

Second Life 3D City Virtual Environment as an Urban Planning Tool for Community Engagement

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Abstract: - Traditional means of urban planning are not satisfying the new demands placed by a modern city. Existing collaborative decision-support systems concentrate on providing the technical backgrounds instead of creating of attractive and powerful platform to involve the general public in decision-making process of urban planning. In the present paper two significant trends – participation and visualization – with direct implications for urban planning are discussed. ‘Second Life’ is an interactive and effective three-dimensional virtual environment, which can increase sense of shared presence, social interaction, communication and thinking, and so promote the construction of meaning and knowledge. Virtual environment provides the opportunity to simulate the actual policy scenarios, development of natural environment and landscapes, spatial characteristics of ecosystem, etc. In virtual environment public have the opportunity to use their creative and expressive voice and to do so in activities that are suitable for governance of municipality in democratic way. Empowering the citizens with decision tools helps them to appreciate and feel a sense of ownership toward the outcome and may provide a wider range of solutions and responses to challenges and changes, which in consequence will result to more resilient societies and cities.

Key-Words: -Virtual environment, Second Life, urban planning, urban ecosystem management, citizen participation, sustainability.

1 Introduction

The boundaries between virtual and real are already getting more and more blurred, and this trend is likely to continue in future [1]. During the last few years, three-dimensional virtual worlds have gained global popularity [2]: today there are dozens of internet-based virtual environments (VEs) that can be run on PCs [3]. Advances in technology, lower hardware prices and popularity of the Internet have made it possible for three-dimensional VEs and particularly computer desktop [4]. The greatest number of VE is used for the playing of games, but it can also be used in socializing, education, political expression, military training, etc [5].

The most advanced VE provide their users with detailed 3D graphics, animation, different communication methods and building new objects, and a massive number of places and objects created by others already available [2]. Such activities have therefore led to an increase in not only website creation, but also blogs, wikis, social networking platforms and any form of Internet-based communication which lets any user stretch his/her creativity for contribution to the massive World Wide Web [6]. In many virtual worlds, the basic rules of physics continue to hold, which makes navigation

within them very similar to what one is used to in the real world. The traditional *behaviourist* approach centered around the memorizing of facts has nowadays been replaced by such approaches as *cognitive* approach requiring genuine understanding and *constructivist* approach that focuses on the discovery of new knowledge [5].

The objective of this paper is to study the opportunities of the ‘Second Life’ three-dimensional virtual environment in urban planning with participatory governance.

2 Citizen participation in city planning

In planning, decision making, and resource management geographic information systems (GIS) techniques has been known as one of the most advanced tools available to deal with complex problems with spatial dimensions [7]. Integrating cityscapes in 3D GIS is not a new concept [8]. GIS was used by planners to assess the criteria requested to define the suitability of preserved landscape [9], to estimate changes in the visibility of land cover [10], to assess land-use impacts on biodiversity and conservation planning [11], in visual impact assessment and in urban landscape planning and

design processes [12].

Public participation GIS has emerged as a new research field to address public participation by using GIS. At the present time, most of researchers have focused on how to facilitate participants find preferences and propose solutions. However, they rarely include how to utilize participants' feedback data collected to resolve the possible conflicts and build consensus among participants. Contemporary large projects with environmental impact, brownfield rehabilitation and other urban regeneration projects extensively use community involvement to increase the success of the project and achieve sustainable development (Figure 1).



Figure 1. One of the various 3D scenario images where used for consultation of the community and project evaluation in the urban regeneration at the waterfront of Olhao (source: A. Santos [13]).

According to Newman and Jennings [14], *"people have the right to be involved in the decisions that affect them. Attention needs to be given to empowering those whose voices are not always heard"*. Examples of those marginalized groups are the poor, the minorities, and the disabled. Giving the tools to a wider variety of people to participate in decision making processes of city planning projects contribute to an increased diversity of perspectives, which provide a wider range of solutions and responses to challenges and changes, which in consequence will result to more resilient societies and cities. Empowering the citizens with opinion on an open space city project helps to appreciate it and feel a sense of ownership toward the outcome. Consequently, the Landscape Architect can adopt a new sustainable vision when informed by the public [15].

3 What is a Virtual World?

A virtual world is a computer-based simulated environment intended for its users to experience and interact sometimes via the use of avatars. There are a wide variety of virtual worlds each of which has its own unique competencies. These range from the 3D Google Maps (Figure 2) to the immersive 3D environment of Second Life (Figure 3).

The emergence of the web based 3D virtual worlds provides opportunities new ways to collaborate in the design of spaces. There is growing interest among urban designers and planners to use 3D virtual reality models such as Second Life for the design and planning of buildings, neighborhoods and cities. The city of Boston is recreating parts of Boston and developing teaching resources for the application of 3D virtual technologies as a community engagement tool in urban planning initiatives [16].



Figure 2. Image extracted from Google earth for the 3D city model of Funchal in Portugal.

In another example from the UK, Virtual Birmingham, "aims to promote the use of virtual technologies such as 2D / 3D mapping, web 2.0 and virtual worlds to discover their future potential and capabilities for enabling partners to deliver better services, and citizens and residents to experience the city in many dimensions."

In addition to these examples from Boston and Birmingham, different use of 3D city models in the context of urban planning are being explored: For instance for new building design and tourism. In Portugal 3D city models have still limited role to give 3D visualization of the city center (city of Funchal), other cultural and utilitarian information about restaurants, banks, ect. (city of Barcelos) or about the main cultural heritage elements (Marvão).



Figure 3. Image extract from second life where students with autism, developmental delays, and physical challenges can practice life skills in a safe environment (source: Special Education District 75, New York City, www.district75.net/3d/).

4 The virtual world of ‘Second Life’

The most popular advanced virtual world currently available is Second Life (SL), which is part of a larger group of Internet-based applications known as social media. The flexibility of SL makes it different from other social media [1]. As an open virtual environment, SL can be used in various ways and it is becoming one of the single most compelling educational opportunities for adults in the 21st Century [17]. In SL the users are represented by customizable virtual persons called ‘avatars’ – pieces of software that are the audiovisual bodies that people use to represent themselves and communicate with other people in the Metaverse [18]. As a potential tool for collaboration and communication, the avatar is an instrument of user-expression and individuality [19]. Avatars interact with one another through a variety of text and/or voice based communication methods. Residents or avatars can explore, meet other residents, socialize, participate in individual and group activities, create and trade properties or services from one another [20].

Some users emphasized that SL can have positive effects on the users’ real lives: through SL actions, experimentation, and communication people may find a deeper understanding of themselves and their relations to other people [2]. In comparison with three-dimensional games, SL does not include general rules or objectives and consequently is largely based on the users’ real psychological needs and motivations. The users have tools for continuously developing new activities and personalizing the experience according to their own tastes. SL pleasures can be accessed more easily and

may offer mental or intellectual pleasure that may be more difficult to obtain in the real life [2]. Widely in VE are used performance elements such as narrative, role play, improvisation, and other action-based activities which offer a more open-ended experience and allows to practice various activities and processes that cannot be tried out in the real world [17].

Using of Virtual reality in social media has very promising future, although it has some disadvantages. Immersion in the SL environment requires the users to have an above standard graphics card on a PC and a skill level practice acquired through practice to navigate the interface and the avatar effectively [20]. The number of Internet users significantly differs in countries. Still the most active part of users of virtual environment is young generation of 15-25 ages old. Many virtual worlds offer only little external rewards and their use is consequently largely motivated by the psychological needs of the users [2]. Although SL offers sense of freedom and resembles real people and locations, they still look very different compared to their real life counterparts [1].

5 The role of 3D models and ‘Second Life’ in urban planning

The extension of Second Life from the area of socializing to city decision making can be interesting for the urban planners of any modern city. It can substitute the distribution of two-dimensional content-sharing of information to VE, within avatars having the possibility to explore their virtual environment in three dimensions. With no more restrictions than in real world SL may be an optimal environment for experiential learning where members of community have the opportunity to use their creative and expressive voice and to do so in activities that are fun, vital, special, real, useful, indigenous, celebratory and sustainable [21].

From a survey research in Portugal on how known and important it the use of 3D city models and virtual worlds in city planning, it was found that most participants show and give great importance on it with 87 and 100% respectively. About one third of the participants (36%) had contact with any kind of 3D city model from the internet while the others were informed from the TV or printed materials. Only 11% considered that it can play a crucial role in citizen participation in city planning but 15% and 13% considered that it is mostly useful for city planners and disaster management. Useful only for city mapping considered from 14% and 13% respond that serve only for presenting cultural and tourism

information (Figure 4). The majority of the participants (85%) would like that their city could have 3D world or at least some historical buildings in 3D model. All participants considered that those tools will contribute to more sustainable cities and 41% will preferred to be available some narrative service to help understand the visited VE.

Because the VE typically allows not only observing, but also interaction, the actions of the users affect of the state of the VE [22]. The human-computer interaction is used to facilitate the interactions between users and the 3D VE and lead to a remarkable increase in useful and positive feedback, an increase in public support of the development projects, and a decrease in the time used to explain the projects [23].

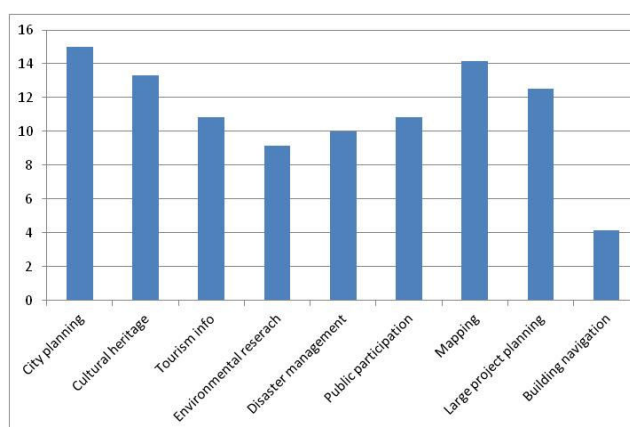


Figure 4. Respondents in % on how useful are 3D city models and virtual worlds.

The open-ended nature of SL served as a self-motivator to participate in solving of purposed problems in urban planning. Socializing in virtual environment is diverse, cooperative, neighborly, friendly, interactive and welcoming, and is executed with stewardship and pride [21]. Inhabitants are interested to be involved in process of decision making, if the purpose of urban developing is connected to reality, tailored to their needs, appealing, interactive and effective [5]. Using of the virtual world meets all those expectations. Residents of SL can perform any activities familiar from their real life – to create their own virtual content, such as houses, streets, and gardens using prefabricated objects [1]. SL virtual platform can increase sense of shared presence, partially dissolves social boundaries, and lowers social anxiety [17].

Multi-User Virtual Environments like SL are uniquely suited media for developing role playing scenarios to engage learning, if it is provided with right mix of opportunity and structure. Interacting within virtual worlds not only helps people build

communities but also exposes them to a ‘diversity of world views’ and to gain new experiences [17]. The scenarios in VE in general represent the certain images or the descriptions of the future, which main goal is to provide certain structured view of the development of the environment [24]. The urban development scenarios enable improvement of understanding of the existing, respectively the potential trends of the development of the significant factors of their equivalent links. By controlling a keyboard or mouse, the users could fly or walk through the 3D environment and zoom-in and zoom-out of a scene easily with the camera-controlling mechanism. Besides, users could also observe the scenes from several vantage points and to see different scenarios of purpose. They could navigate freely around the 3D VE and move to areas of interest [23].

Among the most important focuses of any municipality in the last decades are turned to ecological environment. Protecting of natural areas and landscapes, maintaining of existing ecosystem services, rehabilitation of natural areas in the city borders and predict the flooding hazard risk are some of the challenges. The growing number of city inhabitants and their demands for recreation in natural areas close to their residence put on state policy and municipalities to find the new solutions how to manage simultaneously the aims of natural protection and development of recreation.

The concept of virtual experiment is one of most effective way how to make the applications in environmental policy. Virtual experiments is an experiment set in a controlled lab-like environment using either typical lab or field participants that generates synthetic field cues using virtual reality technology. A virtual experiments combines insights from virtual reality simulations, naturalistic decision making and ecological rationality from psychology, and field and lab experiments from economics [23].

The potential applications for virtual experiments in urban natural areas are numerous: the simulations of actual policy scenarios, the scenarios of natural environment development by adding 4th and 5th dimension, spatial characteristics of ecological networks, estimation of monetary value of recreational services, etc. Through virtual experiments in three-dimensional environment participants can experience different options they choose from naturalistic stimulations. For all of this types of scenarios, some of the most powerful application for virtual experiments will involve continuous representation of dynamically generated effects of policy or management changes. Virtual experiment provides a rich extension to such

practices by adding dynamic rendering over time [23].

The estimation of the monetary value of recreation services is on the top of numerous researches. The most popular method is choice experiment from the set of contingency valuation methods, which present respondents with textual and pictorial descriptions of hypothetical scenarios. This method presents information providing factual cues in static manner. In virtual experiments the information acquisition process is active rather than passive: the respondent chooses what to view and how to view it by moving through the three-dimensional environment. Participants of three-dimensional virtual environment can wander around the area and examine perspectives that interest them. Adding of specific tools and tutorials in virtual environment, intrigue the residents attend, enjoy and make their own improvements in spatial environment of developing projects. In virtual experiment of contingency valuation methods respondents can understand in easier way how management activities of urban forest affect the biological diversity, recreational opportunities, landscape changes and what is the cost.

Fiore et al. [23] discuss about making nature – trees and forests in virtual reality: *SpeeTree* as a commercial package provides different dimensions of the trees, the density of the trees in a forest, the contour structure of the forest terrain, the seasonality and the number of other characteristics of the forest environment. The forest scene image allows for real-time updating as the participant moves through the forest and to add different effects to make the sense of presence more real.

In the field of landscape analysis, the creation of more realistic virtual landscape demands to add numerous variations in vegetation, topography, landmarks, and so forth. To add such factors and their effects on the evolution of the scenarios, it can be linked a separate simulation software package to the graphical rendering software that displays the evolution of a landscape[23].

The new approach in landscape management is based on combination of Geographical Information System (GIS) based data, autonomous agent modeling and a variety of GIS based environment impact models [25]. Inputs of GIS - vegetation cover, topography, weather conditions, and so on makes the model of landscape has to be able to keep tracks of the different factors causing, for instance, management activities or recreation. Figure 5 adapted from [26], shows the special role of virtual environments, rendering technology and visual assessment in establishing modeling parameters and

supporting model execution.

Bishop [25] in his virtual experiment allowed their respondents to visualize a recreational area in Scotland using 3D rendering, and walk virtually whatever they wanted within that area. The chosen attributes and locations were modeled after statistically. The other sample is the use of a comprehensive set of multimedia to stimulate the possibility of rendering an area that is environmentally sensitive more sustainable in the face of growing tourist numbers [27].

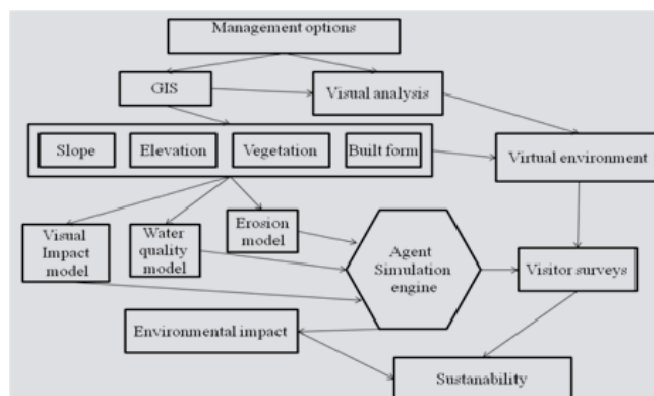


Figure 5. Scheme of one environmental decision support and the role of virtual environment.

One other consideration that land use planners always need to have when they plan alternatives for land use is an insight of the ecological landscape. Krisp and Ahonen presented an interpretation of the abstract phenomenon of ecological barriers [28], shown as the combination of real components of urban environment spatial datasets converted to virtual images of barriers. The phenomenon of ecological barriers lead to habitat fragmentation by a list of land use elements and their impact on animal movement. The aim of visualizing ecological barriers to general public is to gain public attention [28]. The user groups of visualization of ecological barriers would be the general public, the political decision makers in land use planning, and the land use planners.

Large-scale flood mitigation projects can use also the VE novel approach [23]. The residents in and around the flooding areas, are mainly concerned about the safety of the design and their lives and properties during floods. Since such projects observe a complicate technical information, perform and make the engineering analysis of the data, the public faced difficulties in imagining the project's impact and the goals in understanding of construction drawings. 3D VE with advanced technology showing both hydraulic and geometric information, as well as realistic flood flow phenomena, can be an ideal solution for visualization and user interaction. In such

large-scale projects it is important to model the flood project scenarios under different return-periods. By using of VE the users can compare the differences between these situations using different water depths and flow phenomena.

6 Conclusion

The present work expects to improve local urban design projects development mainly in the urban details. Within the broader concept of sustainability we expect that second life or similar gaming software to become a platform to address questions related with local XXI agendas, generating a channel for at a small-scale direct democracy practice. An ontology-based system may improve the communication and interoperability of urban planning projects presented in Second Life. It also could enrich the decision-making process and help governmental officials to take the appropriate decision: accept, reject or suggest modifications in any proposed city project.

The success of virtual world tools in urban planning can be explained by the fact that they fit well in the philosophical foundation of our time, which is often referred to as the postmodern paradigm [1]. As an open VE, 'Second Life' can be used in various ways and in various areas. Today different aspects of land use and urban development planning require the involvement of residents in this process. They are interested, if the purpose of urban developing is connected to reality, tailored to their needs, appealing, interactive and effective, as well as provide the opportunity to gain new knowledge and skills. The potential applications for 'Second Life' three-dimensional virtual city in urban environment planning are numerous and they have to be expanded by using virtual experiments, developing role playing scenarios and by combination of real components together with virtual images. The communication with the various stakeholders, such as inhabitants, landowners and users of the project area, is becoming an important concern for ensuring the success of large-scale projects.

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