

# Theoretical Perspectives For The Development Of 3D City Models In Architectural Education

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*Abstract.* This paper continues the discourse of the round table session of eCAADe 2002 on the problems of existing digital city models. It reviews recent papers on the subject, suggests criteria for the improvement of digital city models, and points out some applications for a broader base of users, and particularly in the field of architectural education. It is suggested here that the design professions of architecture and urban design should be more comprehensively included by broadening the approach to 3dcms. Changes in contemporary architectural, urban planning and design theory, collaborative design practice and constructivist education, lead us to suggest a change of emphasis from 2D urban planning principles to those of 3D urban design and morphology.

*Keywords.* 3D City Models; architectural education; urban identity.

## Background

In a round table session on 3dcms in Warsaw (Dokonal and Martens, 2002), it was among other things asked which professions are involved in the creation and the use of such models? Apart from surveyors and planners largely responsible for the “number of disappointing pilots”, it is suggested here that the design professions of architecture and urban design should be more comprehensively included by broadening the approach to 3dcms.

Andreas Voigt et al propose automatically generated city models to solve the three chief difficulties concerning complex 3D-models; namely, the reduction of the complexity of geometry; the administration of complex models in a structured way; and the interactive representation of the models. They suggest the development of “data-pipelines” as core elements of virtual city models, (Voigt et al., 2002). However, it is rather doubtful that design professionals in general will be direct-

ly concerned with data input, structure and storage.

In a related article, the quality of three-dimensional public and urban space as “experience space” for its inhabitants is discussed: “the architectural object and its relation to the public space is the sensitive joint to be keenly observed with regard to configuration (of 3D city models)” (Voigt, 2001). It is these issues of experience in relation to urban design and 3D city models (3dcms) that will be dealt with in what follows.

### Urban planning and urban design

In a comparison between urban planning and urban design, Thomas makes distinctions as

Town planning	Urban design
2-dimensional	3-dimensional
land use	Space
categories	Specificity
abstract	Tactile
regulation	Creation
social science	Humanities

Table 1: Differences between Town Planning and Urban Design (Thomas, 1999)

shown in Table 1.

The differences can be broadly summarised into two categories, the 'conceptual' category of planning, and the 'experiential' category of urban design.

Peter Bosselmann, has argued that conceptual and experiential representations depict two views of the world (Bosselmann, 1998). As a recent experiment has shown, 'experiential' representations are those that are closer to the lay public's experience and situated knowledge (Mullins et al., 2003).

Work in the development of digital city models to date has been largely constrained by conceptions of a virtual city as a matrix of quantifiable data, captured, mediated and used by specialists in the planning and survey professions. That view is challenged through theoretical approaches to the urban experience, with reference to recent research literature on the reality of simulated environments. The challenge is borne out through examples of current problems in the application of existing digital city models, their limited use by a broader population, and by the cynical view that they are good solutions awaiting a good problem.

Changes in contemporary architectural, urban planning and design theory, collaborative design practice and constructivist education, lead us to suggest a change of emphasis from 2D urban planning principles to those of 3D urban design and morphology.

### Examples and problems with 3dcms

The Aalborg city model has been in a continual process of creation since 1995 by the local municipality. It has been used in an international competition for a 'House of Music' on the city's harbour front. It was a requirement that competitors' proposals included an animation of their building placed in the 3dcm, so that the judges could get a better idea of how it would look in

local context. After the winning entry was announced (Co-op Himmelblau Architects – see fig.1), the animations were made widely available for stereoscopic viewing at a 2003 public exhibition in Copenhagen. This is an example of an innovative use of 3dcms, in which design was



*Figure 1: The House of Music designed by Coop Himmelblau in the context of the 3D city model of Aalborg*

directly related to the context of a virtual place, in a way that was widely understood.

The same 3dcm has recently been used in an experimental workshop by students at the Department of Architecture, Aalborg University. The intention here was to make the process of the city's development more visible and transparent to the general public (Havnefabrikken, 2003). From the submitted proposals and an analysis of the area's spatial and functional potential, a number of 'urban prototypes' were created by the project group, representing various elements of the city. These prototypes were placed on a 2D map by participants; the project group then imported a 3D computer model of the relevant prototype into the Aalborg 3dcm and projected the scene onto a wide-vision 'panorama' screen. The panorama screen gave participants the possibility of experiencing the prototype's spatial implications on the city. In this way, the negotiation became an exchange between the two dimensional map and the three dimensional city model. The debate was thus split into a discussion of function in relation to the two dimensional maps, and form in relation to the 3D city model.

In the above experiment, problems were

experienced in the perception by users of the 3dcms treatment of representation in relation to actual form. It will demand practise by users in achieving an understanding and cognition of the language and thus require a longer process to qualify a group of users of differing backgrounds in taking urban design decisions.

In contemporary urban planning and design, a collaborative process of co-ordination of changeable elements in the city proceeds towards a vision rooted in an evaluation of development strategies. This entails the definition of nodes in the urban fabric, that is to say places with the highest socio-spatial development potential, and the identification of the key coherence levels that interconnect them. An attempt to encourage emphasis on key development nodes using 3dcms entails another level of data structure, an additional 'level of experience' that could include representations of the following: physical dimensions in space representing motion; immaterial

dimensions in physically or virtually defined space; social dimensions in physical space; socio-spatial interactions in physical space.

As an example of efforts in this direction, a recent student exercise at Ljubljana is shown in figure2. This exercise attempts to develop a very simple context as a level of detail in a 3dcm through showing function in 3D and combining experiential (3d) and conceptual (2d) representation.



Figure 2 Student work in urban design elements at the Faculty of Architecture, University of Ljubljana. (B. Pungercic, P. Vidanoski, T. Ebenspanger; exercises prepared by F. Rihtar, T. Zupancic Strojani)

## Hypotheses

We propose a 'nine point ontology' for 3dcms, conceptualised as successful places for design creativity. The ontology attempts to reintegrate active participation in the city experience by paying particular attention to the process of identification in spatial environments, achieved through the following 'placeholders', or descriptors of place: (Strojan and Mullins, 2002).

**Type:** 3dcms are representations of place, a series and hierarchy of places, of both physical and virtual dimensions. Efforts should be made towards multiple, diverse typologies within this general type.

**Community:** Creation and/or enhancement of a community are an essential factor in establishing identity with urban place. Applying this to virtual place, representations of political, economical, cultural, architectural and social issues will be required.

**Participation:** Openness of communication between all the actors in urban design will become an important part of future building processes. This requires qualifying users to understand the spatial dimensions of various proposals within urban design. 3dcms hold the potential to be an exchange between user participation and professional design competence.

**Memory:** 3dcms have concentrated on the representation of historically accurate models, both ancient and modern. A problem however is that prior knowledge of an urban environment does not necessarily enable the grasp of abstract concepts often used in designing new forms and places. The virtual museum of Ljubljana (Festival Ljubljana, 2003) for example, works better in presenting historical development than the current situation.

**Definition:** As Yi-Fu Tuan has shown in his maze experiments, 'space' becomes 'place' in unfamiliar environments only when space

becomes a series of familiar landmarks and paths (Tuan, 1977). Way-finding is the means of acquiring knowledge and establishing a foothold in unbounded space. This entails knowing about the users and their tasks, generating hierarchies of tasks and objects to model the users' tasks, designing interface objects and actions that metaphorically map to the real urban environment.

**Perception:** Level of Detail (LOD) should include an experiential mode which simulates every day experience. The ambiguity between concrete form as experienced, and the abstraction of prototypes and models should be explicitly separated into levels or layers in a system of different contents and data structures.

**Discovery:** Identity of place is not a static phenomenon; it is continually changing in both individual and collective consciousness, just as it is in the city itself. A number of researchers have pointed out the advantages to legitimizing chance, intuition, instability, and ambiguity, in generating design. This suggests that 3dcms may reflect different views on the city by those users in a process of discovery, not necessarily replicating the physical city exactly.

**Use:** Use the 3dcm for play, recreation, amusement, and leisure as well as data retrieval tools. The use of 3dcms for the context of game-like use should be investigated more fully – little research is available in this regard. Precedents exist in the web based game of VVV (Wayne, 1997), and the use of as 'Quake II' attempted as a model of learning, collaboration and as a VR system (Richens and Trinder, 1999).

**Security:** A sense of ownership and responsibility for the preservation of place will be encouraged when the 3dcm enables the setting of goals, choosing of tasks, developing assessments and evaluating performance of buildings.

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