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Making and Using a City Model

Adelaide, Australia

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The building of a city model of Adelaide, Australia, has been as much determined by stakeholder enthusiasm and administrative context as technical questions. The present state of the model is comprehensive in area but exists with parts at very different levels of detail, determined by the various motivations behind their creation. The paper describes some examples of the use of sections of the model as a basis for student design projects, as a basis for City planning department-initiated explorations of development proposals, as a basis for the negotiation of acceptable development proposal strategies between City planners and the public, and as a means of presenting the implications of development proposals to City councillors who are members of the Planning Committee.
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Introduction

Adelaide is the capital City of South Australia. The total population of the city and suburbs is about 1 million people, but the population of the City itself is only about 15,000. It contains the major cultural, government, tertiary education, shopping and business districts as well as residential neighbourhoods. Divided into Adelaide proper and North Adelaide by the River Torrens and the Park Lands along its banks, both are separated by a further belt of Park Lands from the surrounding suburbs. The process of making a computer model of the city began with two separate activities: the building by the City Council Planning Department of a 2D GIS database of building sites, footprints and number of floors for use in asset management, and the building by students of Adelaide University's School of Architecture of detailed models of selected buildings of historical significance (figure 1).

Over time, the School built models of segments of the city as the context for building design and urban design studio projects. The establishment in the City of a national research centre on the social uses of GIS systems led to the making of a 'block model' of the whole city based on the GIS data. Later work developed from the incremental addition of modelled buildings by University students, and the modelling of small segments of the city during twenty five case

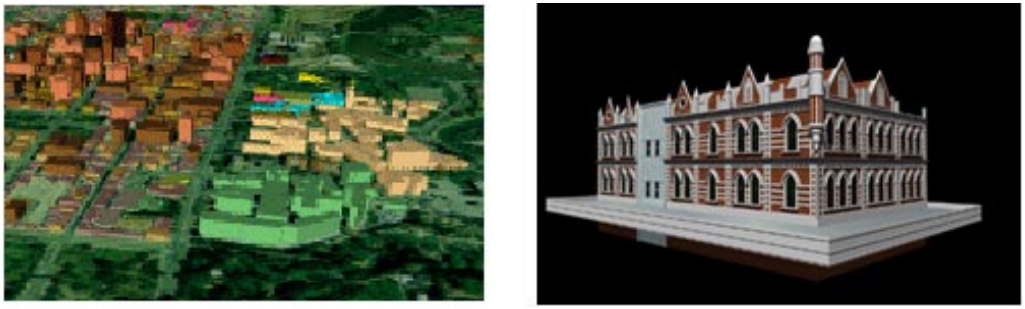

Figure 1: The interactive model, using building 'blocks' mixed with digitised aerial photographs (left, Steve Kirkby et al 1997), and one of a number of detailed individual facade models of significant city buildings made at the same time but not integrated with the interactive model (right, Adrian Price, 1997)

studies which constituted a separate joint University/ City research project on the use of computer modelling in the development proposal assessment process.

City models for government and public

In this section we briefly describe the model components and how they relate to the purposes behind their construction. There has not so far been the stakeholder interest nor the funding available to resource the making of a City model as a single integrated activity.

A quick block model using GIS data

In the mid 1990's Adelaide University's National Key Centre for the Social Applications of Geographic Information Systems (GIS), in association with the City of Adelaide and Maptek (a software developer/ provider), created an interactive 3D block model of the City (Kirkby, Flint, Jacobs et al. (1996), Radford, Woodbury, Braithwaite et al. (1997)). This stemmed from the development of 2D GIS in the early 1960's, and their general acceptance as a spatial data storage and analysis tool during the 1980's and the early 1990's. At least five different government institutions at local and state levels collected spatial data for the central business district of Adelaide: road centre lines, building footprints, sewer pipes water pipes, electrical cables, electrical ducts, precinct boundaries, zoning boundaries, and a digital elevation model, and it was constructed using only these data sources. The block model was combined with aerial photographs of the surrounding park lands, suburbs and street network, and of the major squares in the City. Maptek's products concentrated on the modelling and visualisation of geological formations for use in the mining industry, and the result was algorithmically based and required specialist software, hardware and operators.

The result was surprisingly realistic when the views are those of the city as a whole, or of large segments of the city. It also worked well in animated sequences where the lack of modelling detail was less apparent when images change quickly. Nevertheless, the interactive model was of little use for other than city promotion purposes. Once its sense of innovation paled, its dependence on specialist software and the crudeness of the image as soon as the area of interest focussed on a small part of the model meant that it quickly ceased to be used – a fate common to models dependent on software that is not easily, and relatively cheaply, available. The process had mixed benefits. While the prominence that this model gained undoubtedly provided an impetus to other activities, the extravagant claims made in publicity also generated a sense that a computer City model had been 'done'.

A city segment model for advertising

Shortly after this experience, a model of a ten hectare segment of the city commissioned by a developer of

Figure 2 The 'East End' model

inner city housing provided us with further experience of making models for promotional purposes. The model included historic buildings which were to be retained in redevelopment and proposed new buildings and street layouts, with the model being created in order to generate an animation video that could be sent to prospective purchasers (figure 2). The interest in this experience lay in the degree of detail necessary to fulfil the developer's expectations. Accuracy was not particularly sought but credibility established by apparent detail such as balustrades, street furniture and trees was important. The video mixed images from 'real' streets and buildings in the neighbourhood with animations from the model. In making the model there was more concern for accuracy than was really necessary in order to allow for its interactive use to establish views from apartments. This never eventuated (fig 2).

Pragmatic abstract models for use in development control

Development control is often controversial and political. Over the last ten years three dimensional computer visual simulations have been used to improve communication and the design control process. Advocates of visual simulation assert that it has considerable potential to improve the quality of decision making by planners, politicians and the public (Hall 1992a, 1992b, Levy 1995, Bosselman 1998). Three dimensional (3D) visual simulations of future urban environments allows their impact to be assessed before committing to the reality. A series of consulting and research projects, which has now extended over five years, with the City of Adelaide Council suggests that social, cultural and organisational issues – ignored in almost all of the literature – dominate the technical issues in the use of modelling for decision making and negotiation. Abstract models are often sufficient.

A project concerning a thirteen storey inner city student housing scheme in Rose Lane provides an example. The issues in this scheme were many– scale, solar access, access to the building, noise, surveillance and security – but solar access to the lane was considered to be of primary importance. To investigate this impact, an abstract block model was created using the building footprints from the City's GIS database and extruding them to set heights in a modelling program (figure 4). Taking an hour to construct, the model consisted of simple shapes to represent the existing built form and the proposed residential tower. City planners had to rely on the proponent's verbal description to create their 'building envelope' because there were no architectural drawings for the preliminary inquiry. As solar access was the main question, no further detail such as street trees, street furniture or other information was included.

The simplicity of the model allowed the proposal 'envelope' to be interactivity altered in real time to investigate various scenarios for a variety of shading times and conditions. The proposal 'envelope' had its street facade set back from the lane, placed in line with adjacent buildings and also its height altered. Each time, an image was captured to compare it to the existing condition prior to the proposal's imposition.

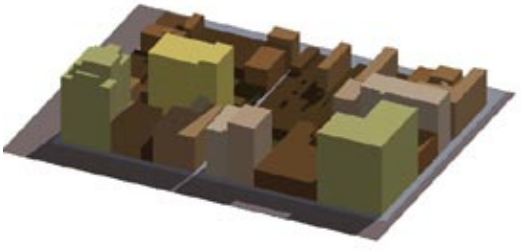

Figure 3 Models of development proposals in Rose Lane (left) and Circle Terrace (right) illustrating the different levels of abstraction selected as appropriate to the questions which the model sought to answer.

The modelling exploration showed that the proposal had minimal impact on the lane with the existing built fabric contributing significantly to the overshadowing once midday was past. This exploration assisted in allaying concerns that the development of the negatively impact on the lane's amenity.

The speed of model creation and interactive exploration assisted by the model's simplicity made this kind of investigation, on a purely preliminary project, feasible in everyday planning practice. Creating the model tailored to the prime question of interest meant that it was available quickly and it was not a burden on resources to undertake. The careful selection of information included in a visualisation model is the key to routine use in planning practice. The model was also available for future use if the project proceeded.

Other development applications pose different questions and require different kinds of models. A proposal to replace a bungalow in Circle Terrace with a group of four houses led to a model being constructed to a greater level of detail because the neighbouring houses were of heritage significance and understanding the impact on their heritage value involved the relationships between their facades as well as overall massing. Overlooking and overshadowing were also questioned. The model (figure 4) was actively used in discussing these issues with the applicant and checking the offered solutions. Additional detail such as vegetation was not required as it was not under assessment.

The key point is that in these case studies the models were created to a level of detail that was sufficient to address the issues under investigation. The abstract models increased the timeliness of the City planners' response in the tight time frames of development control. By resisting realistic detail the models were highly effective in assisting the City planners assessment of proposals, providing them with information previously unavailable or difficult to source.

City models for student projects

The models described above were developed in response to perceived needs in the public domain. Within the academy, city models have been made and used for a variety of pedagogical purposes. This frames the city as a resource for teaching, and enhances the utility of that resource by its representation in ways that facilitate its role in education.

Making models of city fragments

Many models of individual buildings and small sections of the city have been constructed as student projects

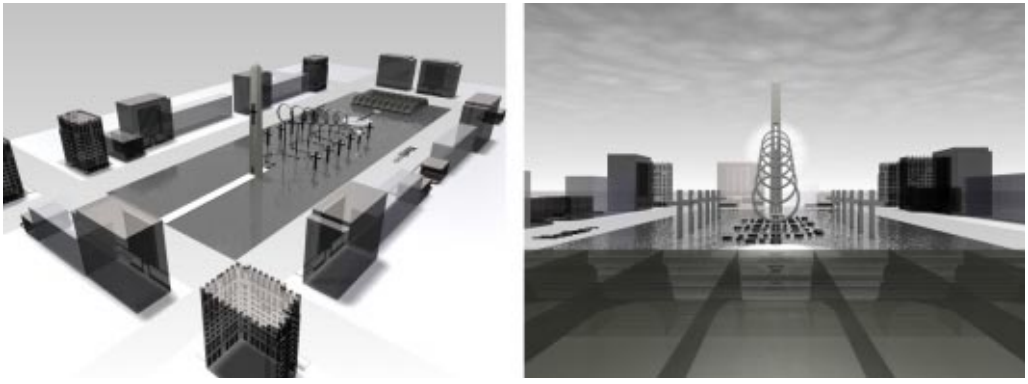

Figure 4 First year student design composition project in a freely modified city context model: "The task of this assignment is to create a spatial narrative that embodies at least three distinct experiential strategies and to demonstrate those strategies through a sequence of computer-generated renderings."

over the last five years. In most cases these were built from a combination of drawings and photographs. They were usually quite detailed, capturing the character of often historic buildings with no specific end in mind for their use. This process continues, with a second year CAD class routinely modelling the interior and exterior of city buildings as a part of learning about the medium.

Using models as context

Segments of the city model are used as context for student design projects at all levels of the program. In the second semester of first year, students enrol in a course in architectural composition. A main aim of the course is to instil an ethos of using experience as a principal issue in design. The first assignment is to create a design for a large urban park and to present that design as a sequence of images all taken from a pedestrian's perspective (figure 4). We used Victoria Square, the central urban square of Adelaide, as a model for the park for the simple reason that it provides a known context, particularly one of a known size. The square is easily accessible, being only one kilometre from the university and most students had previously visited it. The actual buildings around Victoria Square were less important to the project than having some detail in the building models. Having only block models of the actual buildings on the Square, we substituted more detailed models of other buildings in the City (fig 4).

Mid-program, digital design studios have taken public spaces and their surrounding buildings as contexts for urban design projects. These have an urban design focus, with students developing and explaining strategies for modifying the given context through a narrative including image sequences, annotations and animations. All design work takes place within the CAD medium, and the task is contrasted with the parallel "virtual space design" of an environment which relates to no physical place. Towards the end of the program, a design studio for a "mixed use urban building" provides a site description as a segment of the city model (figure 5). Some students produce most of their design work within the CAD medium, while others use the computer city model only for checking cast shadows and building bulk.

For all of these educational purposes a detailed model is not required. The need is to provide an adequate context for the students' own work. The traditional physical model provides an exemplar; the

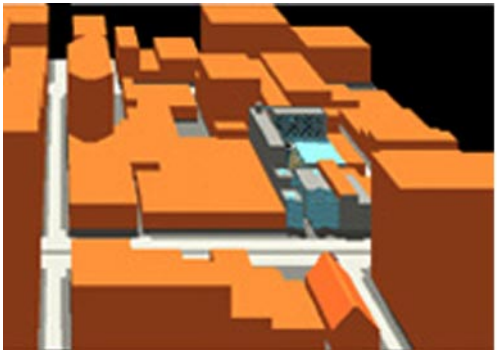

Figure 5 Final year building design project (left Axel Saile,2000) and third-year urban design project (right, Ben Pitman 1999). Simple models of volumes of neighbouring buildings is sufficient.

neighbouring buildings are played down with limited detail and single colour. Neither is accuracy particularly important. It needs to broadly corresponds with 'reality' because the point of using a model of the city rather than of a "make believe" or distant place is to allow students to visit and absorb the actual place.

Conclusions

The conclusions of the paper focus on the essential relationship between model form and the reasons for its creation, and how the active use of a relatively 'abstract' model in the negotiation and exploration of development options by both planners and students can be much more useful and powerful than the passive presentation of impressive 'realistic' renderings or animations. It demonstrates what can be achieved in a useful and practical sense with existing limited resources. This contrasts with the view from another city's planning department that "[we] could have a model in twelve months provided that there is a revolution in computing and a program arrives that integrates all that we want from GIS, CAD and visualisation" (fig 5).

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