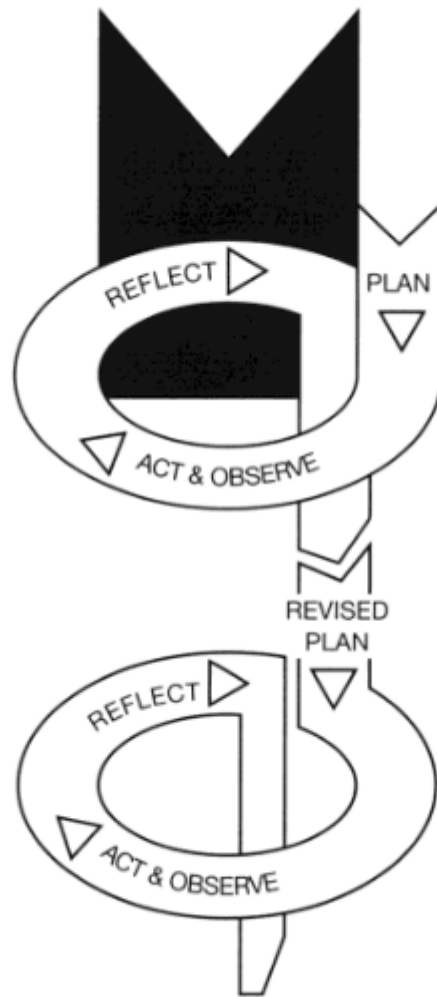And then again new cycle begins with the same steps.

Figure 4.1. The spiral of action research by Kemmis and McTaggart (1990).

In the planning phase the problem area should be identified and investigated and thought what evidences will be collected to evaluate if the action was successful or not. In the acting phase the solution should be implemented and in observing phase evidence should be gathered to decide whether the solution was successful (Davidoff & Van Den Berg, 1990). In the reflecting phase the researcher will focus on analyzing the change and therefore criteria's should be formulated to prove the change that happened. As the result of the action research is not only improving but also creating the opportunity to study among participants it is also

important to evaluate what was learned, what is the value of it and is it possible to engage this knowledge somewhere in the future (Gray, 2004).

Authors of this illustration (figure 4.1) suggests to use it as a stiff structure, because in real life this process may not be so pure like this cycle of planning, acting, observing and reflecting suggest (Koshy, 2005).

In the context of this study, first author identified the problem that there is lack of needed online instructional materials about using SL in the context of architecture. Then the instruction was developed based on the theoretical materials. In the next phase, author looked for the most appropriate users of developed material. Users were involved in the validation phase of the online instructional materials. Their evaluation was taken into consideration when designing the materials in the next phase.

4.2 Sampling and selection criteria

While forming the sample it is very important to have a critical view to select all the participants with special care. Sample of this research was created based on the user overall experiences with online learning, with architecture of any kind or with online activities like using social networks, having overall knowledge about virtual worlds and etc.

The sample of this action research consists of three participants. First participants is Kersti Toming who is participating in 'Co-Create' project where Second Life will be used as a learning environment and therefore making Kersti relevant participant. She is also studying first year interactive media and knowledge environments at the University of Tallinn and is therefore familiar with online activities and has overall picture of virtual world Second Life.

Second participant is Imre Kuusk who is doing master degree in naval architecture in Tallinn University of Technology and Helsinki University of technology at the same time. He was chosen to be one of the participant, because of his wide knowledge in architecture. He has few experiences in learning online, but has never been part of any virtual world and needed guidance before starting the test.

Third person is Marili Rõõm who has finished University of Tartu in information technology and after finishing master degree in Tartu, she became mathematic and informatics teacher. She has very good teaching and technical knowledge and therefore very good candidate to test the instructions. Her online learning skills are over average, though she has not been the member of any virtual world.

4.3 Data collection

Data collection instrument was an interview that was conducted during the evaluation session of the online instructional material. Questions (see Appendix) were open-ended and focused of the structure and design of the developed material; previous experience of using the Second Life, barriers and other factors that users faced while testing the material and some general questions. Questions based on questionnaire developed by the Estonian E-learning Development Centre (E-Õppe Arenduskeskus, 2007) and with that instrument the course feedback is usually collected.

Testing was built up in form of observation. Participant and author of the thesis were sitting in the same room and author gave a basic overview of the material and testing process. Participant received the link to the LeMill online instruction page and started with the testing. At the same time author observed and when question appeared, the problematic part of the instruction was overviewed together and author made notes according to the participant's suggestions. With this pattern it was tested till the end of the instructions. After the testing was finished, participant received a questionnaire with open-ended questions. Questions were represented in a written form and answers were received in discussion form. Testing sessions were conducted separately with every participant from half a hour to hour and a half, depending on the computer using skills of the participant.

Interviews with participants were taped, transcribed and categorized by the following themes:

a) Language
b) Content
c) Interface

d) Technical problems

e) Structure

f) Experience

Questionnaire is attached in the appendix 2.

5 Results and discussion

This chapter gives answers to the research questions related with the designed online instructional material about architecture in Second Life.

Online instruction materials where created by using LeMill online environment. The reason why author chose LeMill is that other people have opportunity to expand the instructions further and there will be more value for the future users. Also materials created in LeMill can be reused and it has Creative Common license (Toikkanen, 2011), which means that its content is free and open. Instructional material created by the author is visible to the participant as a simple webpage. Material is built up with the following pattern: simple introduction part and instruction material which is divided into four parts. Every step in every part in the instruction material is numbered, so user has good overview which part is being worked on at the moment. Every step includes textual explanation, picture and in the end of every part there is a video which shows previously mentioned instructions all together in action. Video was necessary because some parts were not easily and well explained by words and it gives better overview. Materials where created in English, because then more people get value out of this.

Based on the theory and participants feedback, online instructional materials should be based on the following principles:

a) All the instructions should be linguistically correct.
b) Content must be correct and unequivocal in the contest of the entire material.
c) Instruction should be with clear and simple design.
d) No technical issues should appear while testing.
e) Structure must be easily understandable and explained before starting with the instructional material.
f) Estimated user experience must be described.

Based on the interviews of the study it can be said that user expectations to the architectural online instructional materials are quite high. User expects that instructions are explained step-by-step. If instructions are explained in correct order and the compiler of the material is not

missing anything, then user is pleased. There must not appear the situation where the next step in instruction material is not related to the previous one. User gets confused and may lost interest, because of not knowing the next step. As the author was observing the participant it was possible to ask help, but future users of the instructional material do not have this opportunity. As the graphical vision is really important in architecture then users also expect to see pictures and graphics in the instructional materials. Only one user out of three expected that the material consist also video material. User also assumes that all kind of secondary material should not be used. Concrete instruction must consist of all the necessary information without any misleading link.

Participants were asked questions which were categorized by the following themes: language, content, interface, technical problems, structure, and experience. Questions about language came up quite often. Descriptions of instruction points 10, 14 and 21 were changed to be clearer. At first one participant thought that point 14 of the instruction material was pointless, but later realized that it was there to give a simple overview, no practical steps were done. In content part there was not any negative comment. One participant suggests to make the instruction even more detailed in general part, but as this instructional material covers only building part in Second Life, this suggestion was not considered. Others thought that this content is good for getting started with building in Second Life. In design theme there was the less excitement. Participants only pointed out that design is simple and is not overstrained. Author did not add any special design, to get users attention only to the created materials. Technical problems came out most often. All the participants complained that their computers started to work more slowly and it interrupted also activities in world. This is one thing that must be considered before starting to use this virtual world, that participant must have powerful computer. Also there were errors in Second Life while participants where using it. Two participants were kicked out without any explanation. Users were satisfied with structure of the work where the structure of the instructional material was described before the instructional part itself. It gave better understanding to cope with the material. In experience part it came out that one of the participants has never been in any virtual world, one has been playing massively multi-player online game before and one is familiar with Second Life and its possibilities.

Participant's suggestions that were carried out after the test session and what are already implemented:

- Some of the points such as 10, 14, 21 of instructional materials where rephrased
- Improving the video – there were inaccuracy of the building when avatar zoomed into it. Corners were not exactly side by side.
- Improving video – voice was added to the video
- Author of the instructional material was referring to the material, but there was no reference.

Participant's suggestions that was not included in this thesis, because these were not the aims of thesis:

- Translating the instructional material into Estonian language, including videos
- Author did not post these materials to any architectural communities due to the lack of knowledge in architectural field. Instead the participants were encouraged to share the open material on their own.

In addition to previously mentioned feedback one the participant with background of architecture suggested that these materials should be found from the environments and working communities which architectures use in their everyday life such as Graphisoft.

In order to see architects using virtual world Second Life environment in their work, there should be found good solution how they could do that. For example, architects could be given the opportunity to project their work entirely in Second life or Linden Lab should improve Second Life in a way that would let architects to use it as they use AutoCAD today. To keep an eye on the future, Second Life should improve and develop their building tools further, to improve their building services.

6 Conclusion

In this paper action research is used to find out which architectural solutions and how should be implemented in virtual world Second Life and therefore four research questions where formulated to help to guide the study

Theoretical overview based mainly on virtual worlds and its possibilities; architectural solutions in Second Life and to the principles of creating online instructional materials.

Practical part of the thesis was to study the creation and testing of architectural instructional materials. The importance to contribute to this study came along with lack of instructional materials of Second life building tools and authors feeling that virtual world in-world building tools are becoming more popular among architects. Examples of best practice in Second Life and implementations of architectural possibilities in online world play significant role in it. Data collection instrument was an open-ended interview that was conducted during evaluation session of the online instructional material. Questionnaire consisted of 13 questions.

Aim of the thesis was to develop online instructional material, validate it with users and improve it according to the participant's feedback. Therefore general guidelines were provided.

Results of the thesis are:

- Second Life is more suitable for promoting products and services during shorter period of time. To keep visitors interest, active ongoing campaigns should be provided.
- To design different instructional online materials various tools can be used such as LeMill, eXe and Lectora. For the practical part of the thesis, web-based authoring tool LeMill were used, because of its open and free content policy.
- Three main principles that should be based on the preparations of architectural online materials: material should be clear and simple; created with the tools which are supported by various platforms and usable by the average level computer user.

- Based on the feedback gathered during the design session the most important expectations were videos with audio; in some cases there were lack of understanding of materials due to moderate language skills in English.

The feedback gathered during the meeting with participants should be considered in the future while developing new resources.

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Appendix 1

Juhend

Appendix 2

Questions asked from the participants to evaluate instructional materials created in LeMill.

1. Have You used *Second Life* before testing this instructional material?
2. How do You like the structure of the instructional material?
3. How do you coped with technical tools and programs used in this training?
4. How do You feel Yourself after finishing the material?
5. What would You positively bring out from these instructional material?
6. What would You negatively bring out from these instruction materials?
7. How you're satisfied with the course design?
8. Was there any misleading instruction?
9. What do You think, is this instruction useful for You?
10. How to You plan to use this knowledge in the future?
11. Was the time devoted to the learning of the instructions balanced for You?
12. What were the main problems while going through the instructions?
13. Was the video helpful?

Arhitektuuriliste lahenduste rakendamine virtuaalmaailmas Second Life

Käesolevas magistritöös annab autor ülevaate virtuaalmaailmadest üldiselt ja võimalustest, mida pakub populaarseim 3D virtuaalmaailm Second Life. Samuti toob autor välja põhimõtted, millest võiks lähtuda internetipõhiste juhendite koostamisel ning koostab nendest lähtuvalt veebipõhise juhendi virtuaalmaailma Second Life ehitamise kohta LeMill keskkonnas.

Elades virtuaalmaailmade kõrgajal, peab autor vajalikuks antud teemade vajalikkust:

- Kuidas on firmad ja organisatsioonid oma tooteid rakendanud Second Life'is ja teistes virtuaalmaailmades?
- Millised erinevad võimalused eksisteerivad täna arhitektuuriliste lahenduste rakendamisel virtuaalmaailmas?
- Millistele põhimõtetele tuleks tugineda arhitektuuriliste veebimaterjalide loomisel?
- Millised ootused on kasutajal arhitektuuriteemalistele veebimaterjalidele?

Magistritöö raames oli uurimise aluseks autori poolt koostatud virtuaalmaailmas Second Life ehitamise juhend, mida testiti ja mille käigus viidi sisse testijate poolt välja toodud soovitused. Hinnang juhendi kasutatavusele on antud magistritöö autori poolt ja antud juhend jääb Interneti asjast huvitatutele kasutada.

Magistritöö pikkus on 47 lehekülge, sisaldab ühte joonist, ühte pilti, kahte lisa ja ühte tabelit. Kirjanduse ja veebiviited on lisatud kirjanduse loetellu. Magistritöö on kirjutatud inglise keeles.