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Computer generated simulation of landscape during the future architect training

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Abstract. The article deals with question of using software tools for landscape computer simulation during professional future architect training at a university. Computer simulation of the landscape at the final stage of project development during "Computer technologies in architectural design" study and during qualification design project with Allplan CAD will aid future architects to increase the effectiveness of design, to implement the idea and concept and to become competitive specialists.

Keywords*: computer simulation, landscape, future architect training.*

Introduction. The rapid development of information technology and computer engineering has led to significant changes in all areas of society and in individual spheres of its operation. Innovative approaches are used in various areas to reduce the task-solving time.

Computer graphics allows to process a project from idea to its virtual visualization, thus having system-fulfilling role in all phases of architectural design. The use of computer hardware and software in the preparation of future architects is necessary because, it can shorten design - development work on a new design significantly, implement the process of design itself and get better solutions. Creating, editing and using three-dimensional graphics and animation gives the architect the opportunity to convey an idea effectively and to demonstrate projects and presentations flexibly. And one of the most important factors for the successful and bright project implementation is modern software usage.

Unfortunately, in the field of higher architectural education the potential of modern computer facilities is not fully used and possibilities of computer technology are not utilized effectively. Since modern architecture is seeking to create an object that is in harmony with their environment, the topic of computer landscape simulation is relevant in the landscape modeling during the future architects training.

Review of the publications on the topic. Interaction of architecture and nature is explored in works of D.Simonds, P.Portoheza, Ch. Jencks, I.Dobritsynoyi and others.

Introduction in the learning process of innovative methods and computerized training technologies, design and educational process realization is aimed at mastering modern computer tools and technologies by students and is dedicated to research of V. Bykov, R. Gurevich, A. Gurzhii, M. Zhaldak A. Ershov, E. Polat, J. Robert A. Spivakovsky, A. Spirin, N.Tverezovskoyi and others.

Different theoretical and methodological aspects of architects training in higher education system research by K. Halabyan, L. Ermakov, M. Barhina, E. Belousov, Y. Belokon, N. Dokuchaeva, M. Demin, Y. Doroshenko, O. Kashchenko A . Kudryavtsev, A. Stepanov, G. Somov, V. Timohina, V. Tovbycha, M.A.Turkusa M. Nykolskoho, N. Nechayev, L. Kholodov and others is dedicated to.

The aim of the work is the survey of software features research for computer landscape simulation during future architects training at the university.

Materials and methods. Research methodology includes: the method of analysis, synthesis, comparison, generalization, systematization of theoretical data used to identify problems condition of the study; experimental method, based on the specifics of architecture; simulation method in terms of environmental approach.

Results and discussion. Modern computer graphics gives the architect new progressive future opportunities to realize their creative potential. As a result, the emergence of powerful computers triggered the opportunity to implement mathematical integration of graphics with a view to future virtualization projects on the screen. Computer simulation architecture implements a virtual environment.

The principles and techniques of computer design form the basis of the current architectural practice and provide dynamic shaping in interactive mode of the object virtual model with regard to space relief formation of natural or artificial environment. Rationalization of computer tools and architectural design technology usefor solving architecture - design tasks improves the efficiency and quality of the process [1].

Applications for realistic space display of natural or artificial environment relief formation can be grouped by the similarity of the interface and the same work principles: geographic information systems (GIS), three-dimensional graphics editors, landscape designers, landscape generators, computer-aided design and others. In accordance with their capabilities, functionality vary for more than several times [2].

Review and analysis of the special software achievements for 3D-modeling of landscape have showed that the most basic functions of the software are to construct 3D models, but not the area; there is a great variety of programs that will be inaccessible to the user without special training and skills, while there are programs that allow the user to create a simplified experience without 3D-model; 3D-modeling requires a significant technical resources use.

Three-dimensional simulation allows to create the object model, that is almost identical to the real image, which can have a high level of detail, but requires high system resources (3D StudioMax, Cinema 4D, etc.). Often the landscape dseems artificial and too simplified.

The principle of the generator landscape functioning is complex and is based on understanding of the the natural landscape internal structure and geographic data

knowledge of different ecosystems. Most generators built landscape relief based on elevation map that can be obtained on the basis of real data taken from the GIS database, can be created by the program itself, or by the user`s data. The relief in artificial natural landscapes can be supplemented by various options entourage. The functionality of the package can be expanded to with the help of extra plugin use.

The models of landscape in computer-aided design is obtained by changes within the given size according to the building based on topographic survey.

The authors [3,4] indicate that SAD question of choice is very important, because they must meet the following requirements as efficiency of project implementation, a great resource, high technical performance and quality of work, simplicity and useability of interface, reliability, affordable price.

The use of VIM process increases productivity of construction industry significantly and can solve many current problems associated with the lack of consistency in information exchange [5].

Building Information Modeling facilitates work with the object and is superior to classical methods of design. BIM allows a virtual mode to develop and agree on the components of the system for future buildings in advance, check their viability, functionality and performance qualities.

The integrated package Allplan is CAD-system for all design work. All stages of the work, whether it is the sketch, plan, landscape and changes made automatically are available in graphic form for all participants of the design process [6].

Allplan provides a number of convenient features for creating a project landscape system. To these features belong image processing import formats (DXF, DWG, DGN, and others.), fast data entry. Automatic detection points inventory positioning, marking axes control enforcement points, splines and coupling for Euler spiral are just a few examples of the rich range of features of the program.

Master plans are known for their complicated geometry. Work on it always starts with the initial surveying the area. Knowledge of points coordinates is the most important precondition for the transfer of data location into the graphic. These coordinates can be obtained by digitizing existing maps in the Allplan program. It can be done with te help of manual input from the keyboard or directly from files containing information about the point. Existing or newly created points of three-dimensional space can be processed later in the module «Digital Terrain Model». Continuous communication between members of the design process should be provided by using the «Geodesy» function module in order to work on a master plan smoothly.

Many types of signs typical for road construction of curves and inscription elements are used for plan presenting. Its capabilities expand with assess features, control and special functions, such as control points check or bending the edge of the road.

The "Master Plan" function enables creating an accurate 3D model of the area. The function is divided into 4 modules for convenient use:

• The Site Plan module. This module enables a variety of functions, especially for the road and bridge construction. In addition, it contains commands to build any curves and slopes, as well as for inscription and picketing (placement) of axial lines. There are additional commands for example to create files and share geodetic points. The coordinates can be imported into the program by digitizing existing maps, manually with the keyboard or on the basis of created files points of random format.

• The Digital Terrain Model module is a multifunctional tool. It is the basis for all stages of design vertical space near the building, drawing creation, calculation and display of pits and mounds that gives new possibilities for terrain submission in three dimensions. TSMM is particularly useful in the breakdown of complex areas, athletic fields, golf courses, etc. Besides it provides all the necessary tools for vertical planning to a designer. With the help Digital Terrain module master plan data in space can be edited and modeled . These surveys are introduced or, if it is possible, are imported digitally. Filling-up and dredging can designed and calculated. Also, DXF and DWG files can be imported and exported.

The area is represented with a grid that consists of a three-dimensional triangular planes. Special areas (eg, construction sites) can be defined in the grid and than cut during editing. Master plan can be converted into 3D-body module and edited into 3D model. Then it can be converted back into Digital Terrain Model.

• The Landscaping Planning module includes special features for creating dendrological and landscape plans , intelligent signs for creating plants, comfortable design for plants and trees, automatic creation of plant explication, information generation and s plant specification at all stages of design, creating original drawings by using Bezier curves, random sketches, lines, patterns, volume calculations. Calculation of planting plants areas and road surfaces. Computer-aided response and specifications on gardening items, pavement and small architectural forms.

Conducted studies [7-8] enabled to determine that the land (topography) and vegetation is most actively used in the architecture as formative material, water is used less active.

• The Urban Planning module. It is possible to create a surrounding building and calculate required indices for project in this module. With the help of the digital model designing and sands and dredging calculating can be conducted. Accordingly, you DXF and DWG files can be imported and exported. The functions of the module are used to create topographical, cadastral situation and plans, to identify areas of housing, buildings, to create a consolidated plan of installations, to calculate areas, lengths and volumes construction. And also it cab ne used for automated receipt information and specifications for residential and public buildings and structures [9].

Complex task at the development phase of the project during the study course "Computer technologies in architectural design" (10 semester 5th course) at the National Aviation University includes the construction of the building and building terrain model with the means of Allplan programs "Geodesy" functional module. Future architects, using the tools of the program, perform graphic work on modeling the environment under the proposed option. As the basis for work situational plan is provided, topo data of the terrain and building data for design (e.g. art center) as the main element of the environment. With computer design the placement of buildings with respect to relief is taken into account:

- on a plane
- to elevation,
- on a slope,
- hollow in the ground,
- near a reservoir,
- on water.

The interaction of architecture with relief is taken into account:

- overlay overhang,
- transformation of the environment,
- terracing,
- geoarhitecture.

Environment model design begins with downloading and analysis of topographic underlying cause in Allplan CAD environment. The use of scanned topographic maps with further setting the relevant data is possible, as well as the use of fabricated arrays of coordinates points. By means of the Site Plan module future architects set the basic parameters of the terrain. In particular parameters such as pickets, axis lines, curves and slopes, options for the design of roads and bridges can be set. By means of the Digital Terrain Model module spatial triangulation terrain model is created with coordinate points automatically, which can be analyzed and visualized by appropriate means. To clarify the type of terrain satellite images of Google Earth and panoramic shooting of the area are used. On the terrain model designed building is located and work on models of environmental elements in Allplan CAD continues. Geodesy Module provides the main functions to designer for spatial planning and urban development. It is creating plans of areas use or building plans. The module allows o calculate such important indicators as ratios floor space, land area, building volume and create a model of the surrounding area of 3D buildings of various types [10].

The Landscaping Planning module is used for the design and planning of plot with green plantations, walkways and landscape objects. This module endues an opportunity to create green space plans with automatic creation of explications and plant funds. The nodule is supplemented with seedlings catalogs and special signs. At the end of work a student has to assess the accuracy of he conducted computer simulation.

Summary. Computer simulation of the landscape at the final stage of project development during "Computer technologies in architectural design" (10 semester 5th year) study and during qualification design project with Allplan CAD will aid future architects to increase the effectiveness of design, to observe the future real project and to implement the idea and concept. Complementing and extending information educational environment with cloud technologies will enable students to become demanded specialists in the labor market.

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Компьютерное моделирование при подготовке будущих архитекторов

И. В. Бирилло, Л. В. Осипа, О. Ю. Костюченко

Аннотация: В статье рассматриваются вопросы использования программных средств для компьютерного моделирования ландшафта в профессиональной подготовке будущих архитекторов в университете. Компьютерное моделирование на конечном этапе разработки проекта при изучении дисциплины «Компьютерные технологии в архитектурном проектировании» и во время дипломного проектирования в САПР Allplan поможет будущим архитекторам повысить эффективность проектирования, воплотить идею и концепцию, стать конкурентоспособными специалистами.

Ключевые слова: *компьютерное моделирование, ландшафт, подготовка будущих архитекторов.*