3D Urban Landscape Visualization

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1 Introduction

Present time features rapid advancements in information technologies, which are used to communicate architectural design projects. Most of users are primarily interested in models of buildings, terrain, vegetation, and traffic networks. A European Organization for Experimental Photogrammetric Research survey on city models showed that 95 % of participants were most interested in 3D building data. Computer technology, computer graphics, and computer-aided design (CAD) now offer powerful tools for creating and visualizing digital models of cities. Manual measurement and entry are impractical; so researchers use various sensors to acquire accurate data for 3D urban landscapes. They then integrate the resulting 3D building models into spatial databases and geographic information systems (GIS) to support urban planning and analysis applications. The complexity of application demands and technology challenges make urban modelling an intensive research area.

The investigation is aimed at the evaluation and introduction of affective 3D visualization and communication media using concurrent engineering approach in architectural education process at the Riga Technical University. The innovations in architectural design practice in Latvia will facilitate the increase of design quality and productivity considerably. Our review examines existing modern software tools, which enable to solve the tasks of 3D city modelling. In addition paper reviews the recent history of urban landscape visualization technologies and software techniques, outlines some of the issues for representation of the urban landscape elements, as they may be visualized using GIS software.

2 Digital Urban Landscape Visualization

Digital landscape visualization has a relatively short history in the context of other forms of landscape representation – arguably, the first efforts were in the 1960's. The development of CAD and computer graphics in general also started at that time, but the majority of those early efforts were focused on the representation and visualization of objects, such as gears, airplanes, and etc. A specific concern for the urban landscape was present early on in the development of flight simulation software, and it was during the formative early years of GIS development that visualization of terrain, for example, became a subject of study and development, and grid meshes and TINs, among other useful techniques, were invented.

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For the next twenty or so years, terrain representation and visualization was predominantly the purview of 'GIS'-style software, with some minor efforts in civil-engineering or computer aided architectural design software. Today, 40 years later, landscape visualization has entered mainstream efforts in professional fields such as architecture, landscape architecture, civil engineering and Hollywood movie-effects, and is now enabled by many CAD and animation/rendering systems, as well as GIS and remote-sensing software. In all of these and other efforts, recent developments in computer science and computer graphics have made breathtaking and eye-tricking effects possible. CAD, GIS, image processing and even digital video technologies and techniques have blurred together into a powerful combined system for creating digital urban landscape visualizations.

3 3D Urban Landscape Visualisation software

Imagery is far more than pictures of the earth's surface. It is a valuable source of data that captures actual events at specific times and places in the world so that you can study how the earth changes over time. ERDAS IMAGINE by Leica Geosystems gives the tools to manipulate and understand this data. ERDAS IMAGINE is a broad collection of software tools designed specifically to process imagery. It allows extracting data from images like a seasoned professional, regardless of experience or education. ERDAS IMAGINE introduces enterprise-enabled geospatial imaging processing. A relational database provides enormous benefit by enabling end-user visibility into the data it contains and increasing the accessibility of the data. This maximizes the investment in image and feature geospatial information. The three modules providing enterprise capabilities are IMAGINE Essentials, IMAGINE Enterprise Loader and IMAGINE Enterprise Editor.

The first tier of the ERDAS IMAGINE suite, IMAGINE Essentials, offers the basic tools for image mapping, visualization, enhancement and geocorrection. It is a powerful, low-cost image mapping and visualization tool that allows combining different types of geographic data with imagery and organizing it efficiently for projects. At the mid-level tier of the ERDAS IMAGINE suite, IMAGINE Advantage builds upon the capabilities of IMAGINE Essentials to offer more advanced and precise mapping and image processing capabilities. IMAGINE Professional, the highest tier of the ERDAS IMAGINE suite, provides a comprehensive set of tools for advanced geographic imaging, remote sensing and GIS professionals. IMAGINE Professional builds on all of the capabilities of IMAGINE Essentials and IMAGINE Advantage with advanced modelling and analysis features. The add-on modules for ERDAS IMAGINE can be grouped into convenient product tiers, with each tier offering your organization a specific level of flexibility to more

accurately meet your needs and requirements. Add-on modules: ATCOR is atmospheric correction and haze removal software used to correct changes in the spectral reflectance of materials on the earth's surface. The IMAGINE Vector module allows you to import and export vector data, and clean and build topologically within an ESRI Arc structured format, without conversion. IMAGINE Radar Interpreter provides the fundamental tools needed to process and enhance SAR images. Because it is data source independent, it allows you to work with any SAR imagery. IMAGINE VirtualGIS is a powerful yet easy-to-use visual analysis tool that offers GIS functions and capabilities in a 3D environment. Beyond simple 3D renderings and basic fly-troughs, it allows creating accurate 3D interpretations of projects for interactive presentations. The IMAGINE Subpixel Classifier is a multispectral imagery exploitation tool which detects materials that occupy less than 100% of a pixel and provides an estimate of the amount of material present. The IMAGINE Developers' Toolkit consists of a set of libraries and documentation that allow you to customize and extend ERDAS IMAGINE. Stereo Analyst is a 3D model generation, interpretation, measurement and visualization tool, which uses stereo imagery to derive 3D information. It is used to create 3D models that are output to IMAGINE VirtualGIS for presentation.

ArcGIS by ESRI is an integrated collection of GIS software products for building a complete GIS. There are four products; each adds a higher level of functionality. ArcReader is a free viewer for maps authored using the other ArcGIS Desktop products. It can view and print all maps and data types. It also has some simple tools to explore and query maps. ArcView provides extensive mapping, data use, and analysis along with simple editing and geoprocessing capabilities. Arc Editor includes advanced editing for shape files and geodatabases in addition to the full functionality of ArcView. ArcInfo is the full function, flagship GIS desktop. It extends the functionality of both ArcView and ArcEditor with advanced geoprocessing. It also includes the legacy applications for ArcInfo Workstation.

Using optional extensions with ArcGIS Desktop products allows you to perform extended tasks such as raster geoprocessing and three-dimensional analysis. Unless noted, extensions can be used with ArcView, ArcEditor and ArcInfo. ArcGIS 3D Analyst allows effectively visualizing and analyzing surface data. Using ArcGIS 3D Analyst, can view a surface from multiple viewpoints, query a surface, determine what is visible from a chosen location on a surface, create a realistic perspective image that drapes raster and vector data over a surface, and record or perform three-dimensional navigation. The ArcGlobe application in ArcGIS 3D Analyst allows managing and visualizing, from a local or global perspective, extremely large sets of three-dimensional geographic data. ArcGlobe provides the capability to seamlessly interact with any geographic information as data layers on 3D globe.

ArcGIS Geostatistical Analyst is an extension to ArcGIS Desktop (ArcInfo, ArcEditor, and ArcView) that provides a variety of tools for spatial data exploration, identification of data anomalies, optimum prediction, evaluation of prediction uncertainty, and surface creation. ArcGIS Network Analyst is a powerful extension that provides network-based spatial analysis including routing, travel directions, closest facility, and service area analysis. ArcGIS Schematics enables users to generate, visualize, and manipulate diagrams from data in a geodatabase. Using ArcGIS Spatial Analyst, can derive new information from your existing data, analyze spatial relationships, and build spatial models integrating core ArcGIS Desktop and ArcGIS Spatial Analyst tools. ArcGIS Survey Analyst is an extension to the ArcGIS family of desktop products that allows you to manage survey data in a geodatabase and display survey measurements and observations on a map. ArcGIS Data Interoperability enables ArcGIS Desktop users to easily use and distribute data in many formats. ArcGIS Publisher delivers the capability to easily share and distribute your maps and GIS data. ArcScan for ArcGIS provides a comprehensive, efficient, and easy-to-use set of tools for raster-to-vector conversion. Maplex for ArcGIS is an automated high-quality cartographic text placement and labelling extension for ArcGIS Desktop.

Autodesk Maya, 3D Studio Max, software are the world's most powerfully integrated 3D modelling, animation, effects and rendering solution. Autodesk Maya combines an industry-leading suite of 3D visual effects with computer graphics and character animation tools, enables to realize creative vision for design projects. 3D Studio Max is a professional 3D animation rendering and modelling software package used mostly by game developers, design visualization specialists. Learn tips to create rich, complex design virtualizations or 3D film effects. Autodesk Envision software is an ideal tool for professionals involved in mapping, planning, surveying, civil engineering, and facilities/infrastructure management projects. Autodesk’s latest technologies-, including Autodesk Envision, allow the user to create, share, and manage mapping and design data throughout the project lifecycle. The application works stand-alone on a Laptop PC, a desktop computer, or over the Internet, and is included in both the Autodesk Civil Series and Autodesk Map Series.

Mapper3D - represents means of three-dimensional visualization of the spatial information. Mapper3D it is built in MapInfo Professional and creates the own menu and the panel of tools.

4 Conclusions

The challenges of urban landscape visualization arise in part from the sheer complexity of landscapes – in size, in curviness, in fractal dimension, and so on. Some of the problems come from the need to integrate several different sources of material, or techniques. But to the extent that these challenges can be overcome by ever faster computers, larger disks, cheaper RAM, better software and more clever algorithms.

The considered software is useful modern tool in the field of planning, construction and representations of city landscapes. It is necessary to note, that the given software are means for tasks decisions elaborated under specific problems of the developers of the software given. Separate decisions are necessary for use of the given products for the decision of other problems and furthermore integration with software of other developers for creation of 3D city models.

In spite of the fact that all programs themselves are commercial products, which should be evaluated for their practical availability, it is necessary to solve a problem of more general level. This problem is the software tools integration into general process of planning, construction and representation of city landscapes.

Integration of various products in general 3D visualization of city planning is an important educational and applied problem. Master and doctoral students will be involved in research activities.