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Virtual Campus in the Context of an Educational Virtual City: a Case Study

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Abstract: In this paper we focus on virtual campuses, i.e. virtual worlds representing real educational institutions that are based on the metaphor of a university and provide users with different learning tools. More specifically, we focus on the idea of integrating a virtual campus into the context of a virtual city where the students live and work to extend its possibilities for supporting learning and socializing. In this paper we describe an empirical case study that was performed to test and develop our initial ideas. We present a set of guidelines for designing a virtual campus in the city context, based on the results of the study.

Introduction

In recent years, the use of 3D virtual worlds has been continuously increased, and adopting virtual worlds for educational settings is becoming more and more widespread. As it is stressed in (de Freitas, 2008), in the future all kinds of virtual worlds will offer different opportunities for learning. In (Prasolova-Førland & Divitini, 2003) we have argued that virtual worlds have promising potential for supporting learning communities, providing students and teachers with a place where they can perform overcoming the barriers of the physical world. According to (Kelton, 2007), virtual worlds allow people to interact in a way that conveys a sense of presence lacking in other media.

3D virtual worlds can be defined as "networked desktop virtual reality in which users move and interact in simulated 3D spaces" (Dickey, 2005). Within such environments, users are represented by avatars – 3D animated characters that allow users to convey their identity, presence, location and activities and interact with other users, agents or virtual objects. Communication possibilities are usually presented in the form of a limited choice of gestures and text-based chat tools, in some cases also a voice chat. Examples of successful 3D virtual world applications include Second Life (www.secondlife.com), Active Worlds (www.activeworlds.com), Wonderland (https://lg3d-wonderland.dev.java.net) and others.

The design of educational virtual worlds is often based on the social constructivist approach (Vygotsky, 1978), allowing learners to co-construct their environment and understanding together with their peers (Bryceson, 2007). In this way, the virtual space provides a dynamic and flexible environment where distributed learners can share information and form the environment according to their needs.

In this paper we concentrate upon one type of educational virtual worlds, *virtual campuses*. More specifically we focus on the idea of placing a virtual campus in the context of a virtual city. A virtual campus can be defined as an environment that uses the metaphor of a university and provides users with a range of different tools for learning. A growing number of universities have introduced virtual representations of themselves in the form of virtual campuses for supporting a wide range of educational activities. But we argue, referring to (Vygotsky, 1978), that socializing is of essential importance for learning and needs to be maintained. Using a city context can extend a campus not only spatially, but also add more possibilities for learning, gaming and socializing. While virtual campuses often focus on collaboration among people that are geographically distributed, the metaphor of "virtual city" brings local issues back into the distributed virtual environment, recognizing the critical role of place and local communities in learning. This not only supports interactions with "others around the world, but also – and, perhaps more importantly, with people nearby" (Rheingold, 2003).

Previously we argued that a virtual campus can benefit the learning process in many ways. In (Fominykh, Prasolova-Førland, Morozov, & Gerasimov, 2008), based on the survey and case studies made, we derived an initial set of requirements for a 3D virtual campus and presented the start-up of NTNU's campus design. We consider a virtual campus as a special *place* to perform learning activities and with a *set of tools* to benefit educational process (Clark & Maher, 2001).

A virtual city can supplement a virtual campus by providing additional arenas for their social activities, such as places for clubs, concerts, parties and so on. Moreover, a virtual city around the campus can be an additional place for dissemination and sharing of educational content, educational simulations and demonstrations, as well as a place where students, using special tools, can collaboratively create and share their own content, including 3D constructions. While virtual campuses have substantial potential in terms of attracting new students (Fominykh, et al., 2008), a virtual city is probably best suited for these purposes. It can provide an atmosphere of a real city and information in the form of different media, allowing prospective foreign students and any other users to learn about the local culture, architecture, history, etc.

In the next section we look at existing virtual campuses and cities discussing their features and current weaknesses and suggesting the concept of a virtual campus in the context of a virtual city. In section 3 we describe an empirical case study that was performed to test and develop our initial ideas. Further we present some of the case study's results and discuss them in section 4. As an outcome of the discussion, we propose a set of guidelines for designing a virtual campus in the city context. Finally, section 5 concludes the paper, outlining directions for future work.

Related work

Many different educational projects that define themselves as 'Virtual Universities' or 'Virtual Campuses' have been developed. Such projects started as online multimedia services for distance learning in the early 90s. Today providing online educational services for time and space separated users is one of the most important roles of virtual campuses. Generally, virtual campuses provide users with different sets of possibilities, ranging from web-based systems (e.g. http://vu.org/) to immersive 3D worlds. In this paper we primarily focus on the latter category as well as considering 'Virtual Cities' as another type of 3D virtual worlds.

3D virtual campuses are created based on different types of platforms and technological solutions. For example, Virtual Campus of Nanyang Technological University in Singapore (Prasolova-Førland, Sourin, & Sourina, 2006) is based on blaxxun technology (www.blaxxun.com). This virtual campus provides a very realistic, 'photographic' resemblance of the corresponding physical campus, with offices and students' rooms. There are also different tools available there for students for getting consultations, following lectures and doing practical exercises, especially in computer graphics. There are also numerous examples of virtual representations of real educational institutions in Active Worlds, such as iUni (http://iuni.slis.indiana.edu). However, the most widely used platform at the moment is Second Life, although it has certain disadvantages as a learning environment (Helmer, 2007). Over 500 universities and colleges have a presence in Second Life, a 3D virtual world opened to the public in 2003, which today is inhabited by millions of 'residents' from around the globe. Major universities already using SL include California State University, Harvard University, Ohio State University, University of Hertfordshire and University of Sussex, just to mention a few. The presence of institutions working in Second Life varies broadly, from full-scale, highly realistic campuses, less realistic 'digital interpretations' to individual classes taught in common areas. For example, Northern Illinois University is supplementing both credit and non-credit courses with Second Life classes in art, computer science, education, and communication (Kelton, 2007). In Ohio State University's virtual campus visitors can take several courses, get access to learning materials, visit art installation, music center and other places. Harvard Law School offered a course in Second Life called "CyberOne: Law in the Court of Public Opinion" (Jennings & Collins, 2008). It is common for many of virtual campuses that they attempt to create a 'familiar' atmosphere for the students. Virtual campuses often provide a clear association with the real educational institutions they represent, conveying their 'spirit' and atmosphere by different means. These means may include a realistic outlook, informational resources, possibilities to contact the representatives of the educational institutions, etc.

Virtual campuses and cities are often created within bigger virtual worlds, using their advantages, but also being restricted by their limitations. 'Social virtual worlds', such as Second Life, that are often used for virtual campuses resemble only little parts of real world or sometimes do not even have anything in common with the reality. Whereas virtual worlds that represent the physical world in a very direct and realistic way, known as 'mirror worlds', do not have satisfactory support of learning and socializing (de Freitas, 2008). Examples of mirror worlds include *virtual cities* that nowadays often have detailed and attractive models and advanced functionality. The most

known virtual cities are made for Geo-navigation, such as in Google Earth (http://earth.google.com), heritage preservation, such as Rome Reborn (http://www.romereborn.virginia.edu) and Forbidden City (http://www.beyondspaceandtime.org). There also exist virtual cities that are made for gaming and socializing, for example Cybertown (http://www.cybertown.com) and Citypixel (http://www.citypixel.com). However, virtual city designers focus even less on education and training (de Freitas, 2008), (Dickey, 2005) and (Prasolova-Førland, 2005).

It is supported in (Dokonal, Martens, & Plösch, 2004), emphasizing that in the virtual city design the most important questions are probably for what purposes and how virtual cities can be used. Although the level of detail is often of high importance, it is not only an issue of creating a realistic 3D model of the city. A virtual city can not only be a space, but a place which is invested with social meaning (Harrison & Dourish, 1996). In such a way, provided functionality of a virtual campus as well as a virtual city acquire significant importance, because the system should allow users to *do* something in the environment. These may include facilities for communicating and exploring the environment, collaborative work, learning and socializing, tools for creating and sharing the content and other resources.

Based on the discussion in the Introduction and the presented literature overview, we suggest the concept of a virtual campus integrated into a virtual city. The city context can extend the possibilities of a virtual campus to support learning and socializing. At the same time, a campus can enrich a virtual city with social meaning and educational content. Together, the integration of a virtual city and a campus may connect local and distributed communities of learners. We have performed an explorative case study to identify to what extent a virtual world of a city and a campus can enhance educational process and what functionality is required. In our work we develop further a systematic approach to virtual campus design (Fominykh, et al., 2008) and consider this empirical study as a view in a broader perspective and a source of up-to-date feedback.

Case Study

To identify the expectations that present-day students have of a virtual campus and of a virtual city as well as to investigate what functionality and content are needed for such a system, we performed a case study among the students at the Norwegian University of Science and Technology (NTNU). The students performed a number of educational activities in the Virtual City of Yoshkar-Ola (VCYO).

System Description

This section presents a short description of the Virtual City of Yoshkar-Ola (VCYO) system. In reality Yoshkar-Ola is a city in the Volga region in Russia, where Multimedia Systems Laboratory (VCYO developer) is located. VCYO is a multiuser virtual environment representing the central part of the real city in exact manner with buildings (with examples of interiors), streets, yards, trees and other elements (Fig. 1 and 2).

Figure 1. The main square in the Virtual City of Yoshkar-Ola

The model of the city contains also the main building of NTNU as a symbol of collaboration between universities and as a fun element (Fig. 2). The system is a Research and Development project, which is freeware and available on the web (http://virtyola.ru/index.php?lang=english).

The system's functionality includes representing users by realistic customizable avatars. A user can effortlessly explore the world, moving his/her avatar by using intuitive interface. A big and a mini-map as well as teleportation are available to facilitate navigation in the virtual city. Users can communicate to each other by text chatting (private, local-group and global chats); voice chatting is being tested. The system also supports social software (Owen, Grant, Sayers, & Facer, 2006) functionality. It is possible to examine descriptions of places and buildings in the city, users' notes and photos in the virtual world (Fig. 2). A user can also add their own comments to existing notes or photos, to leave their own notes and put their own pictures around the world. Such user-generated content often shows users' opinions of the virtual and the corresponding real places that can be useful and interesting for other users.

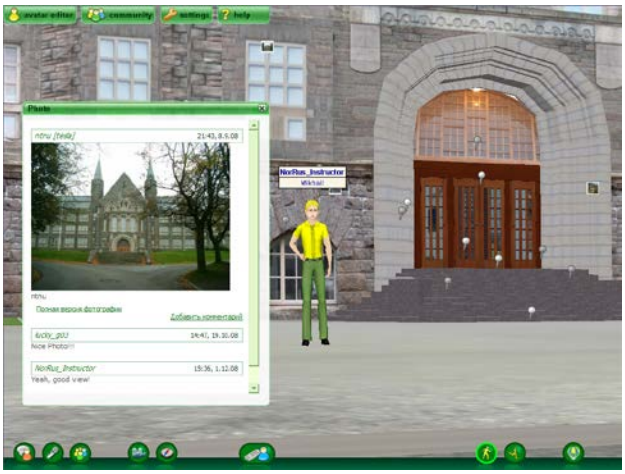

Figure 2. Photo-sharing in the Virtual City of Yoshkar-Ola

A citizen of the virtual city can also create a social network with other users, filling a profile, adding friends to a friend list, keeping a blog and commenting others' blogs. VCYO also contains some educational tools to enable live virtual lectures such as facilities for slide show, video and web.

Case study settings

The goal of the case study was to investigate how a 3D virtual city can support collaborative learning and socializing among students as well as to identify users' expectations of a virtual campus and its integration into the virtual city context.

34 students divided into 8 groups participated in the case study, most of them in their 4th year of study. The students included both ethnical Norwegian and exchange students from other cultural backgrounds, plus a small group of Russian students. The students were given an exercise where during the preparatory phase they were supposed to explore a virtual world VCYO, aiming to analyze the different design features used and to discuss the usage of virtual worlds for learning and socializing. The students were also asked to make suggestions how they would have designed a virtual campus representing NTNU and a virtual city of Trondheim (the city where NTNU is situated) in the most appropriate way.

As a practical part of the exercise students first had to customize their avatars and explore the world, different places and objects in it. Next, they had to try different communication functionalities and contact other on-line users. Furthermore, students were supposed to explore the social network of the virtual city's community and use social software functionality to build their own social network. A central task was participation in a virtual lecture. The lecture took place in the open-air auditorium (Fig. 3) in VCYO, where several tools for learning are situated. Lecture theatre with slide show, web browser and video screens with a pointer, as well as chat were used during the lecture. The event lasted about 2 hours that included the lecture itself and the associated discussion. Due to technical

problems and server overload, the originally planned lecture had to be interrupted and finished 9 days later. After the lecture, the students had a discussion on virtual worlds and virtual cities in educational settings.

Figure 3. Virtual lecture in the open-air auditorium in the Virtual City of Yoshkar-Ola

The students also delivered essays answering a number of questions regarding their experience in the virtual city and their opinions about the future design of NTNU's virtual campus and the virtual city of Trondheim.

All the data in this explorative case study was gathered from the following sources of evidence:

- direct observation of students' activities online
- archival records (visiting statistics, chat log as well as notes, pictures and comments recording)
- users' feedback (essays and questionnaires)

The data have been analyzed to define:

- The overall impression from the VCYO, how to improve it and what functionality is missing
- How social software and communication tools were used in the VCYO and how helpful these tools were for navigation in a virtual city and for building a social network
- What places in VCYO were the most sought-for, what roles they played and what other places are needed in a virtual campus/city
- What educational experience the students got and how it can be improved in any virtual campus
- How would Norwegian students design a virtual campus of NTNU and a virtual representation of their home city

Results and discussion

In this section we summarize the results from the case study, discuss them and outline a set of guidelines for designing a virtual campus in the context of an educational virtual city.

Case study results

This sub-section presents the empirical data that was gathered during the case study that is mostly how the students used communication and social software tools, path recording data as well as some examples. From the 34 students participating in the study, 27 communicated by chat and posted text-notes and pictures. We selected 28 discussions that students took part in from the chat-log (excluding the lecture). Most commonly during these discussions the students helped each other to understand the system's functionality details and navigate in the virtual city, shared their impressions generally about the VCYO, as well as about particular places and objects, etc. Some of the observed students also met other visitors of VCYO and had some informal conversations. In general, we observed a number of examples of 'social navigation', where the students were guided by peers (for example, how to enter buildings or to get to the lecture place) or invited friends to see some places (for example, to take a walk on the city's roofs).

Students posted 135 notes in the virtual city; some of them were commented by their peers or other virtual citizens. Notes were tagged to particular places so that students from the observed group used them mostly to ask about interesting places, buildings and objects, while local virtual citizens often answered by commenting on those notes. For example, there were discussions around the virtual gallery in VCYO replicating the one available in reality in the city of Yoshkar-Ola (Fig. 4). Some of the Norwegian students expressed their interest in the exposition, wishing to learn more about Russian art.

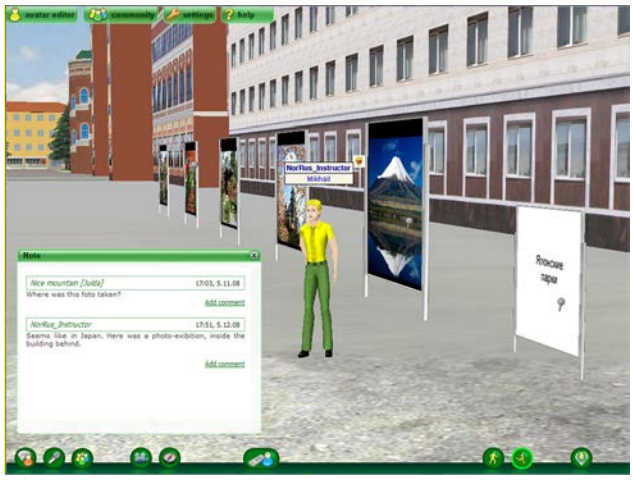

Figure 4. Example of note with comments in a gallery in the Virtual City of Yoshkar-Ola

The students from the observed group were interested in the photos of the real city posted in appropriate places in the virtual one; however, they uploaded relatively few pictures of their own. But there was one exception – the main building of NTNU that was created and placed in the outskirts of the VCYO. All of Norwegian students could easily recognize this building and some of them posted photos of it, also leaving a lot of notes discussing the building, the university and other issues (Fig. 2).

Concerning profiles, friend lists and personal blogs functionality, it should be said that it was used to a smaller degree, due to technical problems and the relatively small size of the community and a short trial period.

We performed path recordings during the whole case study time (Fig. 5) and during the lecture event alone (Fig. 6). These data were also used to analyze how much time students spent in the virtual city and what places they visited. Students used different 'movement patterns', but most of them explored the city moving from place to place, spending time in interesting or fun places and running or teleporting through other ones. In addition, we discovered the trend among the students to go towards familiar places and explore mostly the space on the way.

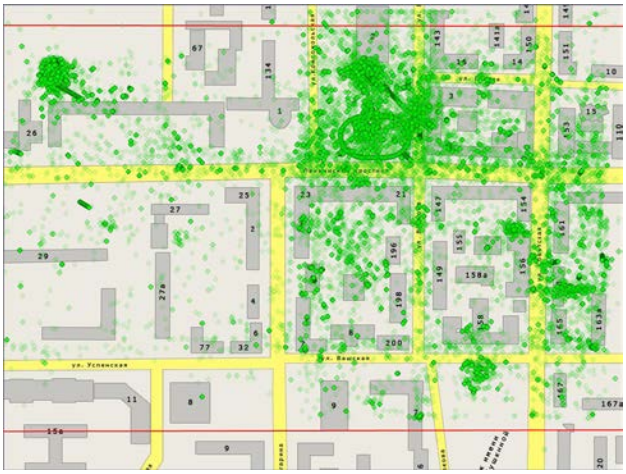

Figure 5. Visiting statistics in the Virtual City of Yoshkar-Ola during the case study

During the lecture in the VCYO and the associated discussion students expressed a lot of suggestions as to how to improve the system's functionality, as well as debated advantages and limitation of learning in virtual worlds.

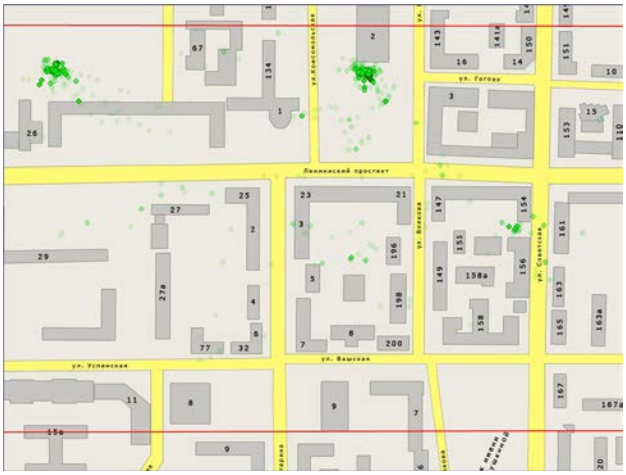

Figure 6. Visiting statistics in the Virtual City of Yoshkar-Ola during the virtual lecture

Discussion

In this sub-section we discuss how the system's existing functionalities support or limit users' experience in the VCYO, based on the analysis of the results.

The *navigation* and exploration of the city was mostly concentrated around the entry and a few other areas of interest such as the main square, model of the main building of NTNU and the lecture place as the navigation patterns in Figs. 5, 6 and direct students' feedbacks showed. One of the reasons for that was that the students did not get sufficient information upon log-in about the different places in the city that might be interesting to visit, plus at this stage of development not all constructions had enough informational content to motivate in-depth exploration. In addition, existing avatar moving functionality (clicking on the place to move) turned out to be not efficient enough for the target audience used to playing computer games. The majority of students expressed the wish to use arrow or WASD keys. The jumping functionality turned out to be useful to get an overview and as a 'fun' element. As an improvement a 'flying' mode was proposed, as well as a more transparent, searchable map with information about different locations. Still, the navigation patterns showed that the existing support for social navigation (by chat and leaving notes) was not fully efficient and that additional facilities are needed.

The *community network* development allowed us to analyze the efficiency and limitations of the different tools in the virtual city context. Considering the small quantity of virtual citizens in this case study, the limited time-span and some technical problems, the resulting community network (in terms of blogs and friend-lists) was moderate but satisfactory. One of the most useful tools was the one allowing to see 'who is on-line' and teleporting to any user from the list. User notes were used quite a lot, allowing students to discuss asynchronously particular places or objects and enriching the environment with user-generated content. Notes with comments often contained quite meaningful discussions and were usually attached to the places related to the discussion topic. For example, there were a lot of notes with questions about buildings and places, highlighting the need for 'marking the buildings', explaining their purpose. Almost every student from the observed group left or commented notes, at least with jokes or very short phrases. The functionality allowing posting photos was mostly useful in relation to places familiar from reality, showing the importance of the connection between the real and the virtual.

The total amount of notes was less, but comparable to the amount of chat messages – the main communication tool. The findings above suggest that the notes functionality was easy to use and helpful, but most importantly, they highlight the importance of 'situatedness' and context for community development in the virtual city. The students used the virtual city as a discussion board, connecting together the content and virtual places.

The *educational experience* included taking part in the virtual lecture. Tools for live lecturing available in the open air auditorium (shared displays for slide show, video and co-browsing) proved to be useful for the lecture joining 2 cities, Trondheim and Yoshkar-Ola. Still, there were some problems. For example, visibility problems: it was difficult to see all 3 displays simultaneously, because of the narrow view angle and other avatars, blocking parts

of screens. This highlighted the necessity to work further on the organizational settings for virtual lectures. In addition, there were some technical problems due to the server overload. Web and video displays played some movie clips with sounds during the lecture, making it more alive and interesting, though it was inaudible for students using public computers in the lab. The students strongly recommended using voice chat in the future since text chat appeared to be useful, but not sufficient. Also, it was recommended to provide tools like interactive whiteboard, document sharing and so on.

Virtual places within virtual environments can play a number of different roles in an educational context, such as information spaces, meeting and work places, virtual stages, demonstration and exhibitions (Prasolova-Førland, 2005). Our experience and direct students' feedbacks showed that a virtual city itself can provide a number of such places as well as supplement a virtual campus. For example, the streets and squares could serve as natural meeting places, with prominent landmarks such as 'street corners', famous buildings and so on serving as navigation aids. The same landmarks (such as the main building of NTNU in our example) as well as designated places (libraries, campus, boards at teleportation hubs) where community members can store resources and leave their notes, announcements and comments, function as an information place set in a rich context. In our case, it allowed Norwegian students to learn about a foreign city by posting their questions on the buildings of interest and receiving answers from the locals.

A virtual city can also function as an exhibition, attracting public interest to the corresponding exhibition in reality and allowing the community members to post comments and questions, as shown in the gallery example (Fig. 4). As our experience with the virtual lecture shows, a virtual city can function as a workplace. Still this requires that corresponding facilities are in place as discussed earlier. An important aspect here, as noted in almost all students' essays, is the 'disturbance' factor while having a lecture in an open space (a square) with other users wondering around and other visual impressions diverting attention from the lecture itself. It was suggested to keep such 'serious' educational events 'indoors' in settings close to real-life auditoriums, to create a better focus on the educational content. Such open places in the city are better suited to serve as 'virtual stages' for concerts, city events and gatherings, promoting a feeling of 'togetherness' and presence among distributed users.

To conclude, our case study in VCYO educed some limitations of the system, but at the same time it showed that a virtual city can successfully be used in a wide range of educational activities and in particular as a context for a virtual campus.

Guidelines for designing a virtual campus in the context of a virtual city

Based on the case study results and the discussion in the previous sub-section, we propose a set of guidelines for designing a virtual campus in the context of a virtual city. Since in (Fominykh, et al., 2008) we have already presented an initial set of requirements for a virtual campus, in the following guidelines we will focus more on the aspects of a virtual campus as an integral part of a virtual city, creating together an arena where students can learn and socialize. We can think of a scenario where the city's cafes, clubs, squares, museums and libraries constitute a network connected to the infrastructure of the campus. We made these guidelines focusing primarily on the city of Trondheim (that is often called a "nr. 1 student city in Norway") and on the virtual campus of NTNU. Trondheim is actively used by the students for festivals, parties and educational activities, containing a number of dedicated buildings and businesses offering student-targeted services. Still we believe that these findings and guidelines can also be applicable in other similar contexts:

The *appearance* of a virtual campus as well as a virtual city should be as authentic as possible to create a familiar atmosphere and aid navigation. The overall structure of a campus and a city should be presented in a maximally realistic way, while special attention should be paid to the major and most significant buildings, such as main campus buildings and city's points of interest. Both the campus and the city should contain places for students' socializing such as cafes, coffee bars, squares and other open places for gatherings, student clubs, places for sports activities (such as tennis and soccer) and stores selling commodities that students might need. The design of certain places for various educational, social, fun or other activities could have a limited reality resemblance to serve the specific goals in a best possible way, such as auditoriums, buildings representing courses and faculties, but also private houses and educational spaces that can be built by the students and teachers within the major structure of the campus/city. Also, the outside of certain buildings might be scaled down to make it easier for users to move around while the inside could be scaled up to give more space for activities.

Informational resources should be an essential part of a virtual campus and a virtual city. It was generally agreed that only models of buildings without corresponding information have a very limited value and meaning, especially for the users not familiar with the city and the campus. Therefore, there should be a strong correspondence between the constructions in the virtual city/campus and the associated informational resources and facilities. For example,

the city hall should contain information about local government; the doctors' offices should contain information about the medical services. The faculty buildings should contain information about the corresponding study programs and research projects, the different auditoriums and course rooms in the campus should display information on lecture schedules and contain resources such as video recordings of the lectures. Informational resources should also be contained in the offices of university teachers and city officials. In some cases, these could be represented by virtual humans, being able to answer a certain set of 'frequently asked questions'. According to the students, this approach would lead to a lower threshold for asking for help. Such informational resources are especially relevant for foreign students who need to get acquainted with the city and local customs as quickly as possible. The students also emphasized the need for library resources with appropriate search facilities. For better efficiency and availability, such resources in the campus and the city should be interconnected, giving the students access to contextualized information, such as what political events took place in the city during a certain historical period studied in a history class.

The city should in general contain multimedia resources such as sound, pictures, video and 'enactments' with virtual agents associated with relevant important buildings and landmarks, allowing the users to learn about the city, its history and culture. The same applies to campus as on several occasions the students expressed the need for animations to be used as a learning aid in different courses. Therefore, there is a need for a set of tools for content manipulation. Referring to the feedback from students, we can conclude that the system should provide a special toolkit for working on the media content in order not to overload the system's interface. This toolkit should include easy to use instruments to create and modify any content, including 3D objects, and should be available for all users.

A wide array of *community resources and tools* reflecting and supporting the life of the student community should be integrated in a virtual world of a campus and a city, in a situated and contextualized manner. For example, there should be established some virtual places for social activities (imaginary ones or representations of real places) such as squares, parks, art galleries, museums, student clubs, open-air auditoriums. Other examples include bulletin boards with announcements, blogs and virtual houses for community members, discussion forums and tools for supporting social networks with extensive possibilities for the users to share, annotate and modify the content. There should be clear connections between the community resources and the related virtual places. Moreover, there should be possibilities for automatic recording of the events happening in certain places such as lectures in the lecture halls. A basic support for commercial activities targeting students' needs should be provided to ensure better integration of local businesses into the student community. The students specifically emphasized the importance of 'friends' networks, maintaining the awareness of the activities and whereabouts of ones' friends, as well as their social and educational calendars. In this way a student will have the possibility to teleport to a place in the city or on the campus where his/her friends have a party or a working meeting. There should be search possibilities for locating community members with the needed characteristics (e.g. potential collaboration partners).

Various *navigation facilities* should be available for users to access the content in a virtual campus and a city in the most efficient way. For the campus it could be, for example, teleportation links between buildings and faculties, including different geographically distributed sub-campuses, areas for meetings and research environments. The system should allow advanced searches to get an overview of both social structures (such as the positions of friends and their virtual 'offices') and course and research-related structures. The city environment should provide for example 'city tours' led by agents, 'tourist offices' with information and links to the major points of interest plus searchable maps with filters where one can look for shops, local businesses, historical places and so on. There should be bookmarks and 'transportation routes' marked clearly between different places. In order to support social navigation, there should be possibilities for sharing information on paths taken and places visited by other users. The navigation systems for the campus and the city should be integrated to allow free movement within the overall social and educational space. Such integrated system would be especially useful for new students, serving as a virtual 'helpmate' and supplementing the physical helpmates who according to tradition are assigned at the beginning of the academic year to all newcomers to show them around the area.

Atmosphere plays an important role, according to students' feedbacks. Appropriate music and sounds, moving objects, mystery elements such as "hidden doors and secret passages," presence of other users, real or artificial, will contribute to make the virtual world more 'alive' and appealing. The students repeatedly suggested adding gaming elements to the virtual campus and the city. This includes both games as a part of different courses, different types of quests and social games similar to those available on MSN Messenger. Another unexpected elements suggested by the students are places for sports that are not always straightforward to practice in a virtual environment, suggesting that the atmosphere created by such places is more important than the actual functionality.

Conclusions and future work

In this paper we propose and discuss the concept of a virtual campus integrated into a virtual city. We presented also the settings and the basic results of the case study that took place in the Virtual City of Yoshkar-Ola where the group of NTNU students performed several tasks. Gathered empirical data and the students' direct feedbacks allowed us to analyze the effectiveness of different tools supporting educational and social activities and make suggestions for their development and improvement. In addition, we derived and presented a set of the major guidelines for designing a virtual campus in the context of a virtual city. These guidelines will be used for designing a virtual city representing Trondheim, where a virtual campus of NTNU is supposed to be the main feature.

Future work will include further development of the Virtual City of Yoshkar-Ola, the design of the NTNU's Virtual Campus integrated in the city context, as well as the development of the theoretical framework for designing 3D immersive virtual worlds for learning.

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