

The 3D-City Model – A New Space

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We have worked with the construction and use of 3D city models for about ten years. This work has given us valuable experience concerning model methodology. In addition to this collection of knowledge, our perception of the concept of city models has changed radically. In order to explain this shift in paradigms we begin by describing some of the concrete models we have made, showing the relationship between model structure (methodology and content) and model use.

We also describe the projects we are working on at present in order to illustrate new ideas concerning the potential development of 3D city models

Keywords: Digital 3D city model; urban regeneration; Participatory Design; On line Community

Ten years experience in the construction and use of digital 3D-city models

Proposal for congress hotel in Kalvebod Brygge, Copenhagen, 1993 (fig 1).

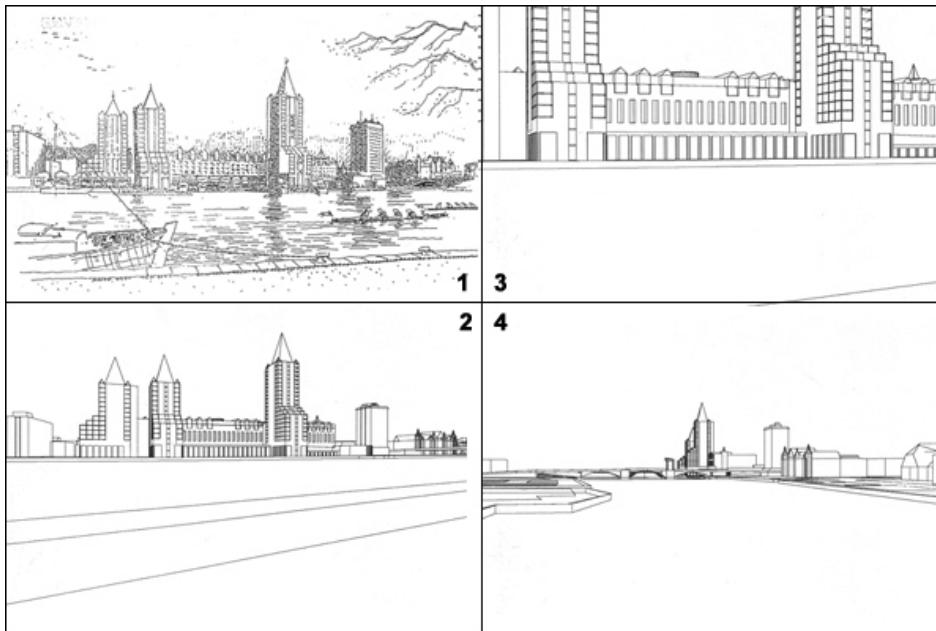


Figure1. 1. The illustration made by the architect. 2. The perspective of the model with the same viewpoint and a 11mm lens. 3 The same perspective but with a 50 mm lens. 4. The project seen from the harbour.

In the summer of 1993 a public hearing started about the construction of a congress hotel in Kalvebod Brygge along the Copenhagen waterfront. The material supplied by the City of Copenhagen was accompanied by an illustration of the project made by the architect who had designed the hotel: a perspective of the hotel seen from the other side of the harbour basin.

People who lived in buildings offering direct views of the proposed hotel protested against the project. Their criticism focused on the size of the hotel, and they claimed that the illustration was misleading. Using the same viewpoint as the one used in the architect's perspective, they made a photo montage, which gave a completely different impression of the project. The subsequent debate concerned the illustrations rather than the project's visual impact on the entire medieval city (and not only its impact on views from buildings on the other side of the harbour). In consultation with the City of Copenhagen we made a 3D model of the area where the hotel was to be located. The City requested the hotel architect to submit a digital 3D model of the project. The two models were then combined. Numerous perspectives from selected viewpoints were generated and publicised in major national newspapers (see for example article in the *Politiken* of Thursday 19 August 1993). By means of the model we were able to recreate the two illustrations; the architect's perspective and the residents' photo montage. We were thus able to demonstrate that neither of the illustrations was incorrect. However, the architect had used an extremely wide angle (similar to an 11 mm lens), and consequently the illustration should in fact be seen at a distance of 6 cm from the paper!

The decision to make and use a 3D city model was taken in the midst of a heated debate. In order to bring this debate further it was necessary to present results within a few days. It was therefore essential to create a reliable model in a very short period of time. In collaboration with a representative of an IT firm we managed to create the model in a few days, driven

by a true hacker spirit as described by Pekka Himanen.

The output was perspectives in the form of outline drawings (with concealed lines). The output was thus void of any rendering effects - as opposed to the architect's illustration.

The strength of the model was that it made it possible to generate as many perspectives as desired. By generating many perspectives showing a project from many sides you obtain a much more accurate impression of the size of the project and its architectural relationship with the surrounding cityscape.

The model was shown to the public at an open-house event at which people could have a perspective drawing from any viewpoint they wanted. Perspective drawings were handed out on transparent film, so that people could take them to the viewpoint chose, hold them up in the right direction and look through them at the right distance. It was a kind of 'augmented reality' - primitive but inexpensive and very effective.

Dissemination of @rchitecture via the Internet – Kongens Nytorv 1997

Whenever public authorities present projects and plans there are generally great differences between the presentations and the actual completed project. There have been several examples of misunderstandings based on such discrepancies in Copenhagen in recent years. Even politicians have been subject to such misunderstandings.

The possibility of presenting architecture by means of true 3D models on the Internet, instead of pictures of 3D models, opens up completely new perspectives for dissemination of information about projects to citizens.

The new opportunities are mainly a result of the possibility of presenting 3D models interactively. As opposed to pictures and videos in which the sequence of pictures is determined in advance, the Internet and VRML allow people to explore the projects as they please.

Go to contents 15

The purpose of this pilot project was to test the construction and use of digital three-dimensional models for the provision of information about architecture on the Internet. The main objective of the pilot project was to show and test this type of dissemination of information on the basis of a concrete example. We chose Kongens Nytorv because most people in Denmark know this central square in Copenhagen and would therefore find it easy to relate to the way in which we presented the square by means of digital 3D models and to the way in which we presented the models on the Internet.

In our presentation we paid great attention to illustrating the process of transformation: we showed future plans and compared them not only with present conditions but also with previous transformations of the square, the reason being that we consider cities to be living organisms. Consequently new projects must be seen as contributions to further development of the city.

The development of the Kongens Nytorv models (1750, 1997 and 2000?) including their design, functionality and interface to Internet dissemination systems has been the central element in our work with digital city models.

Our decision to use geometrically defined objects to illustrate buildings and the like rather than mapped images has been very important because it has enabled us to control how abstract or detailed we want models to be (LOD). These aspects were important in relation to comparisons of existing and non-existing situations and conditions. Moreover, our experiments with the design of presentations and navigation in an Internet browser opened up for completely new communication methods.

Urban architecture in urban regeneration, 1999

In connection with a research project (Danish Building and Urban Research) concerning the development of new methods for improved dialogue on urban architecture between specialists and laypeople, we prepared a 3D model of the district in which the various

methods formulated were tested (the Holmbladsgade district in Copenhagen).

Our digital model was not used directly but only as a basis for the preparation of analogue illustrations for panels, working documents and reports, one reason being that the research team was not very familiar with the opportunities offered by IT. Another reason was that the use of IT was not part of the original plan for the project. However, as the project progressed it turned out that the 3D model was the most important document. It was used to store all information provided by architects and residents about the special qualities of the district

The base data for the model was a digital map prepared by the City of Copenhagen. Photos were used to determine building heights and for modelling facades wherever necessary. Since we knew both the width of facades from the map and the building heights, it was relatively easy to convert photos into orthophotos that could be used for modelling the facades. Further data was processed and added on the illustrations, not on the model.

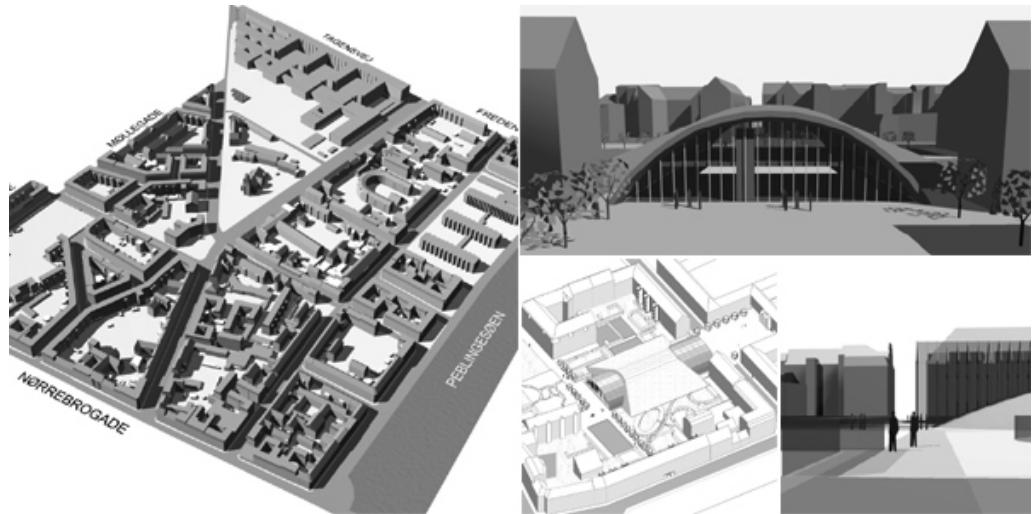
The experience gained in relation to this work triggered the idea of using the 3D city model for more than just a representation of the city's physical form. The model could also be developed into a new forum in which residents could express their points of view about the city, just as the model could be used to strengthen the social network of residents.

Inner Nørrebro district (fig 2)

The City of Copenhagen has run a pilot project for a number of years in which local district councils were established in five districts. The purpose of the project was to reduce the democratic distance between citizens and authorities and to use closer contact and more direct dialogue to ensure increased focus on social and ethnic problems in the districts in question.

As a result of the delegation of various functions to the local districts and the resulting increased focus on a flatter, less bureaucratic structure in relation to decision-making processes it became necessary to develop new methods for use in local government.

Figure2. Illustrations from the 3D digital model of Inner Nørrebro district showing a part of the model and illustrations from the project to a sport hall in the area.



Our digital model of the Inner Nørrebro district was very different from the model we had made in relation to the Kongens Nytorv project. Major parts of Copenhagen have for several years been reproduced in a model in scale 1:500. This 'mahogany model' is no longer updated, but when we were to determine the degree of detailing and the structure of our digital model, we used the mahogany model as our reference.

The colours and details of our digital model of the Inner Nørrebro district are to a great extent inspired by the wooden model of Copenhagen. Only brown, yellow and grey colours are used in the model, which means that details in the design of roofs, balconies and the like become very distinct and recognisable. The model is divided into four districts and comprises about 850 buildings.

The model is based on a digital map, data transferred from the 'mahogany model' and photo measuring.

The Inner Nørrebro district is built up in GIS, AutoCAD Land Development Desktop, and linked to

a database that provides access to various other types of information.

The digital model of the Inner Nørrebro district was used in three different projects and experiments. It was the first step in the development of a management tool for use in registration of undeveloped areas in the district, and it was subsequently used as a 'spatial city map' for localisation of places and for dissemination of information about individual experiments carried out in a project funded by the European Union, Eco-city, which looked at the sorting and recycling of waste.

Finally a small part of the model was prepared in greater detail in connection with debate concerning the location of a sports hall in a specific area.

The use of the spatial digital model resulted in positive response whenever it was applied. Although it is relatively abstract it makes it possible for people to understand contexts. However, our work also showed that it is important to be able to control technology on various levels and that it will take time to anchor the various methods applied in debate and cooperation.

The Electronic Neighbourhood, urban regeneration in the Outer Nørrebro South district

In relation to a new urban regeneration project in Outer Nørrebro South, an older part of Copenhagen, a research project about the use of IT “The Electronic Neighbourhood” is taking place.

The purpose of the method is to build an electronic neighbourhood in collaboration with the residents, professionals and public authorities. The Electronic Neighbourhood is meant to be a new public space where projects are presented, discussed, planned and followed up.

“The Electronic Neighbourhood” is a partnership project carried out by the School of Architecture and Danish Building and Urban Research in collaboration with the committee of the urban regeneration project Outer Nørrebro South, has been granted funds from the Ministry of Housing and Urban Affairs to investigate various theories concerning the digital city model and the importance of dialogue for the establishment of networks in local communities.

We expect the electronic district to be a portal link to urban regeneration where people can follow the various experiments carried out by the research team. In addition we expect both the digital model and the various methods used in the experiments to have widespread use in various theme groups and among stakeholders (residents, professionals and public authorities). Three years have been set aside for this research project. After this period the project will be evaluated and a report will be made for use in similar projects. Further follow-up on developments in the urban regeneration projects and the findings of the research project is expected after the three-year period.

Conclusion

In the ten years we have worked with digital 3D city models we have seen a growing interest in the construction and use of city models in urban planning. Two different mindsets are at play at present. The

first is found among producers of maps (land surveyors), according to whom models should be made on the basis of top-down principles like a photogrammetric map, the ideal being to make the model look as real as possible. In this perspective issues such as standards, technology and the accuracy and completeness of the finished product are central elements.

The other mindset, which is the one we adhere to, uses the bottom-up method. For architects and urban planners, the main purpose of the models is to enable them to analyse and assess various issues relating to architecture and urban planning and to help them identify possible solutions. The models are thus tools rather than final objects. Consequently the process relating to the making of the models is more important than the product itself.

Seen in this perspective, the form and content of the model will always be determined by the purpose for which the models are intended. Consequently no detailed rules concerning form and content can be formulated.

The development of a complete model of, for example, Copenhagen will therefore be a question of uniting various models in an overall data structure which makes the model accessible to everybody. In other words, it is a question of meta data.

Recent years have seen rapid development of information technology, especially in the field of so-called information and communication technologies. New functions can now be added to the models, so that the models will not only be mere representations of physical cities. The models may include various functions which formerly required a physical space. Consequently they can be regarded and developed as extensions of physical cities rather than mere mirror reflections of them. Seen in this perspective the roles of architects and urban planners will change. It will no longer just be to plan and shape physical cities but will include the design of digital cities. It is the validity and usefulness of this thesis we want to verify in our project called The Electronic Neighbourhood.

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