

A Working Session on 3-D City Modeling

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On the occasion of a presentation on a city model for Graz at the eCAADe-conference in Weimar (2000), some attendees informed us about their previous work in this field and the idea of preparing a working session with colleagues involved in 3-D city modeling was born. During the initial phase of research for this eCAADe conference activity it turned out that a large number of city models has been created in the course of time for different reasons resp. purposes. Therefore a rich variety in the production of city models can be noticed. This working session on 3-D city modeling brings together experts focusing on different aspects concerning the creation and use of city models, such as data input, data structure, data storage and data quality. Also the definition of a perspective on the future of 3-D city modeling can be regarded as an important topic. In this paper a rough overview on the different submissions will be presented. Furthermore three blitz statements are incorporated as time was too short to produce a full paper. Both with the individual contributions as with this overview paper it is intended to present a knowledge-base to this working field. Finally, the start for a growing bibliography was made in order to support future work in this area.

Keywords: *Urban Modeling; 3-D Modeling; Collaboration, City Information, Model Adaptation*

City Modeling: Built to Last or Data Production for Digital Shelves?

Urban models are created for very different reasons and also in many different ways as well as a variety of details. They are used for commercial, educational and/or municipal purposes. It can easily be understood that a standard procedure “how to produce a city model” does not exist. But on the other hand the accompanying difficulties and barriers in creating and using city models seem to be quite universal. To be effective in the field of city modeling a fruitful exchange

of knowledge is essential, which can e.g. be realized by means of establishing working contacts with experts involved in this area of research. A working session like this one on the occasion of the Annual eCAADe-conference can serve indefinitely as a forum for discussion on central topics, such as the production, the practical use and the storage of 3-D city models. This may possibly lead in the (near) future to the establishment of a guiding source book on standards for the creation of 3-D city models (see the contribution from V. Bourdakis).

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After successfully setting up a city model (which – like a real city – is never finished) for a specific task the question remains how to use these models in the future. How can e.g. “digital dust” be kept away from these models and make them play an active role in supporting the life in real cities. There are several options for keeping city models available nowadays. In the framework of the Internet information systems can help keeping models “alive” (Maver et.al., Kos). Educational needs and the demands of planning departments (Dokonal et.al., Holmgren et.al, Knight et.al. and Pietsch et.al.) can furthermore establish new possibilities for urban analysis. Innovative ideas like “City Experimental Labs” (Voigt) or Labs for Morphological Analysis of Spatial Volumes (Dave) may offer new possibilities for the use of such 3-D city models. The papers presented in this session are dealing with the following cities:

- Adelaide (Australia) - Making and Using a City Model
- Copenhagen (Denmark) - The 3D-City Model, A New Public Space
- Glasgow (Scotland) - Visit VRGlasgow
- Graz (Austria) - On the Borderline - Building a City Model with Students
- Rio de Janeiro (Brasil) - Modeling the City History

A discussion may focus on a broad range of theoretical as well as practical aspects, such as the question: “How to manage a 3-D city model from the very beginning and how to sustain”. But also the challenge to keep the information up-to-date, i.e. keeping the accumulated data suitable or better adaptable for tasks not to be anticipated at the initial moment of creation.

Statement 1: Large-scale modeling: where do we go from here? [Dave]

Similar to many other research groups, we have developed and worked with 3-D models of varying details, scale and complexity:

- Avenches: Working with a team of photogrammetrists, a digital 3-D model of Avenches, a historic Roman settlement in north-

west Switzerland was developed. It was subsequently used to develop a shell for linking multimedia data with 3D model based information.

- Melbourne CBD: Part of the CBD model originally developed by a local architectural firm was used in a networked design studio.
- University Campus: Based on aerial photogrammetric survey, a detailed model is under development in Collaboratory for Architectural and Environmental Visualization (CAEV) at University of Melbourne.
- A number of other 3D models of urban and landscape environments are also under experimentation and development in CAEV (2000).

Our experiences in developing and using the above models are quite similar to experiences of many other research groups. Some of the pressing problems often mentioned in these projects include developing metadata or organizational principles for collating 3-D information, (semi-) automated procedures for data acquisition, developing real-time techniques for data access using levels of details, degree of visual fidelity and geometric accuracy, and navigation techniques. All these issues are significant from implementation and developmental perspectives.

Major aims that originally drove our projects (and many other projects) are to document a spatial setting, appreciate its temporal (e.g. historical) dimension or to use it as a spatial context to evaluate appropriateness of new design projects possibly in an immersive or full-scale projection environment.

Lately, we are exploring a different direction in these projects by asking what new insights can one gain by use of these models? This reorientation of our work is informed by the realization that increasing computing power and faster memories at falling prices will render many current questions and problems in large-scale modeling non-issues. It is also informed by a need to ensure that benefits derived from use of models are greater than the effort invested in developing them. As one possible answer in this direction, we are considering (semi)automated

morphological analysis of spatial volumes that may offer new insights into the structure of spatial environments.

For further information: [CAEV 2000] Collaboratory for Architectural and Environmental Visualization, Faculty of Architecture, Building & Planning, University of Melbourne. <http://www.arbld.unimelb.edu.au/~bdave/caev/home.htm>

Statement 2: Liverpool City Model [Brown/Knight]

The Liverpool city model has been sporadically developed for a number of years in parallel with our work on interface design for virtual environments. The original intention was for the model to be used both by students and by local practices to aid in the development of designs, but with the creation of a 'real-time' model by a commercial enterprise (outside the University), our focus has shifted to the creation of a web accessible resource. We have used our experience in the creation of both the embryonic city models and other large scale urban models to determine different levels of detail required for both recognisability and visual orientation, whilst retaining small enough file sizes for web access.

The first stage in this is the a virtual campus tour for our university using the 3D model as a base. Through a variety of media, this is converted into a Macromedia Flash 'pseudo' 3D tour. The prototype has been well received by the University and work progresses on the final version.

The second stage is a series of architectural walking tours for the Liverpool Architectural Society. These will highlight individual buildings of architectural interest in Liverpool, will follow the format (but not design) of the campus tours and be web accessible over a 'typical' telephone based web access.

We have for a number of years used students for the creation of the model with the predictable results of lack of accuracy, non-adherence to standards and other miscellaneous inaccuracies. This mirrors the experiences of other city modellers such as Graz.

For further information: CAAD Research Unit (School of Architecture and Building Engineering) - <http://www.liv.ac.uk/abe/caadru>

Statement 3: The Digital City as City Experimental Lab [Voigt]

Configuration of the urban space and its space sections is significantly influenced by the securing and further development of the city and building-up volume. 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. The digital city - in its broadest term - is to be used, in order to design and develop the real city of tomorrow in the optimum way and manner. Digital cities may be regarded as working models for the city of the future, for further development of the city and building-up volume. In dealing with present-day and future problem situations of spatial planning space-related analysis and synthesis processes are called for. They make for the efficient recording, aggregated representation and interlacing of the essential space-related stock data as well as for the development of frame conditions and objectives referring to space and moreover, for the representation and conveyance of planning variants. Regarding usefulness and implementations of digitally assisted space-related simulation environments the following requirements are being increasingly demanded:

- "Electronic Sketching": Integration of the computer at earlier stages of the spatial planning processes or the architectural planning process;
- "Spatial Interaction": Increased interaction with information and planning assistance systems: e.g. by navigation in digital city models in real time; spatial interaction / modification-possibilities of the digital model (e.g. by moving, shifting, rotating, scaling, texturing of objects);
- pnf3VR-simulation environments: New designing of user-interfaces, overcoming the "obstacle"

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monitor (e.g. by utilizing the VR-environment CAVE).

In combining the above mentioned a present-day challenge for the scope digital cities” can be specified by means of setting up and operating a City Experimental Lab (CEL), e.g. for work sessions of planning- or design councils, expert hearings etc. and for the continuous information of citizens on present planning work at the various degrees of concreteness and commitment, etc. Such a lab could and should act as an *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. Thus those possibilities are to be enhanced which turn the present city configuration into a virtual experience by integrating visions, utopias and the future developments.

Selected project references:

- “Digital City Vienna – Pilotproject” (area around UNO-City, Wagramer Straße, Vienna, Austria): By means of a digital, three-dimensional work-as-executed model the urban-spatial development possibilities in variants can be subjected to a spatial discussion throughout workshops making interactive use of a high-speed graphic computer.
- “New Approaches to Building-up Planning” (Neue Wege in der Bebauungsplanung, Linz, Upper Austria): The main goal of building-up planning is the advancement of the building-up plan (regulation plan) from a restraint-(regulatory) plan to a designing plan for public space. The transformation of the “New Approaches to Building-up Planning” was achieved in a three-dimensional, digital manner based on specific projects of the capital Linz.

For further information:

<http://www.ifoer.tuwien.ac.at>

Outlook

It is hoped that this working session on 3-D City modeling delivers a base to improve the exchange of experiences made by people involved in this field. Although the hard- and software-technology implemented in this area is rapidly developing, there is doubtlessly a demand for continuing research. In order to support the dissemination of already available information, a first collection of links as well as a bibliography on 3-D city modeling is incorporated at the end of this paper. For a first start the citations are displayed by the year of publication. We would like to encourage the readers to inform us about missing listings. It is also intended to record this in the near future in CUMINCAD (<http://itc.fgg.uni-lj.si/cumincad/>).

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Collections of Links

<http://homepage.mac.com/dbrady1/URBAN3.HTML>
http://www.agr.uni-rostock.de/gg/cebit_e/grundlagen/grnd_projekte_e.html
<http://www.bath.ac.uk/Centres/CASA/bathmodl.htm>
<http://www.casa.ucl.ac.uk/3dcities>
<http://www.casa.ucl.ac.uk/sprawl/>
<http://www.digcity.tuGRAZ.at>
<http://www.equator.ac.uk>
<http://www.fau.ufrj.br/prourb/cidades/vsmm99/index-i.htm>
<http://www.gisca.adelaide.edu.au/gisca/pd/am.html>
<http://www.i3.com/products/CityModels/citymodels.htm>
http://www.i3mainz.fh-mainz.de/projekte/e_stadtmodelle.html
<http://www.rtzvirtual.es/rtz/PLAZA/Ingles/PlazaReal.html>
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