CONCEPTION OF URBAN SPACE – SIMULATORS SUPPORTING PLANNING WORK

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Resumen:

La experimentación con el espacio, la búsqueda de soluciones en combinación con una anticipación sin riesgos del futuro son las más importantes funciones de una simulación urbanística. Estas funciones facilitan la concepción, la toma de decisiones y la comunicación en el proceso de planeación. En cuestiones relativas a la concepción del espacio urbano, como modelar el volumen y la forma de la ciudad y mejorar el ajuste del espacio (“fit”) y la funcionalidad en el uso (“fitness for use”) es necesario contar con simuladores adecuados como apoyo a la planificación. Esto sirve para apoyar todas las fases de los procesos de planeación de espacios urbanos: crear conciencia sobre la percepción y aceptación de los espacios, desarrollo y definición de sus características, definición de las prioridades en el mantenimiento o renovación, elaboración de variantes, análisis de efectos y consecuencias – en términos de espacio - en la visualización de espacios así como para su presentación, de forma accesible y comprensible, como base para la toma de decisiones. Este trabajo presenta los posibles usos de CAVE (un sistema que permite ver las imágenes en tres dimensiones y en tiempo real) como instrumento de planeación. Se han considerado los siguientes puntos: el aspecto cualitativo y cuantitativo en la modelación de espacios urbanos, la consideración y previsión de los cambios dinámicos del espacio urbano, las ventajas de diferentes “levels of detail” (LOD`s) en la fase de planificación, la navegación en espacios urbanos y la interacción con ellos, empleo del programa tomando en cuenta las exigencias prácticas del proceso de planificación, la presentación de las necesidades actuales en la investigación y el desarrollo.

Abstract

Experimenting with “space”, joint exploring solution possibilities with all those concerned and the anticipation of the future involving as little risks as possible are important functions of space-related simulation contributing to increasing of knowledge, decision-finding and communication throughout the planning process. Questions as to conception of urban space, the modeling of urban volume and urban design, the improvement of spatial match (“fit”) and workability regarding utilization (”fitness for use”) call for suited simulators supporting planning work. All planning phases of urban-spatial planning processes are to benefit thereby: understanding is promoted, spatial characteristics developed, preservation- and renewal priorities are deduced, variants are conceived, spatial impact analysis of spatial ideas and graphic communication are to act as basis for decision-finding. The present contribution also discusses the application possibilities of the “CAVE” (space with three-dimensional image projections) as planning tool. The following questions are to be covered: qualitative and quantitative aspects of modeling of urban space, planning benefits arising from differing “levels of details” (LOD’s), “navigation in” and “interaction with urban spaces”, testing in line with requirements and examples of planning practice as well as current research- and development needs.

1. Planning Work & Simulators

Simulation-assisted experimenting with urban space is to be regarded as an essential contribution for the configuration of our vital space. The experimental handling of elements and relations of urban space assisted by simulators makes for a increased awareness regarding the characteristics of spaces for future planning including definition of maintenance priorities as well as alteration possibilities (development potentials). Playful development of spatial ideas ensures adequate suitability of the stock and projects (“fit”) and issues a contribution as to improved usability of spatial resources (“fitness for use”). The “building-up- and urban volume” acts as central parameter regarding experimentation within urban space. In the long run the building-up volume acts as the defined three-dimensional scope of reference and action regarding constructional-spatial development, specifying the interaction between material three-dimensional elements and free areas throughout the settled area.

Space-related model creation and simulation are the vehicles of planning work – whether used consciously or unconsciously, regardless if high-tech or in simple words and pictures. Activities resulting from planning ideas cannot be done away with without effort and thus are “one-shot”-operations. In the run-up to concrete activities model generation and simulation add to optimizing planning considerations and to a reduction of risks.

A number of approaches for the further development of urban-space-related simulators are to illustrate the scope of the research area and research requirements:

Establishing virtual city models ("**Digital Cities**", cf. Bourdakis, 2001, Voigt&Linzer, 1999) has become an important planning tool for configuring the future of our cities and vital spaces. The constant changing of physical space represents a considerable factor concerning the conception of the virtual image (virtual city model). The dynamics of space suggests the development of "data-pipelines" as core elements of virtual city models (the term "data-pipeline" stands for the procedural flow of the space- and time-related data of various sources); The "digital city" (in its broadest meaning) is used today in order to best-possibly devise and define the real city of tomorrow.

"**Space-related Content-Management-Systems, SCMS**" are considered as navigation systems through complex space-related data-sets (including all kinds of space-related information based on GIS, enriched with metainformation that might be useful during the planning- and configuration process) supporting a broad range of questions during the planning- and configuration process.

"**City Experimental Labs, CEL**" (cf. Voigt et al., 2000) could and should act as "expert system" in the preliminary stages of decision-finding, making available all particulars regarding decisions to the politicians, the planning administration, outside advisors and particularly to the citizens concerned in the suited present-day manner.

2. Performance Specifications for Experimenting with Urban Space

If we aim at enhancing "simulators" for experimenting with urban space the following aspects (amongst others) are to be accounted for:

qualitative and quantitative aspects of modeling of urban space (setting-up of multi-functionally useable space databases containing geoinformation for spatial analyses, 3D-data for the generation of 3D-city models, supporting the entire planning process)

"**navigation in**" and "**interaction with urban spaces**" (free choice of viewing points by the user, "moving" in space, i.e. digital drives and digital camera rides, resp.) in real time; modification of the digital model (by moving, shifting, rotating, scaling, texturing etc. of digital objects)

planning benefits arising from differing "**levels of details**" (LODs) - testing in line with requirements and examples of planning practice

The following table "**Experimenting with Urban Space**" acts as thematic framework ("performance specifications") for functions to be supported by means of simulators: The enumerated scope of topics, however incomplete, shows a great variety, calling for priorities concerning technical implementation:

Urban configuration: checking spatial impact and value of individual experience

volumes, silhouettes, space profiles, proportions, public spaces, squares and streets, relation of "positive- and negative space", sequence of public spaces, distant and close-up impacts of urban space dominants ("landmarks"), large-scale projects, constructional-infrastructural single projects, etc..

Grouping, shaping and structuring of building volumes

spatial organization, spatial densification, variants of mass distribution, height development, adding and grouping in the context of building-up structure models, shifting of single objects, object groups or entire models, rotation, scaling of models in all axes of space, "deformation" and "morphing" etc.

Arrangement and distribution of building volumes in a defined framework

e.g. defined by: urban-constructional characteristic values, maximum building height, specifications regarding incidence of light and distances, topography, solar supply, city climate, aerodynamic conditions, noise pollution, infrastructure equipment, population density, etc.

Variations of the individual objects or of object groups in the constructional-spatial context

characteristics of space, dialogue situation, confrontation situation, building-up of building gaps, solitary object, urban-spatial problem- and conflict situation, positioning of the building (in the street area), roofscape, variation of eave and gable positions, texturing and structuring of facades, color, development of variants and determining alternatives etc.

Changes concerning existing stock

supplementation of stock, demolition of single objects, deconcentration of interior courtyards, large-scale demolition

Urban-spatial detail questions

planting, configuration of surfaces, city furnishing, art within public space, sign posting (e.g. visibility and legibility in different viewing situations), poster application, path tracking, lighting, etc..

Temporary space installations

temporary facades (posters, scaffolding) festivals, various installations in space, etc.

Interaction of space-structures

building-up structure and traffic organization and/or traffic load; building-up structure, population structure and social infrastructure, capacity utilization; building-up structure and technical infrastructure (supply and disposal), supply demand; building-up structure and city ecology, city climate; building-up structure and social space, public space, usability; building-up structure and investment volume, follow-up expenses, repair cycles; noise pollution due to constructive and traffic measures; energy requirements and efficiency of resources of building-up structures etc..

3. Digital Working Environments (Digital Workbenches)

Realization of the enumerated simulations depends on the working environments at the users disposal.

The classical anonymous user mostly does not dispose of the suited special tools (software) or. special hardware systems. Requirements usually are described as "standard web browser", internet access, laptop and. "average PC-system" . The functionalities mainly are limited to viewing, observing, navigation, and interaction.

the official in charge disposes of a part of the required special software for managing the data concerned. Only special questions and requirements are solved in special environments. His workstation is "modern". Data processing is performed at his local workstation...

Special environments are used for processes of decision finding. The workgroups joining in such processes mostly come from different specialized fields. The tools offer functionalities (see above) ensuring quick availability of variants, versions and limited alterations as well as sufficient metainformation.

Two special environments, i.e. CAVE, a Virtual Reality-Environment and Personal Displays, an Augmented-Reality-Environment are described below.

3.1. CAVE

"CAVE´s" principally lend themselves as suited simulators for urban space to be adapted accordingly in line with the above mentioned topics. CAVE is a walk-through cubical space, the walls, ceilings and floors of which can be used for video-projections. The pictures displayed are 3D-realtime renderings from a virtual model from the viewing perspective of a viewer situated in the location. By means of tracking sensors the viewer's position is determined by the computer, thus configuring constantly changing pictures. The user therefore is of the impression of moving within a virtual model. A 3D-joystick enables the user to interact in the surrounding scenario. CAVE´s have the advantage that several persons can see the same picture (perspective) simultaneously and thus can discuss this picture. Any position (navigation) and every size (scaling, ranging from viewing an entire city model to walking-through a microscopic element) can be chosen interactively. The viewer has the impression of standing in the model.

Fig 1 – "CAVE" (concept)

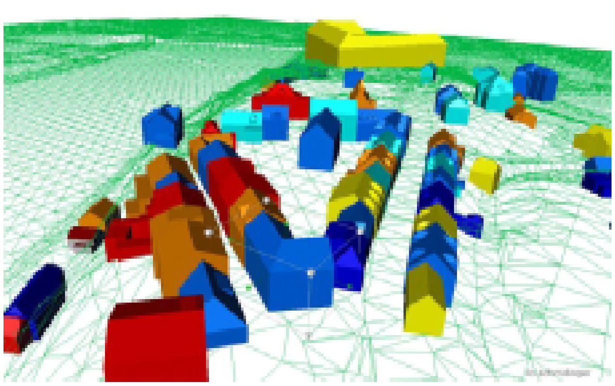

Fig 2 – Digital working environment (variation of building volumens)

3.2. Personal Display (Microvision)

The term Personal Display is used by Microvision. A number of terms for systems projecting the user information via laser to the retina exist. Personal Displays issue information to the user allocated to a real object. The virtual models serve as basis for the geometric disposal of information. A part of the above mentioned functionalities can be provided by means of Personal Display.

4. The Data

The main prerequisite for the utilization of such systems is a structured, standardized and flexible form of processing and availability of data. The following factors are to be accounted for:

4.1. Type of data

Following information is to be issued in the simulation databases:
text: text-based information, information from existing systems and data bases
2D-geometry (points, lines, polygons): information from available GIS-Systems, information to be gathered
3D-geometry: information from differing data sources: CAD, GIS, 3D-Scanner, etc.
simulation data: information from GIS and/or simulation tools
voxel data: 3D-volume data (water, geological layers, clouds, etc.)
pictures: picture materials as individual object-attributes for other objects
sound, video: sound- and video material as own objects or attributes for other objects

4.2. Dimensions

The main dimensions featured are time, variants and level of detail (LOD). The objects are linked in the described form with the dimension "time" thus delivering meaningful analyses. The time units range from seconds to millions of years in intervals according to application and simulation and calling for constant up-dating. The dimension "variants" is a major prerequisite for simulations in combination with time. Variants also are used in terms of different building variants. "Level of detail" not only offers basic functions for visualizing complex data sets, but also supports the handling of differing model scales and compiling processes.

4.3. Origin of data (data sources)

There are differing compiling and up-dating processes for the differing data. The data groups are to be configured according to these workflows and their data origin.

4.4. Existing data / systems

Simulation systems are flexible and open-ended systems closely connected to the available systems (GIS, Databases, etc.), having access to data of existing systems and also providing data. The central function of the simulation system is the concrete generation of models based on the called-up data as well as the processing of data for simulation in the mentioned environments.

Summary

Concluding the following statement could be characteristic for further developments of simulators for urban space regarding research work:

Those possibilities are to be enhanced which turn the present city configuration into a virtual experience by integrating visions, utopias and the future developments.

Here the story of “Eudossia” in the marvelous book ***“Le città invisibili - The Invisible Cities”*** by Italo Calvino may add some more valuable contributions:

Fig 3 –Eudossia“ (free according to Italo Calvino)

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